

Package ‘mlr3pipelines’

October 13, 2022

Title Preprocessing Operators and Pipelines for 'mlr3'

Version 0.4.2

Description Dataflow programming toolkit that enriches 'mlr3' with a diverse set of pipelining operators ('PipeOps') that can be composed into graphs. Operations exist for data preprocessing, model fitting, and ensemble learning. Graphs can themselves be treated as 'mlr3' 'Learners' and can therefore be resampled, benchmarked, and tuned.

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URL <https://mlr3pipelines.mlr-org.com>,
<https://github.com/mlr-org/mlr3pipelines>

BugReports <https://github.com/mlr-org/mlr3pipelines/issues>

Depends R (>= 3.1.0)

Imports backports, checkmate, data.table, digest, lgr, mlr3 (>= 0.6.0), mlr3misc (>= 0.9.0), paradox, R6, withr

Suggests ggplot2, glmnet, igraph, knitr, lme4, mlbench, bbotk (>= 0.3.0), mlr3filters (>= 0.1.1), mlr3learners, mlr3measures, nloptr, quanteda, rmarkdown, rpart, stopwords, testthat, visNetwork, bestNormalize, fastICA, kernlab, smotefamily, evaluate, NMF, MASS, kknn, GenSA, methods, vtreat, future

ByteCompile true

Encoding UTF-8

Config/testthat/edition 3

Config/testthat/parallel true

NeedsCompilation no

RoxygenNote 7.2.0

Collate 'Graph.R' 'GraphLearner.R' 'mlr_pipeops.R' 'multiplicity.R'
'utils.R' 'PipeOp.R' 'PipeOpEnsemble.R' 'LearnerAvg.R'
'NO_OP.R' 'PipeOpTaskPreproc.R' 'PipeOpBoxCox.R'
'PipeOpBranch.R' 'PipeOpChunk.R' 'PipeOpClassBalancing.R'
'PipeOpClassWeights.R' 'PipeOpClassifAvg.R' 'PipeOpColApply.R'

'PipeOpColRoles.R' 'PipeOpCollapseFactors.R' 'PipeOpCopy.R'
 'PipeOpDateFeatures.R' 'PipeOpEncode.R' 'PipeOpEncodeImpact.R'
 'PipeOpEncodeLmer.R' 'PipeOpFeatureUnion.R' 'PipeOpFilter.R'
 'PipeOpFixFactors.R' 'PipeOpHistBin.R' 'PipeOpICA.R'
 'PipeOpImpute.R' 'PipeOpImputeConstant.R' 'PipeOpImputeHist.R'
 'PipeOpImputeLearner.R' 'PipeOpImputeMean.R'
 'PipeOpImputeMedian.R' 'PipeOpImputeMode.R' 'PipeOpImputeOOR.R'
 'PipeOpImputeSample.R' 'PipeOpKernelPCA.R' 'PipeOpLearner.R'
 'PipeOpLearnerCV.R' 'PipeOpMissingIndicators.R'
 'PipeOpModelMatrix.R' 'PipeOpMultiplicity.R' 'PipeOpMutate.R'
 'PipeOpNMF.R' 'PipeOpNOP.R' 'PipeOpOVR.R' 'PipeOpPCA.R'
 'PipeOpProxy.R' 'PipeOpQuantileBin.R'
 'PipeOpRandomProjection.R' 'PipeOpRandomResponse.R'
 'PipeOpRegrAvg.R' 'PipeOpRemoveConstants.R'
 'PipeOpRenameColumns.R' 'PipeOpScale.R' 'PipeOpScaleMaxAbs.R'
 'PipeOpScaleRange.R' 'PipeOpSelect.R' 'PipeOpSmote.R'
 'PipeOpSpatialSign.R' 'PipeOpSubsample.R'
 'PipeOpTextVectorizer.R' 'PipeOpThreshold.R' 'PipeOpTrafo.R'
 'PipeOpTuneThreshold.R' 'PipeOpUnbranch.R' 'PipeOpVtreat.R'
 'PipeOpYeoJohnson.R' 'Selector.R' 'assert_graph.R'
 'bibentries.R' 'greplicate.R' 'gunion.R' 'mlr_graphs.R'
 'operators.R' 'pipeline_bagging.R' 'pipeline_branch.R'
 'pipeline_greplicate.R' 'pipeline_ovr.R' 'pipeline_robustify.R'
 'pipeline_stacking.R' 'pipeline_targettrafo.R' 'po.R' 'ppl.R'
 'reexports.R' 'typecheck.R' 'zzz.R'

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Repository CRAN

Date/Publication 2022-09-20 22:00:07 UTC

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mlr3pipelines-package *mlr3pipelines: Preprocessing Operators and Pipelines for 'mlr3'*

Description

Dataflow programming toolkit that enriches 'mlr3' with a diverse set of pipelining operators ('PipeOps') that can be composed into graphs. Operations exist for data preprocessing, model fitting, and ensemble learning. Graphs can themselves be treated as 'mlr3' 'Learners' and can therefore be resampled, benchmarked, and tuned.

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See Also

Useful links:

- <https://mlr3pipelines.mlr-org.com>
- <https://github.com/mlr-org/mlr3pipelines>
- Report bugs at <https://github.com/mlr-org/mlr3pipelines/issues>

add_class_hierarchy_cache

Add a Class Hierarchy to the Cache

Description

Add a class hierarchy to the class hierarchy cache. This is necessary whenever an S3 class's class hierarchy is important when inferring compatibility between types.

Usage

```
add_class_hierarchy_cache(hierarchy)
```

Arguments

hierarchy character the class hierarchy to add; should correspond to the class() of the lowest object in the hierarchy.

Value

NULL

See Also

Other class hierarchy operations: [register_autoconvert_function\(\)](#), [reset_autoconvert_register\(\)](#), [reset_class_hierarchy_cache\(\)](#)

Examples

```
# This lets mlr3pipelines handle "data.table" as "data.frame".
# This is an example and not necessary, because mlr3pipelines adds it by default.

add_class_hierarchy_cache(c("data.table", "data.frame"))
```

as.Multiplicity *Convert an object to a Multiplicity*

Description

Convert an object to a [Multiplicity](#).

Usage

```
as.Multiplicity(x)
```

Arguments

x (any)
Object to convert.

Value

[Multiplicity](#)

assert_graph	<i>Assertion for mlr3pipelines Graph</i>
--------------	--

Description

Function that checks that a given object is a Graph and throws an error if not.

Usage

```
assert_graph(x)
```

Arguments

x	(any) Object to check.
---	---------------------------

Value

[Graph](#) invisible(x)

See Also

Other Graph operators: [%>>%\(\)](#), [as_graph\(\)](#), [as_pipeop\(\)](#), [assert_pipeop\(\)](#), [chain_graphs\(\)](#), [grePLICATE\(\)](#), [gunion\(\)](#), [mlr_graphs_grePLICATE](#)

assert_pipeop	<i>Assertion for mlr3pipelines PipeOp</i>
---------------	---

Description

Function that checks that a given object is a PipeOp and throws an error if not.

Usage

```
assert_pipeop(x)
```

Arguments

x	(any) Object to check.
---	---------------------------

Value

[PipeOp](#) invisible(x)

See Also

Other Graph operators: [%>>%\(\)](#), [as_graph\(\)](#), [as_pipeop\(\)](#), [assert_graph\(\)](#), [chain_graphs\(\)](#), [greplicate\(\)](#), [gunion\(\)](#), [mlr_graphs_greplicate](#)

as_graph

Conversion to mlr3pipelines Graph

Description

The argument is turned into a [Graph](#) if possible. If `clone` is `TRUE`, a deep copy is made if the incoming object is a [Graph](#) to ensure the resulting object is a different reference from the incoming object.

[as_graph\(\)](#) is an S3 method and can therefore be implemented by other packages that may add objects that can naturally be converted to [Graphs](#).

By default, [as_graph\(\)](#) tries to

- apply [gunion\(\)](#) to `x` if it is a `list`, which recursively applies [as_graph\(\)](#) to all list elements first
- create a [Graph](#) with only one element if `x` is a [PipeOp](#) or can be converted to one using [as_pipeop\(\)](#).

Usage

```
as_graph(x, clone = FALSE)
```

Arguments

<code>x</code>	(any) Object to convert.
<code>clone</code>	(logical(1)) Whether to return a (deep copied) clone if <code>x</code> is a Graph .

Value

[Graph](#) `x` or a deep clone of it.

See Also

Other Graph operators: [%>>%\(\)](#), [as_pipeop\(\)](#), [assert_graph\(\)](#), [assert_pipeop\(\)](#), [chain_graphs\(\)](#), [greplicate\(\)](#), [gunion\(\)](#), [mlr_graphs_greplicate](#)

as_pipeop

*Conversion to mlr3pipelines PipeOp***Description**

The argument is turned into a [PipeOp](#) if possible. If `clone` is `TRUE`, a deep copy is made if the incoming object is a [PipeOp](#) to ensure the resulting object is a different reference from the incoming object.

`as_pipeop()` is an S3 method and can therefore be implemented by other packages that may add objects that can naturally be converted to [PipeOps](#). Objects that can be converted are for example [Learner](#) (using [PipeOpLearner](#)) or [Filter](#) (using [PipeOpFilter](#)).

Usage

```
as_pipeop(x, clone = FALSE)
```

Arguments

<code>x</code>	(any) Object to convert.
<code>clone</code>	(logical(1)) Whether to return a (deep copied) clone if <code>x</code> is a PipeOp .

Value

[PipeOp](#) `x` or a deep clone of it.

See Also

Other Graph operators: [%>>%\(\)](#), [as_graph\(\)](#), [assert_graph\(\)](#), [assert_pipeop\(\)](#), [chain_graphs\(\)](#), [grepligate\(\)](#), [gunion\(\)](#), [mlr_graphs_grepligate](#)

chain_graphs

*Chain a Series of Graphs***Description**

Takes an arbitrary amount of [Graphs](#) or [PipeOps](#) (or objects that can be automatically converted into [Graphs](#) or [PipeOps](#), see [as_graph\(\)](#) and [as_pipeop\(\)](#)) as inputs and joins them in a serial [Graph](#), as if connecting them using `%>>%`.

Care is taken to avoid unnecessarily cloning of components. A call of `chain_graphs(list(g1, g2, g3, g4, ...), in_place = FALSE)` is equivalent to `g1 %>>% g2 %>>|% g3 %>>|% g4 %>>|% ...`. A call of `chain_graphs(list(g1, g2, g3, g4, ...), in_place = FALSE)` is equivalent to `g1 %>>|% g2 %>>|% g3 %>>|% g4 %>>|% ...` (differing in the first operator being `%>>|%` as well).

Usage

```
chain_graphs(graphs, in_place = FALSE)
```

Arguments

graphs	list of (Graph PipeOp NULL ...) List of elements which are the Graphs to be joined. Elements must be convertible to Graph or PipeOp using as_graph() and as_pipeop() . NULL is the neutral element of <code>%>>%</code> and skipped.
in_place	(logical(1)) Whether to try to avoid cloning the first element of graphs, similar to the difference of <code>%>>!</code> over <code>%>>%</code> . This can only be avoided if <code>graphs[[1]]</code> is already a Graph . Beware that, if <code>chain_graphs()</code> fails because of id collisions, then <code>graphs[[1]]</code> will possibly be in an incompletely modified state when <code>in_place</code> is TRUE.

Value

[Graph](#) the resulting [Graph](#), or NULL if there are no non-null values in graphs.

See Also

Other Graph operators: [%>>\(\)](#), [as_graph\(\)](#), [as_pipeop\(\)](#), [assert_graph\(\)](#), [assert_pipeop\(\)](#), [grePLICATE\(\)](#), [gunion\(\)](#), [mlr_graphs_grePLICATE](#)

filter_noop

Remove NO_OPs from a List

Description

Remove all [NO_OP](#) elements from a list.

Usage

```
filter_noop(x)
```

Arguments

x	list List to filter.
---	-------------------------

Value

list: The input list, with all [NO_OP](#) elements removed.

See Also

Other Path Branching: [NO_OP](#), [is_noop\(\)](#), [mlr_pipeops_branch](#), [mlr_pipeops_unbranch](#)

Graph

Graph Base Class

Description

A [Graph](#) is a representation of a machine learning pipeline graph. It can be *trained*, and subsequently used for *prediction*.

A [Graph](#) is most useful when used together with [Learner](#) objects encapsulated as [PipeOpLearner](#). In this case, the [Graph](#) produces [Prediction](#) data during its `$predict()` phase and can be used as a [Learner](#) itself (using the [GraphLearner](#) wrapper). However, the [Graph](#) can also be used without [Learner](#) objects to simply perform preprocessing of data, and, in principle, does not even need to handle data at all but can be used for general processes with dependency structure (although the [PipeOps](#) for this would need to be written).

Format

[R6Class](#) [Graph](#)

[R6Class](#).

Construction

`Graph$new()`

Internals

A [Graph](#) is made up of a list of [PipeOps](#), and a [data.table](#) of edges. Both for training and prediction, the [Graph](#) performs topological sorting of the [PipeOps](#) and executes their respective `$train()` or `$predict()` functions in order, moving the [PipeOp](#) results along the edges as input to other [PipeOps](#).

Fields

- `pipeops` :: named list of [PipeOp](#)
Contains all [PipeOps](#) in the [Graph](#), named by the [PipeOp](#)'s `$ids`.
- `edges` :: [data.table](#) with columns `src_id` (character), `src_channel` (character), `dst_id` (character), `dst_channel` (character)
Table of connections between the [PipeOps](#). A [data.table](#). `src_id` and `dst_id` are `$ids` of [PipeOps](#) that must be present in the `$pipeops` list. `src_channel` and `dst_channel` must respectively be `$output` and `$input` channel names of the respective [PipeOps](#).
- `is_trained` :: `logical(1)`
Is the [Graph](#), i.e. are all of its [PipeOps](#), trained, and can the [Graph](#) be used for prediction?
- `lhs` :: character
Ids of the 'left-hand-side' [PipeOps](#) that have some unconnected input channels and therefore act as [Graph](#) input layer.

- `rhs` :: character
Ids of the 'right-hand-side' `PipeOps` that have some unconnected output channels and therefore act as `Graph` output layer.
- `input` :: `data.table` with columns `name` (character), `train` (character), `predict` (character), `op.id` (character), `channel.name` (character)
Input channels of the `Graph`. For each channel lists the name, input type during training, input type during prediction, `PipeOp` \$`id` of the `PipeOp` the channel pertains to, and channel name as the `PipeOp` knows it.
- `output` :: `data.table` with columns `name` (character), `train` (character), `predict` (character), `op.id` (character), `channel.name` (character)
Output channels of the `Graph`. For each channel lists the name, output type during training, output type during prediction, `PipeOp` \$`id` of the `PipeOp` the channel pertains to, and channel name as the `PipeOp` knows it.
- `packages` :: character
Set of all required packages for the various methods in the `Graph`, a set union of all required packages of all contained `PipeOp` objects.
- `state` :: named list
Get / Set the \$`state` of each of the members of `PipeOp`.
- `param_set` :: `ParamSet`
Parameters and parameter constraints. Parameter values are in \$`param_set`\$`values`. These are the union of \$`param_sets` of all `PipeOps` in the `Graph`. Parameter names as seen by the `Graph` have the naming scheme `<PipeOp$id>.<PipeOp original parameter name>`. Changing \$`param_set`\$`values` also propagates the changes directly to the contained `PipeOps` and is an alternative to changing a `PipeOps` \$`param_set`\$`values` directly.
- `hash` :: character(1)
Stores a checksum calculated on the `Graph` configuration, which includes all `PipeOp` hashes (and therefore their \$`param_set`\$`values`) and a hash of \$`edges`.
- `keep_results` :: logical(1)
Whether to store intermediate results in the `PipeOp`'s \$`result` slot, mostly for debugging purposes. Default FALSE.
- `man` :: character(1)
Identifying string of the help page that shows with `help()`.

Methods

- `ids(sorted = FALSE)`
(logical(1)) -> character
Get IDs of all `PipeOps`. This is in order that `PipeOps` were added if `sorted` is FALSE, and topologically sorted if `sorted` is TRUE.
- `add_pipeop(op)`
(`PipeOp` | `Learner` | `Filter` | ...) -> self
Mutates `Graph` by adding a `PipeOp` to the `Graph`. This does not add any edges, so the new `PipeOp` will not be connected within the `Graph` at first.
Instead of supplying a `PipeOp` directly, an object that can naturally be converted to a `PipeOp` can also be supplied, e.g. a `Learner` or a `Filter`; see `as_pipeop()`. The argument given as `op` is always cloned; to access a `Graph`'s `PipeOps` by-reference, use \$`pipeops`.

Note that `$add_pipeop()` is a relatively low-level operation, it is recommended to build graphs using `%>%`.

- `add_edge(src_id, dst_id, src_channel = NULL, dst_channel = NULL)`
(character(1), character(1), character(1) | numeric(1) | NULL, character(1) | numeric(1) | NULL) -> self
Add an edge from `PipeOp` `src_id`, and its channel `src_channel` (identified by its name or number as listed in the `PipeOp`'s `$output`), to `PipeOp` `dst_id`'s channel `dst_channel` (identified by its name or number as listed in the `PipeOp`'s `$input`). If source or destination `PipeOp` have only one input / output channel and `src_channel` / `dst_channel` are therefore unambiguous, they can be omitted (i.e. left as NULL).
- `chain(g1, clone = TRUE)`
(list of Graphs, logical(1)) -> self
Takes a list of Graphs or `PipeOps` (or objects that can be automatically converted into Graphs or `PipeOps`, see `as_graph()` and `as_pipeop()`) as inputs and joins them in a serial Graph coming after self, as if connecting them using `%>%`.
- `plot(html)`
(logical(1)) -> NULL
Plot the `Graph`, using either the **igraph** package (for `html = FALSE`, default) or the `visNetwork` package for `html = TRUE` producing a `htmlWidget`. The `htmlWidget` can be rescaled using `visOptions`.
- `print(dot = FALSE, dotname = "dot", fontsize = 24L)`
(logical(1), character(1), integer(1)) -> NULL
Print a representation of the `Graph` on the console. If `dot` is FALSE, output is a table with one row for each contained `PipeOp` and columns ID (`$id` of `PipeOp`), State (short representation of `$state` of `PipeOp`), `scissors` (`PipeOps` that take their input directly from the `PipeOp` on this line), and `predecessors` (the `PipeOps` that produce the data that is read as input by the `PipeOp` on this line). If `dot` is TRUE, print a DOT representation of the `Graph` on the console. The DOT output can be named via the argument `dotname` and the `fontsize` can also be specified.
- `set_names(old, new)`
(character, character) -> self
Rename `PipeOps`: Change ID of each `PipeOp` as identified by `old` to the corresponding item in `new`. This should be used instead of changing a `PipeOp`'s `$id` value directly!
- `update_ids(prefix = "", postfix = "")`
(character, character) -> self
Pre- or postfix `PipeOp`'s existing ids. Both `prefix` and `postfix` default to "", i.e. no changes.
- `train(input, single_input = TRUE)`
(any, logical(1)) -> named list
Train `Graph` by traversing the `Graphs`' edges and calling all the `PipeOp`'s `$train` methods in turn. Return a named list of outputs for each unconnected `PipeOp` out-channel, named according to the `Graph`'s `$output` name column. During training, the `$state` member of each `PipeOps` will be set and the `$is_trained` slot of the `Graph` (and each individual `PipeOp`) will consequently be set to TRUE.
If `single_input` is TRUE, the input value will be sent to each unconnected `PipeOp`'s input channel (as listed in the `Graph`'s `$input`). Typically, input should be a `Task`, although this is dependent on the `PipeOps` in the `Graph`. If `single_input` is FALSE, then input should be a list with the same length as the `Graph`'s `$input` table has rows; each list item will be sent to a corresponding input channel of the `Graph`. If input is a named list, names must

correspond to input channel names (`$input$name`) and inputs will be sent to the channels by name; otherwise they will be sent to the channels in order in which they are listed in `$input`.

- `predict(input, single_input = TRUE)`
(any, logical(1)) -> list of any
Predict with the [Graph](#) by calling all the [PipeOp](#)'s `$train` methods. Input and output, as well as the function of the `single_input` argument, are analogous to `$train()`.
- `help(help_type)`
(character(1)) -> help file
Displays the help file of the concrete [PipeOp](#) instance. `help_type` is one of "text", "html", "pdf" and behaves as the `help_type` argument of R's `help()`.

See Also

Other `mlr3` pipelines backend related: [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_graphs](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops](#)

Examples

```
library("mlr3")

g = Graph$new()$
  add_pipeop(PipeOpScale$new(id = "scale"))$
  add_pipeop(PipeOpPCA$new(id = "pca"))$
  add_edge("scale", "pca")
g$input
g$output

task = tsk("iris")
trained = g$train(task)
trained[[1]]$data()

task$filter(1:10)
predicted = g$predict(task)
predicted[[1]]$data()
```

greplicate

Create Disjoint Graph Union of Copies of a Graph

Description

Create a new [Graph](#) containing `n` copies of the input [Graph](#) / [PipeOp](#). To avoid ID collisions, [PipeOp](#) IDs are suffixed with `_i` where `i` ranges from 1 to `n`.

This function is deprecated and will be removed in the next version in favor of using `pipeline_greplicate` / `ppl("greplicate")`.

Usage

```
greplicate(graph, n)
```

Arguments

graph	Graph Graph to replicate.
n	integer(1) Number of copies to create.

Value

[Graph](#) containing n copies of input graph.

See Also

Other Graph operators: [%>%\(\)](#), [as_graph\(\)](#), [as_pipeop\(\)](#), [assert_graph\(\)](#), [assert_pipeop\(\)](#), [chain_graphs\(\)](#), [gunion\(\)](#), [mlr_graphs_greplicate](#)

gunion	<i>Disjoint Union of Graphs</i>
--------	---------------------------------

Description

Takes an arbitrary amount of [Graphs](#) or [PipeOps](#) (or objects that can be automatically converted into [Graphs](#) or [PipeOps](#), see [as_graph\(\)](#) and [as_pipeop\(\)](#)) as inputs and joins them in a new [Graph](#).

The [PipeOps](#) of the input [Graphs](#) are not joined with new edges across [Graphs](#), so if `length(graphs) > 1`, the resulting [Graph](#) will be disconnected.

This operation always creates deep copies of its input arguments, so they cannot be modified by reference afterwards. To access individual [PipeOps](#) after composition, use the resulting [Graph](#)'s `$pipeops` list.

Usage

```
gunion(graphs, in_place = FALSE)
```

Arguments

graphs	list of (Graph PipeOp NULL ...) List of elements which are the Graphs to be joined. Elements must be convertible to Graph or PipeOp using as_graph() and as_pipeop() . NULL values automatically get converted to PipeOpNOP with a random ID of the format <code>nop_*****</code> . The list can be named, in which case the IDs of the elements are prefixed with the names, separated by a dot (<code>.</code>).
in_place	(logical(1) logical) Whether to try to avoid cloning the first element of <code>graphs</code> , similar to the difference of <code>%>>!</code> over <code>%>>%</code> . This can only be avoided if <code>graphs[[1]]</code> is already a Graph . Unlike chain_graphs() , gunion() does all checks <i>before</i> mutating <code>graphs[[1]]</code> , so it will not leave <code>graphs[[1]]</code> in an incompletely modified state when it fails. <code>in_place</code> may also be of length <code>graph</code> , in which case it determines for each element of <code>graphs</code> whether it is cloned. This is for internal usage and is not recommended.

Value

[Graph](#) the resulting [Graph](#).

See Also

Other Graph operators: [%>>%\(\)](#), [as_graph\(\)](#), [as_pipeop\(\)](#), [assert_graph\(\)](#), [assert_pipeop\(\)](#), [chain_graphs\(\)](#), [greplicate\(\)](#), [mlr_graphs_greplicate](#)

is.Multiplicity	<i>Check if an object is a Multiplicity</i>
-----------------	---

Description

Check if an object is a [Multiplicity](#).

Usage

```
is.Multiplicity(x)
```

Arguments

x	(any) Object to check.
---	---------------------------

Value

```
logical(1)
```

is_noop	<i>Test for NO_OP</i>
---------	-----------------------

Description

Test whether a given object is a [NO_OP](#).

Usage

```
is_noop(x)
```

Arguments

x	any Object to test.
---	------------------------

Value

```
logical(1): Whether x is a NO_OP.
```


See Also

Other Path Branching: [NO_OP](#), [filter_noop\(\)](#), [mlr_pipeops_branch](#), [mlr_pipeops_unbranch](#)

 mlr_graphs

Dictionary of (sub-)graphs

Description

A simple [Dictionary](#) storing objects of class [Graph](#). The dictionary contains a collection of often-used graph structures, and its aim is solely to make often-used functions more accessible. Each Graph has an associated help page, which can be accessed via `?mlr_graphs_<key>`, i.e. `?mlr_graphs_bagging`.

Format

[R6Class](#) object inheriting from `mlr3misc::Dictionary`.

Methods

Methods inherited from [Dictionary](#), as well as:

- `add(key, value)`
(character(1), function)
Adds constructor value to the dictionary with key `key`, potentially overwriting a previously stored item.

S3 methods

- `as.data.table(dict)`
[Dictionary](#) -> `data.table::data.table`
Returns a `data.table` with column `key` (character).

See Also

Other mlr3pipelines backend related: [Graph](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops](#)

Other Dictionaries: [mlr_pipeops](#)

Examples

```
library(mlr3)
lrn = lrn("regr.rpart")
task = mlr_tasks$get("boston_housing")

# Robustify the learner for the task.
gr = pipeline_robustify(task, lrn) %>>% po("learner", lrn)
# or equivalently
gr = mlr_graphs$get("robustify", task = task, learner = lrn) %>>% po(lrn)
```

```
# or equivalently
gr = ppl("robustify", task, lrn) %>>% po("learner", lrn)

# all Graphs currently in the dictionary:
as.data.table(mlr_graphs)
```

mlr_graphs_bagging *Create a bagging learner*

Description

Creates a [Graph](#) that performs bagging for a supplied graph. This is done as follows:

- Subsample the data in each step using [PipeOpSubsample](#), afterwards apply graph
- Replicate this step *iterations* times (in parallel via [multiplicities](#))
- Average outputs of replicated graphs predictions using the averager (note that setting `collect_multipliciy = TRUE` is required)

All input arguments are cloned and have no references in common with the returned [Graph](#).

Usage

```
pipeline_bagging(graph, iterations = 10, frac = 0.7, averager = NULL)
```

Arguments

graph	PipeOp Graph A PipeOpLearner or Graph to create a robustifying pipeline for. Outputs from the replicated graphs are connected with the averager.
iterations	integer(1) Number of bagging iterations. Defaults to 10.
frac	numeric(1) Percentage of rows to keep during subsampling. See PipeOpSubsample for more information. Defaults to 0.7.
averager	PipeOp Graph A PipeOp or Graph that averages the predictions from the replicated and subsampled graph's. In the simplest case, <code>po("classifavg")</code> and <code>po("regavg")</code> can be used in order to perform simple averaging of classification and regression predictions respectively. If NULL (default), no averager is added to the end of the graph. Note that setting <code>collect_multipliciy = TRUE</code> during construction of the averager is required.

Value

[Graph](#)

Examples

```
library(mlr3)
lrn_po = po("learner", lrn("regr.rpart"))
task = mlr_tasks$get("boston_housing")
gr = pipeline_bagging(lrn_po, 3, averager = po("regravg", collect_multiplicity = TRUE))
resample(task, GraphLearner$new(gr), rsmpl("holdout"))
```

mlr_graphs_branch	<i>Branch Between Alternative Paths</i>
-------------------	---

Description

Create a multiplexed graph.

All input arguments are cloned and have no references in common with the returned [Graph](#).

Usage

```
pipeline_branch(graphs, prefix_branchops = "", prefix_paths = FALSE)
```

Arguments

graphs	list of Graph Multiple graphs, possibly named. They all must have exactly one output. If any of the arguments are named, then all must have unique names.
prefix_branchops	character(1) Optional id prefix to prepend to PipeOpBranch and PipeOpUnbranch id. Their resulting IDs will be "[prefix_branchops]branch" and "[prefix_branchops]unbranch". Default is "".
prefix_paths	logical(1) character(1) Whether to add prefixes to graph IDs when performing union. Can be helpful to avoid ID clashes in resulting graph. Default FALSE. If this is TRUE, the prefixes are taken from the names of the input arguments if present or "poX" where X counts up. If this is a character(1), it is a prefix that is added to the PipeOp IDs <i>additionally</i> to the input argument list.

Value

[Graph](#)

Examples

```

library("mlr3")

po_pca = po("pca")
po_nop = po("nop")

branches = pipeline_branch(list(pca = po_pca, nothing = po_nop))
# gives the same as
branches = c("pca", "nothing")
po("branch", branches) %>>%
  gunion(list(po_pca, po_nop)) %>>%
  po("unbranch", branches)

pipeline_branch(list(pca = po_pca, nothing = po_nop),
  prefix_branchops = "br_", prefix_paths = "xy_")
# gives the same as
po("branch", branches, id = "br_branch") %>>%
  gunion(list(xy_pca = po_pca, xy_nothing = po_nop)) %>>%
  po("unbranch", branches, id = "br_unbranch")

```

mlr_graphs_greplicate *Create Disjoint Graph Union of Copies of a Graph*

Description

Create a new [Graph](#) containing n copies of the input [Graph](#) / [PipeOp](#). To avoid ID collisions, PipeOp IDs are suffixed with `_i` where i ranges from 1 to n .

All input arguments are cloned and have no references in common with the returned [Graph](#).

Usage

```
pipeline_greplicate(graph, n)
```

Arguments

graph	Graph Graph to replicate.
n	integer(1) Number of copies to create.

Value

[Graph](#) containing n copies of input graph.

See Also

Other Graph operators: [%>>%\(\)](#), [as_graph\(\)](#), [as_pipeop\(\)](#), [assert_graph\(\)](#), [assert_pipeop\(\)](#), [chain_graphs\(\)](#), [greplicate\(\)](#), [gunion\(\)](#)

Examples

```
library("mlr3")

po_pca = po("pca")
pipeline_grePLICATE(po_pca, n = 2)
```

mlr_graphs_ovr	<i>Create A Graph to Perform "One vs. Rest" classification.</i>
----------------	---

Description

Create a new [Graph](#) for a [classification Task](#) to perform "One vs. Rest" classification.
All input arguments are cloned and have no references in common with the returned [Graph](#).

Usage

```
pipeline_ovr(graph)
```

Arguments

graph	Graph Graph being wrapped between PipeOpOVRSplit and PipeOpOVRUnite . The Graph should return NULL during training and a classification Prediction during prediction.
-------	--

Value

[Graph](#)

Examples

```
library("mlr3")

task = tsk("wine")

learner = lrn("classif.rpart")
learner$predict_type = "prob"

# Simple OVR
g1 = pipeline_ovr(learner)
g1$train(task)
g1$predict(task)

# Bagged Learners
gr = po("replicate", reps = 3) %>>%
  po("subsample") %>>%
  learner %>>%
  po("classifavg", collect_multiplicity = TRUE)
```

```

g2 = pipeline_ovr(gr)
g2$train(task)
g2$predict(task)

# Bagging outside OVR
g3 = po("replicate", reps = 3) %>>%
  pipeline_ovr(po("subsample") %>>% learner) %>>%
  po("classifavg", collect_multiplicity = TRUE)
g3$train(task)
g3$predict(task)

```

mlr_graphs_robustify *Robustify a learner*

Description

Creates a [Graph](#) that can be used to robustify any subsequent learner. Performs the following steps:

- Drops empty factor levels using [PipeOpFixFactors](#)
- Imputes numeric features using [PipeOpImputeHist](#) and [PipeOpMissInd](#)
- Imputes factor features using [PipeOpImputeOOR](#)
- Encodes factors using one-hot-encoding. Factors with a cardinality > max_cardinality are collapsed using [PipeOpCollapseFactors](#)

The graph is built conservatively, i.e. the function always tries to assure everything works. If a learner is provided, some steps can be left out, i.e. if the learner can deal with factor variables, no encoding is performed.

All input arguments are cloned and have no references in common with the returned [Graph](#).

Usage

```

pipeline_robustify(
  task = NULL,
  learner = NULL,
  impute_missings = NULL,
  factors_to_numeric = NULL,
  max_cardinality = 1000,
  ordered_action = "factor",
  character_action = "factor",
  POSIXct_action = "numeric"
)

```

Arguments

task	Task
------	----------------------

A [Task](#) to create a robustifying pipeline for. Optional, if omitted, the "worst possible" [Task](#) is assumed and the full pipeline is created.

learner	Learner A learner to create a robustifying pipeline for. Optional, if omitted, the "worst possible" Learner is assumed and a more conservative pipeline is built.
impute_missings	logical(1) NULL Should missing values be imputed? Defaults to NULL: imputes if the task has missing values (or factors that are not encoded to numerics) and the learner can not handle them.
factors_to_numeric	logical(1) NULL Should (ordered and unordered) factors be encoded? Defaults to NULL: encodes if the task has factors (or character columns that get converted to factor) and the learner can not handle factors.
max_cardinality	integer(1) Maximum number of factor levels allowed. See above. Default: 1000.
ordered_action	character(1) How to handle ordered columns: "factor" (default) or "factor!": convert to factor columns; "numeric" or "numeric!": convert to numeric columns; "integer" or "integer!": convert to integer columns; "ignore" or "ignore!": ignore. When task is given and has no ordered columns, or when learner is given and can handle ordered, then "factor", "numeric" and "integer" are treated like "ignore". This means it is necessary to add the exclamation point to override Task or Learner properties when given. "ignore" and "ignore!" therefore behave completely identically, "ignore!" is only present for consistency. When ordered features are converted to factor, then they are treated like factor features further down in the pipeline, and are possibly eventually converted to numerics, but in a different way: factors get one-hot encoded, ordered_action = "numeric" converts ordered using as.numeric to their integer-valued rank.
character_action	character(1) How to handle character columns: "factor" (default) or "factor!": convert to factor columns; "matrix" or "matrix!": Use PipeOpTextVectorizer . "ignore" or "ignore!": ignore. When task is given and has no character columns, or when learner is given and can handle character, then "factor" and "matrix" are treated like "ignore". This means it is necessary to add the exclamation point to override Task or Learner properties when given. "ignore" and "ignore!" therefore behave completely identically, "ignore!" is only present for consistency. When character columns are converted to factor, then they are treated like factor further down in the pipeline, and are possibly eventually converted to numerics, using one-hot encoding.
POSIXct_action	character(1) How to handle POSIXct columns: "numeric" (default) or "numeric!": convert to numeric columns; "datefeatures" or "datefeatures!": Use PipeOpDateFeatures . "ignore" or "ignore!": ignore. When task is given and has no POSIXct columns, or when learner is given and can handle POSIXct, then "numeric"

and "datefeatures" are treated like "ignore". This means it is necessary to add the exclamation point to override `Task` or `Learner` properties when given. "ignore" and "ignore!" therefore behave completely identically, "ignore!" is only present for consistency.

Value

`Graph`

Examples

```
library(mlr3)
lrn = lrn("regr.rpart")
task = mlr_tasks$get("boston_housing")
gr = pipeline_robustify(task, lrn) %>% po("learner", lrn)
resample(task, GraphLearner$new(gr), rsmp("holdout"))
```

mlr_graphs_stacking *Create A Graph to Perform Stacking.*

Description

Create a new `Graph` for stacking. A stacked learner uses predictions of several base learners and fits a super learner using these predictions as features in order to predict the outcome.

All input arguments are cloned and have no references in common with the returned `Graph`.

Usage

```
pipeline_stacking(
  base_learners,
  super_learner,
  method = "cv",
  folds = 3,
  use_features = TRUE
)
```

Arguments

<code>base_learners</code>	list of <code>Learner</code> A list of base learners.
<code>super_learner</code>	<code>Learner</code> The super learner that makes the final prediction based on the base learners.
<code>method</code>	character(1) "cv" (default) for building a super learner using cross-validated predictions of the base learners or "insample" for building a super learner using the predictions of the base learners trained on all training data.

fold	integer(1) Number of cross-validation folds. Only used for method = "cv". Default 3.
use_features	logical(1) Whether the original features should also be passed to the super learner. Default TRUE.

Value[Graph](#)**Examples**

```

if (requireNamespace("kkn")) {
  library(mlr3)
  library(mlr3learners)

  base_learners = list(
    lrn("classif.rpart", predict_type = "prob"),
    lrn("classif.kknn", predict_type = "prob")
  )
  super_learner = lrn("classif.log_reg")

  graph_stack = pipeline_stacking(base_learners, super_learner)
  graph_learner = as_learner(graph_stack)
  graph_learner$train(tsk("german_credit"))
}

```

mlr_graphs_targettrafo

*Transform and Re-Transform the Target Variable***Description**

Wraps a [Graph](#) that transforms a target during training and inverts the transformation during prediction. This is done as follows:

- Specify a transformation and inversion function using any subclass of [PipeOpTargetTrafo](#), defaults to [PipeOpTargetMutate](#), afterwards apply graph.
- At the very end, during prediction the transformation is inverted using [PipeOpTargetInvert](#).
- To set a transformation and inversion function for [PipeOpTargetMutate](#) see the parameters `trafo` and `inverter` of the `param_set` of the resulting [Graph](#).
- Note that the input graph is not explicitly checked to actually return a [Prediction](#) during prediction.

All input arguments are cloned and have no references in common with the returned [Graph](#).

Usage

```
pipeline_targettrafo(
  graph,
  trafo_pipeop = PipeOpTargetMutate$new(),
  id_prefix = ""
)
```

Arguments

graph	PipeOpLearner Graph A PipeOpLearner or Graph to wrap between a transformation and re-transformation of the target variable.
trafo_pipeop	PipeOp A PipeOp that is a subclass of PipeOpTargetTrafo . Default is PipeOpTargetMutate .
id_prefix	character(1) Optional id prefix to prepend to PipeOpTargetInvert ID. The resulting ID will be "[id_prefix]targetinvert". Default is "".

Value

[Graph](#)

Examples

```
library("mlr3")

tt = pipeline_targettrafo(PipeOpLearner$new(LearnerRegrRpart$new()))
tt$param_set$values$targetmutate.trafo = function(x) log(x, base = 2)
tt$param_set$values$targetmutate.inverter = function(x) list(response = 2 ^ x$response)

# gives the same as
g = Graph$new()
g$add_pipeop(PipeOpTargetMutate$new(param_vals = list(
  trafo = function(x) log(x, base = 2),
  inverter = function(x) list(response = 2 ^ x$response)
)))
g$add_pipeop(LearnerRegrRpart$new())
g$add_pipeop(PipeOpTargetInvert$new())
g$add_edge(src_id = "targetmutate", dst_id = "targetinvert",
  src_channel = 1, dst_channel = 1)
g$add_edge(src_id = "targetmutate", dst_id = "regr.rpart",
  src_channel = 2, dst_channel = 1)
g$add_edge(src_id = "regr.rpart", dst_id = "targetinvert",
  src_channel = 1, dst_channel = 2)
```

mlr_learners_avg	<i>Optimized Weighted Average of Features for Classification and Regression</i>
------------------	---

Description

Computes a weighted average of inputs. Used in the context of computing weighted averages of predictions.

Predictions are averaged using weights (in order of appearance in the data) which are optimized using nonlinear optimization from the package **nloptr** for a measure provided in `measure`. (defaults to `classif.ce` for `LearnerClassifAvg` and `regr.mse` for `LearnerRegrAvg`). Learned weights can be obtained from `$model`. This Learner implements and generalizes an approach proposed in LeDell (2015) that uses non-linear optimization in order to learn base-learner weights that optimize a given performance metric (e.g AUC). The approach is similar but not exactly the same as the one implemented as AUC in the **SuperLearner** R package (when `metric` is `"classif.auc"`). For a more detailed analysis and the general idea, the reader is referred to LeDell (2015).

Note, that weights always sum to 1 by division by `sum(weights)` before weighting incoming features.

Usage

```
mlr_learners_classif_avg
```

```
mlr_learners_regr_avg
```

Format

`R6Class` object inheriting from `mlr3::LearnerClassif/mlr3::Learner`.

Parameters

The parameters are the parameters inherited from `LearnerClassif`, as well as:

- `measure` :: `Measure` | character
`Measure` to optimize for. Will be converted to a `Measure` in case it is character. Initialized to `"classif.ce"`, i.e. misclassification error for classification and `"regr.mse"`, i.e. mean squared error for regression.
- `optimizer` :: `Optimizer` | character(1)
`Optimizer` used to find optimal thresholds. If character, converts to `Optimizer` via `opt`. Initialized to `OptimizerNloptr`. Nloptr hyperparameters are initialized to `xtol_rel = 1e-8`, `algorithm = "NLOPT_LN_COBYLA"` and equal initial weights for each learner. For more fine-grained control, it is recommended to supply a instantiated `Optimizer`.
- `log_level` :: character(1) | integer(1)
Set a temporary log-level for `lgr::get_logger("bbotk")`. Initialized to: `"warn"`.

Methods

- `LearnerClassifAvg$new()`, `id = "classif.avg"`
(chr) -> self
Constructor.
- `LearnerRegrAvg$new()`, `id = "regr.avg"`
(chr) -> self
Constructor.

References

LeDell, Erin (2015). *Scalable Ensemble Learning and Computationally Efficient Variance Estimation*. Ph.D. thesis, UC Berkeley.

See Also

Other Learners: [mlr_learners_graph](#)

Other Ensembles: [PipeOpEnsemble](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_regravg](#)

mlr_learners_graph *Encapsulate a Graph as a Learner*

Description

A [Learner](#) that encapsulates a [Graph](#) to be used in [mlr3](#) resampling and benchmarks.

The Graph must return a single [Prediction](#) on its `$predict()` call. The result of the `$train()` call is discarded, only the internal state changes during training are used.

The `predict_type` of a [GraphLearner](#) can be obtained or set via its `predict_type` active binding. Setting a new `predict_type` will try to set the `predict_type` in all relevant [PipeOp](#) / [Learner](#) encapsulated within the [Graph](#). Similarly, the `predict_type` of a Graph will always be the smallest denominator in the [Graph](#).

A [GraphLearner](#) is always constructed in an untrained state. When the graph argument has a non-NULL `$state`, it is ignored.

Format

[R6Class](#) object inheriting from [mlr3::Learner](#).

Construction

`GraphLearner$new(graph, id = NULL, param_vals = list(), task_type = NULL, predict_type = NULL)`

- `graph` :: [Graph](#) | [PipeOp](#)
[Graph](#) to wrap. Can be a [PipeOp](#), which is automatically converted to a [Graph](#). This argument is usually cloned, unless `clone_graph` is `FALSE`; to access the [Graph](#) inside [GraphLearner](#) by-reference, use `$graph`.

- `id` :: character(1) Identifier of the resulting [Learner](#).
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings . Default `list()`.
- `task_type` :: character(1)
What `task_type` the `GraphLearner` should have; usually automatically inferred for [Graphs](#) that are simple enough.
- `predict_type` :: character(1)
What `predict_type` the `GraphLearner` should have; usually automatically inferred for [Graphs](#) that are simple enough.
- `clone_graph` :: logical(1)
Whether to clone graph upon construction. Unintentionally changing graph by reference can lead to unexpected behaviour, so TRUE (default) is recommended. In particular, note that the `$state` of `$graph` is set to NULL by reference on construction of `GraphLearner`, during `$train()`, and during `$predict()` when `clone_graph` is FALSE.

Fields

Fields inherited from [PipeOp](#), as well as:

- `graph` :: [Graph](#)
[Graph](#) that is being wrapped. This field contains the prototype of the [Graph](#) that is being trained, but does *not* contain the model. Use `graph_model` to access the trained [Graph](#) after `$train()`. Read-only.
- `graph_model` :: [Learner](#)
[Graph](#) that is being wrapped. This [Graph](#) contains a trained state after `$train()`. Read-only.

Internals

`as_graph()` is called on the `graph` argument, so it can technically also be a list of things, which is automatically converted to a [Graph](#) via `gunion()`; however, this will usually not result in a valid [Graph](#) that can work as a [Learner](#). `graph` can furthermore be a [Learner](#), which is then automatically wrapped in a [Graph](#), which is then again wrapped in a `GraphLearner` object; this usually only adds overhead and is not recommended.

See Also

Other Learners: [mlr_learners_avg](#)

Examples

```
library("mlr3")

graph = po("pca") %>>% lrn("classif.rpart")

lr = GraphLearner$new(graph)
lr = as_learner(graph) # equivalent

lr$train(tsk("iris"))
```

```

lr$graph$state # untrained version!
# The following is therefore NULL:
lr$graph$pipeops$classif.rpart$learner_model$model

# To access the trained model from the PipeOpLearner's Learner, use:
lr$graph_model$pipeops$classif.rpart$learner_model$model

# Feature importance (of principal components):
lr$graph_model$pipeops$classif.rpart$learner_model$importance()

```

mlr_pipeops

*Dictionary of PipeOps***Description**

A simple [Dictionary](#) storing objects of class [PipeOp](#). Each [PipeOp](#) has an associated help page, see `mlr_pipeops_[id]`.

Format

[R6Class](#) object inheriting from `mlr3misc::Dictionary`.

Fields

Fields inherited from [Dictionary](#), as well as:

- `metainf` :: environment
Environment that stores the `metainf` argument of the `$add()` method. Only for internal use.

Methods

Methods inherited from [Dictionary](#), as well as:

- `add(key, value, metainf = NULL)`
(`character(1)`, `R6ClassGenerator`, `NULL` | `list`)
Adds constructor value to the dictionary with key `key`, potentially overwriting a previously stored item. If `metainf` is not `NULL` (the default), it must be a list of arguments that will be given to the value constructor (i.e. `value$new()`) when it needs to be constructed for `as.data.table` [PipeOp](#) listing.

S3 methods

- `as.data.table(dict)`
`Dictionary` -> `data.table::data.table`
Returns a `data.table` with columns `key` (`character`), `packages` (`character`), `input.num` (`integer`), `output.num` (`integer`), `input.type.train` (`character`), `input.type.predict` (`character`), `output.type.train` (`character`), `output.type.predict` (`character`).

See Also

Other mlr3pipelines backend related: [Graph](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_graphs](#), [mlr_pipeops_updatetarget](#)

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_ensemblmer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputeconst](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunit](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconst](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalexmaxabs](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#), [mlr_pipeops_select](#), [mlr_pipeops_smote](#), [mlr_pipeops_spatialsign](#), [mlr_pipeops_subsample](#), [mlr_pipeops_targetinvert](#), [mlr_pipeops_targetmutate](#), [mlr_pipeops_targettrafoscale](#), [mlr_pipeops_textvectorizer](#), [mlr_pipeops_threshold](#), [mlr_pipeops_tunethreshold](#), [mlr_pipeops_unbranch](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops_vtreat](#), [mlr_pipeops_yeojohnson](#)

Other Dictionaries: [mlr_graphs](#)

Examples

```
library("mlr3")

mlr_pipeops$get("learner", lrn("classif.rpart"))

# equivalent:
po("learner", learner = lrn("classif.rpart"))

# all PipeOps currently in the dictionary:
as.data.table(mlr_pipeops)[, c("key", "input.num", "output.num", "packages")]
```

mlr_pipeops_boxcox *Box-Cox Transformation of Numeric Features*

Description

Conducts a Box-Cox transformation on numeric features. The lambda parameter of the transformation is estimated during training and used for both training and prediction transformation. See [bestNormalize::boxcox\(\)](#) for details.

Format

[R6Class](#) object inheriting from [PipeOpTaskPreproc/PipeOp](#).

Construction

```
PipeOpBoxCox$new(id = "boxcox", param_vals = list())
```

- `id` :: `character(1)`
Identifier of resulting object, default "boxcox".
- `param_vals` :: `named list`
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpTaskPreproc](#).

The output is the input `Task` with all affected numeric features replaced by their transformed versions.

State

The `$state` is a `named list` with the `$state` elements inherited from [PipeOpTaskPreproc](#), as well as a list of class `boxcox` for each column, which is transformed.

Parameters

The parameters are the parameters inherited from [PipeOpTaskPreproc](#), as well as:

- `standardize` :: `logical(1)`
Whether to center and scale the transformed values to attempt a standard normal distribution. For details see [boxcox\(\)](#).
- `eps` :: `numeric(1)`
Tolerance parameter to identify if lambda parameter is equal to zero. For details see [boxcox\(\)](#).
- `lower` :: `numeric(1)`
Lower value for estimation of lambda parameter. For details see [boxcox\(\)](#).
- `upper` :: `numeric(1)`
Upper value for estimation of lambda parameter. For details see [boxcox\(\)](#).

Internals

Uses the [bestNormalize::boxcox](#) function.

Methods

Only methods inherited from [PipeOpTaskPreproc/PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#),


```
mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_encodeimpact,
mlr_pipeops_encodelmer, mlr_pipeops_encode, mlr_pipeops_featureunion, mlr_pipeops_filter,
mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputeconstant,
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian,
mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_kernelpca,
mlr_pipeops_learner, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply,
mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nmf, mlr_pipeops_nop,
mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin,
mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstant,
mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_scalexmaxabs, mlr_pipeops_scalerange,
mlr_pipeops_scale, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_spatialsign,
mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscale,
mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch,
mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson, mlr_pipeops
```

Examples

```
library("mlr3")

task = tsk("iris")
pop = po("boxcox")

task$data()
pop$train(list(task))[[1]]$data()

pop$state
```

mlr_pipeops_branch *Path Branching*

Description

Perform alternative path branching: [PipeOpBranch](#) has multiple output channels that connect to different paths in a [Graph](#). At any time, only one of these paths will be taken for execution. At the end of the different paths, the [PipeOpUnbranch](#) PipeOp must be used to indicate the end of alternative paths.

Not to be confused with [PipeOpCopy](#), the naming scheme is a bit unfortunate.

Format

[R6Class](#) object inheriting from [PipeOp](#).

Construction

```
PipeOpBranch$new(options, id = "branch", param_vals = list())
```

- `options :: numeric(1) | character`
If `options` is an integer number, it determines the number of output channels / options that are created, named `output1...output<n>`. The `$selection` parameter will then be a `ParamInt`. If `options` is a character, it determines the names of channels directly. The `$selection` parameter will then be a `ParamFct`.
- `id :: character(1)`
Identifier of resulting object, default `"branch"`.
- `param_vals :: named list`
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

`PipeOpBranch` has one input channel named `"input"`, taking any input (`"*"`) both during training and prediction.

`PipeOpBranch` has multiple output channels depending on the `options` construction argument, named `"output1"`, `"output2"`, ... if `options` is numeric, and named after each `options` value if `options` is a character. All output channels produce the object given as input (`"*"`) or `NO_OP`, both during training and prediction.

State

The `$state` is left empty (`list()`).

Parameters

- `selection :: numeric(1) | character(1)`
Selection of branching path to take. Is a `ParamInt` if the `options` parameter during construction was a `numeric(1)`, and ranges from 1 to `options`. Is a `ParamFct` if the `options` parameter was a character and its possible values are the `options` values. Initialized to either 1 (if the `options` construction argument is `numeric(1)`) or the first element of `options` (if it is character).

Internals

Alternative path branching is handled by the `PipeOp` backend. To indicate that a path should not be taken, `PipeOpBranch` returns the `NO_OP` object on its output channel. The `PipeOp` handles each `NO_OP` input by automatically returning a `NO_OP` output without calling `private$.train()` or `private$.predict()`, until `PipeOpUnbranch` is reached. `PipeOpUnbranch` will then take multiple inputs, all except one of which must be a `NO_OP`, and forward the only non-`NO_OP` object on its output.

Fields

Only fields inherited from `PipeOp`.

Methods

Only methods inherited from `PipeOp`.

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_encodeimer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputeconstant](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconstant](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalemaxabs](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#), [mlr_pipeops_select](#), [mlr_pipeops_smote](#), [mlr_pipeops_spatialsign](#), [mlr_pipeops_subsample](#), [mlr_pipeops_targetinvert](#), [mlr_pipeops_targetmutate](#), [mlr_pipeops_targettrafoscale](#), [mlr_pipeops_textvectorizer](#), [mlr_pipeops_threshold](#), [mlr_pipeops_tunethreshold](#), [mlr_pipeops_unbranch](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops_vtreat](#), [mlr_pipeops_yeojohnson](#), [mlr_pipeops](#)

Other Path Branching: [NO_OP](#), [filter_noop\(\)](#), [is_noop\(\)](#), [mlr_pipeops_unbranch](#)

Examples

```
library("mlr3")

pca = po("pca")
nop = po("nop")
choices = c("pca", "nothing")
gr = po("branch", choices) %>>%
  gunion(list(pca, nop)) %>>%
  po("unbranch", choices)

gr$param_set$values$branch.selection = "pca"
gr$train(tsk("iris"))

gr$param_set$values$branch.selection = "nothing"
gr$train(tsk("iris"))
```

mlr_pipeops_chunk

Chunk Input into Multiple Outputs

Description

Chunks its input into `outnum` chunks. Creates `outnum` [Tasks](#) during training, and simply passes on the input during `outnum` times during prediction.

Format

[R6Class](#) object inheriting from [PipeOp](#).

Construction

```
PipeOpChunk$new(outnum, id = "chunk", param_vals = list())
```

- `outnum` :: `numeric(1)`
Number of output channels, and therefore number of chunks created.
- `id` :: `character(1)`
Identifier of resulting object, default "chunk".
- `param_vals` :: `named list`
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output

[PipeOpChunk](#) has one input channel named "input", taking a [Task](#) both during training and prediction.

[PipeOpChunk](#) has multiple output channels depending on the `options` construction argument, named "output1", "output2", ... All output channels produce (respectively disjoint, random) subsets of the input [Task](#) during training, and pass on the original [Task](#) during prediction.

State

The `$state` is left empty (`list()`).

Parameters

- `shuffle` :: `logical(1)`
Should the data be shuffled before chunking? Initialized to TRUE.

Internals

Uses the `mlr3misc::chunk_vector()` function.

Fields

Only fields inherited from [PipeOp](#).

Methods

Only methods inherited from [PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_ensodelmer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputeconstant](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconst](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalemaxabs](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#), [mlr_pipeops_select](#), [mlr_pipeops_smote](#), [mlr_pipeops_spatialsign](#), [mlr_pipeops_subsample](#), [mlr_pipeops_targetinvert](#), [mlr_pipeops_targetmutate](#), [mlr_pipeops_targettrafoscale](#), [mlr_pipeops_textvectorizer](#), [mlr_pipeops_threshold](#), [mlr_pipeops_tunethreshold](#), [mlr_pipeops_unbranch](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops_vtreat](#), [mlr_pipeops_yeojohnson](#), [mlr_pipeops](#)

Examples

```
library("mlr3")

task = tsk("wine")
opc = mlr_pipeops$get("chunk", 2)

# watch the row number: 89 during training (task is chunked)...
opc$train(list(task))

# ... 178 during predict (task is copied)
opc$predict(list(task))
```

```
mlr_pipeops_classbalancing
      Class Balancing
```

Description

Both undersamples a [Task](#) to keep only a fraction of the rows of the majority class, as well as oversamples (repeats data points) rows of the minority class.

Sampling happens only during training phase. Class-balancing a [Task](#) by sampling may be beneficial for classification with imbalanced training data.

Format

[R6Class](#) object inheriting from [PipeOpTaskPreproc](#)/[PipeOp](#).

Construction

```
PipeOpClassBalancing$new(id = "classbalancing", param_vals = list())
```

- `id` :: `character(1)` Identifier of the resulting object, default "classbalancing"
- `param_vals` :: `named list`
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`. Instead of a `Task`, a `TaskClassif` is used as input and output during training and prediction.

The output during training is the input `Task` with added or removed rows to balance target classes. The output during prediction is the unchanged input.

State

The `$state` is a `named list` with the `$state` elements inherited from `PipeOpTaskPreproc`.

Parameters

The parameters are the parameters inherited from `PipeOpTaskPreproc`; however, the `affect_columns` parameter is *not* present. Further parameters are:

- `ratio` :: `numeric(1)`
Ratio of number of rows of classes to keep, relative to the `$reference` value. Initialized to 1.
- `reference` :: `numeric(1)`
What the `$ratio` value is measured against. Can be "all" (mean instance count of all classes), "major" (instance count of class with most instances), "minor" (instance count of class with fewest instances), "nonmajor" (average instance count of all classes except the major one), "nonminor" (average instance count of all classes except the minor one), and "one" (`$ratio` determines the number of instances to have, per class). Initialized to "all".
- `adjust` :: `numeric(1)`
Which classes to up / downsample. Can be "all" (up and downsample all to match required instance count), "major", "minor", "nonmajor", "nonminor" (see respective values for `$reference`), "upsample" (only upsample), and "downsample". Initialized to "all".
- `shuffle` :: `logical(1)`
Whether to shuffle the rows of the resulting task. In case the data is upsampled and `shuffle = FALSE`, the resulting task will have the original rows (which were not removed in down-sampling) in the original order, followed by all newly added rows ordered by target class. Initialized to `TRUE`.

Internals

Up / downsampling happens as follows: At first, a "target class count" is calculated, by taking the mean class count of all classes indicated by the `reference` parameter (e.g. if `reference` is "nonmajor": the mean class count of all classes that are not the "major" class, i.e. the class with the

most samples) and multiplying this with the value of the ratio parameter. If reference is "one", then the "target class count" is just the value of ratio (i.e. $1 * \text{ratio}$).

Then for each class that is referenced by the adjust parameter (e.g. if adjust is "nonminor": each class that is not the class with the fewest samples), `PipeOpClassBalancing` either throws out samples (downsampling), or adds additional rows that are equal to randomly chosen samples (upsampling), until the number of samples for these classes equals the "target class count".

Uses `task$filter()` to remove rows. When identical rows are added during upsampling, then the `taskrow_rolesuse` can *not* be used to duplicate rows because of [inaudible]; instead the `task$rbind()` function is used, and a new `data.table` is attached that contains all rows that are being duplicated exactly as many times as they are being added.

Fields

Only fields inherited from `PipeOpTaskPreproc/PipeOp`.

Methods

Only methods inherited from `PipeOpTaskPreproc/PipeOp`.

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreprocSimple`, `PipeOpTaskPreproc`, `PipeOp`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_ensemblemer`, `mlr_pipeops_encode`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputeconstant`, `mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_mutate`, `mlr_pipeops_nmf`, `mlr_pipeops_nop`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunit`, `mlr_pipeops_pca`, `mlr_pipeops_proxy`, `mlr_pipeops_quantilebin`, `mlr_pipeops_randomprojection`, `mlr_pipeops_randomresponse`, `mlr_pipeops_regravg`, `mlr_pipeops_removeconstant`, `mlr_pipeops_renamecolumns`, `mlr_pipeops_replicate`, `mlr_pipeops_scalemaxabs`, `mlr_pipeops_scalerange`, `mlr_pipeops_scale`, `mlr_pipeops_select`, `mlr_pipeops_smote`, `mlr_pipeops_spatialsign`, `mlr_pipeops_subsample`, `mlr_pipeops_targetinvert`, `mlr_pipeops_targetmutate`, `mlr_pipeops_targettrafoscale`, `mlr_pipeops_textvectorizer`, `mlr_pipeops_threshold`, `mlr_pipeops_tunethreshold`, `mlr_pipeops_unbranch`, `mlr_pipeops_updatetarget`, `mlr_pipeops_vtreat`, `mlr_pipeops_yeojohnson`, `mlr_pipeops`

Examples

```
library("mlr3")

task = tsk("spam")
opb = po("classbalancing")

# target class counts
table(task$truth())
```

```
# double the instances in the minority class (spam)
opb$param_set$values = list(ratio = 2, reference = "minor",
  adjust = "minor", shuffle = FALSE)
result = opb$train(list(task))[[1L]]
table(result$truth())

# up or downsample all classes until exactly 20 per class remain
opb$param_set$values = list(ratio = 20, reference = "one",
  adjust = "all", shuffle = FALSE)
result = opb$train(list(task))[[1]]
table(result$truth())
```

mlr_pipeops_classifavg

Majority Vote Prediction

Description

Perform (weighted) majority vote prediction from classification [Predictions](#) by connecting [PipeOpClassifAvg](#) to multiple [PipeOpLearner](#) outputs.

Always returns a "prob" prediction, regardless of the incoming [Learner](#)'s `$predict_type`. The label of the class with the highest predicted probability is selected as the "response" prediction. If the [Learner](#)'s `$predict_type` is set to "prob", the prediction obtained is also a "prob" type prediction with the probability predicted to be a weighted average of incoming predictions.

All incoming [Learner](#)'s `$predict_type` must agree.

Weights can be set as a parameter; if none are provided, defaults to equal weights for each prediction. Defaults to equal weights for each model.

If ‘

Format

[R6Class](#) inheriting from [PipeOpEnsemble/PipeOp](#).

Construction

```
PipeOpClassifAvg$new(innum = 0, collect_multiplicity = FALSE, id = "classifavg", param_vals = list())
```

- `innum` :: `numeric(1)`
Determines the number of input channels. If `innum` is 0 (default), a `vararg` input channel is created that can take an arbitrary number of inputs.
- `collect_multiplicity` :: `logical(1)`
If `TRUE`, the input is a [Multiplicity](#) collecting channel. This means, a [Multiplicity](#) input, instead of multiple normal inputs, is accepted and the members are aggregated. This requires `innum` to be 0. Default is `FALSE`.
- `id` :: `character(1)` Identifier of the resulting object, default "classifavg".

- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpEnsemble`. Instead of a `Prediction`, a `PredictionClassif` is used as input and output during prediction.

State

The `$state` is left empty (`list()`).

Parameters

The parameters are the parameters inherited from the `PipeOpEnsemble`.

Internals

Inherits from `PipeOpEnsemble` by implementing the private `$weighted_avg_predictions()` method.

Fields

Only fields inherited from `PipeOpEnsemble/PipeOp`.

Methods

Only methods inherited from `PipeOpEnsemble/PipeOp`.

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreprocSimple`, `PipeOpTaskPreproc`, `PipeOp`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classweights`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_encodelmer`, `mlr_pipeops_encode`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputeconstant`, `mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_mutate`, `mlr_pipeops_nmf`, `mlr_pipeops_nop`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunite`, `mlr_pipeops_pca`, `mlr_pipeops_proxy`, `mlr_pipeops_quantilebin`, `mlr_pipeops_randomprojection`, `mlr_pipeops_randomresponse`, `mlr_pipeops_regravg`, `mlr_pipeops_removeconstant`, `mlr_pipeops_renamecolumns`, `mlr_pipeops_replicate`, `mlr_pipeops_scalemaxabs`, `mlr_pipeops_scalerange`, `mlr_pipeops_scale`, `mlr_pipeops_select`, `mlr_pipeops_smote`, `mlr_pipeops_spatialsign`, `mlr_pipeops_subsample`, `mlr_pipeops_targetinvert`, `mlr_pipeops_targetmutate`, `mlr_pipeops_targettrafoscale`, `mlr_pipeops_textvectorizer`, `mlr_pipeops_threshold`, `mlr_pipeops_tunethreshold`, `mlr_pipeops_unbranch`, `mlr_pipeops_updatetarget`, `mlr_pipeops_vtreat`, `mlr_pipeops_yeojohnson`, `mlr_pipeops`

Other Multiplicity PipeOps: [Multiplicity\(\)](#), [PipeOpEnsemble](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_regravg](#), [mlr_pipeops_replicate](#)

Other Ensembles: [PipeOpEnsemble](#), [mlr_learners_avg](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_regravg](#)

Examples

```
library("mlr3")

# Simple Bagging
gr = ppl("grePLICATE",
  po("subsample") %>>%
  po("learner", lrn("classif.rpart")),
  n = 3
) %>>%
  po("classifavg")

resample(tsk("iris"), GraphLearner$new(gr), rsmp("holdout"))
```

mlr_pipeops_classweights

Class Weights for Sample Weighting

Description

Adds a class weight column to the [Task](#) that different [Learners](#) may be able to use for sample weighting. Sample weights are added to each sample according to the target class.

Only binary [classification tasks](#) are supported.

Caution: when constructed naively without parameter, the weights are all set to 1. The `minor_weight` parameter must be adjusted for this [PipeOp](#) to be useful.

Format

[R6Class](#) object inheriting from [PipeOpTaskPreproc/PipeOp](#).

Construction

```
PipeOpClassWeights$new(id = "classweights", param_vals = list())
```

- `id` :: `character(1)` Identifier of the resulting object, default "classweights"
- `param_vals` :: `named list`
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`. Instead of a `Task`, a `TaskClassif` is used as input and output during training and prediction.

The output during training is the input `Task` with added weights column according to target class. The output during prediction is the unchanged input.

State

The `$state` is a named list with the `$state` elements inherited from `PipeOpTaskPreproc`.

Parameters

The parameters are the parameters inherited from `PipeOpTaskPreproc`; however, the `affect_columns` parameter is *not* present. Further parameters are:

- `minor_weight` :: `numeric(1)`
Weight given to samples of the minor class. Major class samples have weight 1. Initialized to 1.

Internals

Introduces, or overwrites, the "weights" column in the `Task`. However, the `Learner` method needs to respect weights for this to have an effect.

The newly introduced column is named `.WEIGHTS`; there will be a naming conflict if this column already exists and is *not* a weight column itself.

Fields

Only fields inherited from `PipeOpTaskPreproc/PipeOp`.

Methods

Only methods inherited from `PipeOpTaskPreproc/PipeOp`.

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreprocSimple`, `PipeOpTaskPreproc`, `PipeOp`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_encodelmer`, `mlr_pipeops_encode`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputeconstant`, `mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_mutate`, `mlr_pipeops_nmf`, `mlr_pipeops_nop`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunite`, `mlr_pipeops_pca`, `mlr_pipeops_proxy`, `mlr_pipeops_quantilebin`, `mlr_pipeops_randomprojection`, `mlr_pipeops_randomresponse`, `mlr_pipeops_regravg`, `mlr_pipeops_removeconst`

```
mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_scalexmaxabs, mlr_pipeops_scalerange,
mlr_pipeops_scale, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_spatialsign,
mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscale,
mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch,
mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson, mlr_pipeops
```

Examples

```
library("mlr3")

task = tsk("spam")
opb = po("classweights")

# task weights
task$weights

# double the instances in the minority class (spam)
opb$param_set$values$minor_weight = 2
result = opb$train(list(task))[[1L]]
result$weights
```

mlr_pipeops_colapply *Apply a Function to each Column of a Task*

Description

Applies a function to each column of a task. Use the `affect_columns` parameter inherited from [PipeOpTaskPreprocSimple](#) to limit the columns this function should be applied to. This can be used for simple parameter transformations or type conversions (e.g. as `.numeric`).

The same function is applied during training and prediction. One important relationship for machine learning preprocessing is that during the prediction phase, the preprocessing on each data row should be independent of other rows. Therefore, the applicator function should always return a vector / list where each result component only depends on the corresponding input component and not on other components. As a rule of thumb, if the function `f` generates output different from `Vectorize(f)`, it is not a function that should be used for applicator.

Format

[R6Class](#) object inheriting from [PipeOpTaskPreprocSimple](#)/[PipeOpTaskPreproc](#)/[PipeOp](#).

Construction

```
PipeOpColApply$new(id = "colapply", param_vals = list())
```

- `id` :: character(1)
Identifier of resulting object, default "colapply".
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreprocSimple`.

The output is the input `Task` with features changed according to the applicator parameter.

State

The `$state` is a named list with the `$state` elements inherited from `PipeOpTaskPreprocSimple`.

Parameters

The parameters are the parameters inherited from `PipeOpTaskPreprocSimple`, as well as:

- `applicator :: function`
Function to apply to each column of the task. The return value should be a vector of the same length as the input, i.e., the function vectorizes over the input. A typical example would be `as.numeric`.
The return value can also be a `matrix`, `data.frame`, or `data.table`. In this case, the length of the input must match the number of returned rows. The names of the resulting features of the output `Task` is based on the (column) name(s) of the return value of the applicator function, prefixed with the original feature name separated by a dot (`.`). Use `Vectorize` to create a vectorizing function from any function that ordinarily only takes one element input.

Internals

Calls `map` on the data, using the value of `applicator` as `f`. and coerces the output via `as.data.table`.

Fields

Only fields inherited from `PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp`.

Methods

Only methods inherited from `PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp`.

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreprocSimple`, `PipeOpTaskPreproc`, `PipeOp`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_collapsefact`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_encodelmer`, `mlr_pipeops_encode`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputeconstant`, `mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_mutate`, `mlr_pipeops_nmf`, `mlr_pipeops_nop`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunite`, `mlr_pipeops_pca`, `mlr_pipeops_proxy`, `mlr_pipeops_quantilebin`,

```
mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstant,
mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange,
mlr_pipeops_scale, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_spatialsign,
mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscale,
mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch,
mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson, mlr_pipeops
```

Examples

```
library("mlr3")

task = tsk("iris")
poca = po("colapply", applicator = as.character)
poca$train(list(task))[[1]] # types are converted

# function that does not vectorize
f1 = function(x) {
  # we could use `ifelse` here, but that is not the point
  if (x > 1) {
    "a"
  } else {
    "b"
  }
}
poca$param_set$values$applicator = Vectorize(f1)
poca$train(list(task))[[1]]$data()

# only affect Petal.* columns
poca$param_set$values$affect_columns = selector_grep("^Petal")
poca$train(list(task))[[1]]$data()

# function returning multiple columns
f2 = function(x) {
  cbind(floor = floor(x), ceiling = ceiling(x))
}
poca$param_set$values$applicator = f2
poca$param_set$values$affect_columns = selector_all()
poca$train(list(task))[[1]]$data()
```

```
mlr_pipeops_collapsefactors
```

Collapse Factors

Description

Collapses factors of type factor, ordered: Collapses the rarest factors in the training samples, until `target_level_count` levels remain. Levels that have prevalence above `no_collapse_above_prevalence` are retained, however. For factor variables, these are collapsed to the next larger level, for ordered variables, rare variables are collapsed to the neighbouring class, whichever has fewer samples.

Levels not seen during training are not touched during prediction; Therefore it is useful to combine this with the [PipeOpFixFactors](#).

Format

[R6Class](#) object inheriting from [PipeOpTaskPreprocSimple](#)/[PipeOpTaskPreproc](#)/[PipeOp](#).

Construction

```
PipeOpCollapseFactors$new(id = "collapsefactors", param_vals = list())
```

- `id` :: `character(1)`
Identifier of resulting object, default "collapsefactors".
- `param_vals` :: `named list`
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpTaskPreproc](#).

The output is the input [Task](#) with rare affected factor and ordered feature levels collapsed.

State

The `$state` is a `named list` with the `$state` elements inherited from [PipeOpTaskPreproc](#), as well as:

- `collapse_map` :: `named list of named list of character`
List of factor level maps. For each factor, `collapse_map` contains a `named list` that indicates what levels of the input task get mapped to what levels of the output task. If `collapse_map` has an entry `feat_1` with an entry `a = c("x", "y")`, it means that levels "x" and "y" get collapsed to level "a" in feature "feat_1".

Parameters

The parameters are the parameters inherited from [PipeOpTaskPreproc](#), as well as:

- `no_collapse_above_prevalence` :: `numeric(1)`
Fraction of samples below which factor levels get collapsed. Default is 1, which causes all levels to be collapsed until `target_level_count` remain.
- `target_level_count` :: `integer(1)`
Number of levels to retain. Default is 2.

Internals

Makes use of the fact that `levels(fact_var) = list(target1 = c("source1", "source2"), target2 = "source2")` causes renaming of level "source1" and "source2" both to "target1", and also "source2" to "target2".

Methods

Only methods inherited from [PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_encode1mer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputeconstant](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunit](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconstant](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalemaxabs](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#), [mlr_pipeops_select](#), [mlr_pipeops_smote](#), [mlr_pipeops_spatialsign](#), [mlr_pipeops_subsample](#), [mlr_pipeops_targetinvert](#), [mlr_pipeops_targetmutate](#), [mlr_pipeops_targettrafoscale](#), [mlr_pipeops_textvectorizer](#), [mlr_pipeops_threshold](#), [mlr_pipeops_tunethreshold](#), [mlr_pipeops_unbranch](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops_vtreat](#), [mlr_pipeops_yeojohnson](#), [mlr_pipeops](#)

Examples

```
library("mlr3")
```

```
mlr_pipeops_colroles  Change Column Roles of a Task
```

Description

Changes the column roles of the input [Task](#) according to `new_role`.

Format

[R6Class](#) object inheriting from [PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp](#).

Construction

```
PipeOpColRoles$new(id = "colroles", param_vals = list())
```

- `id` :: character(1)
Identifier of resulting object, default "colroles".
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`.

The output is the input `Task` with transformed column roles according to `new_role`.

State

The `$state` is a named list with the `$state` elements inherited from `PipeOpTaskPreproc`.

Parameters

The parameters are the parameters inherited from `PipeOpTaskPreproc`, as well as:

- `new_role :: list`
Named list of new column roles. The names must match the column names of the input task that will later be trained/predicted on. Each entry of the list must contain a character vector with possible values of `mlr_reflections$task_col_roles`. If the value is given as `character()`, the column will be dropped from the input task. Changing the role of a column results in this column losing its previous role(s). Setting a new target variable or changing the role of an existing target variable is not supported.

Methods

Only methods inherited from `PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp`.

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreprocSimple`, `PipeOpTaskPreproc`, `PipeOp`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_encode1mer`, `mlr_pipeops_encode`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputeconstant`, `mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_mutate`, `mlr_pipeops_nmf`, `mlr_pipeops_nop`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunite`, `mlr_pipeops_pca`, `mlr_pipeops_proxy`, `mlr_pipeops_quantilebin`, `mlr_pipeops_randomprojection`, `mlr_pipeops_randomresponse`, `mlr_pipeops_regravg`, `mlr_pipeops_removeconstant`, `mlr_pipeops_renamecolumns`, `mlr_pipeops_replicate`, `mlr_pipeops_scalexmaxabs`, `mlr_pipeops_scalerange`, `mlr_pipeops_scale`, `mlr_pipeops_select`, `mlr_pipeops_smote`, `mlr_pipeops_spatialsign`, `mlr_pipeops_subsample`, `mlr_pipeops_targetinvert`, `mlr_pipeops_targetmutate`, `mlr_pipeops_targettrafoscale`, `mlr_pipeops_textvectorizer`, `mlr_pipeops_threshold`, `mlr_pipeops_tunethreshold`, `mlr_pipeops_unbranch`, `mlr_pipeops_updatetarget`, `mlr_pipeops_vtreat`, `mlr_pipeops_yeojohnson`, `mlr_pipeops`

Examples

```
library("mlr3")
```

```

task = tsk("boston_housing")
pop = po("colroles", param_vals = list(
  new_role = list(cmedv = "order")
))

pop$train(list(task))

```

mlr_pipeops_copy

*Copy Input Multiple Times***Description**

Copies its input `outnum` times. This PipeOp usually not needed, because copying happens automatically when one PipeOp is followed by multiple different PipeOps. However, when constructing big Graphs using the `%>>%`-operator, PipeOpCopy can be helpful to specify which PipeOp gets connected to which.

Format

R6Class object inheriting from PipeOp.

Construction

```
PipeOpCopy$new(outnum, id = "copy", param_vals = list())
```

- `outnum` :: numeric(1)
Number of output channels, and therefore number of copies being made.
- `id` :: character(1)
Identifier of resulting object, default "copy".
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default list().

Input and Output Channels

PipeOpCopy has one input channel named "input", taking any input ("*") both during training and prediction.

PipeOpCopy has multiple output channels depending on the `outnum` construction argument, named "output1", "output2", ... All output channels produce the object given as input ("*").

State

The `$state` is left empty (list()).

Parameters

PipeOpCopy has no parameters.

Internals

Note that copies are not clones, but only reference copies. This affects R6-objects: If R6 objects are copied using PipeOpCopy, they must be cloned before

Fields

Only fields inherited from [PipeOp](#).

Methods

Only methods inherited from [PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_ensemblemer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputeconstant](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconstant](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalemaxabs](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#), [mlr_pipeops_select](#), [mlr_pipeops_smote](#), [mlr_pipeops_spatialsign](#), [mlr_pipeops_subsample](#), [mlr_pipeops_targetinvert](#), [mlr_pipeops_targetmutate](#), [mlr_pipeops_targettrafoscale](#), [mlr_pipeops_textvectorizer](#), [mlr_pipeops_threshold](#), [mlr_pipeops_tunethreshold](#), [mlr_pipeops_unbranch](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops_vtreat](#), [mlr_pipeops_yeojohnson](#), [mlr_pipeops](#)

Other Placeholder Pipeops: [mlr_pipeops_nop](#)

Examples

```
# The following copies the output of 'scale' automatically to both
# 'pca' and 'nop'
po("scale") %>>%
  gunion(list(
    po("pca"),
    po("nop")
  ))

# The following would not work: the '%>>'-operator does not know
# which output to connect to which input
# > gunion(list(
# >   po("scale"),
# >   po("select")
```

```

# > )) %>>%
# >   gunion(list(
# >     po("pca"),
# >     po("nop"),
# >     po("imputemean")
# >   ))
# Instead, the 'copy' operator makes clear which output gets copied.
gunion(list(
  po("scale") %>>% mlr_pipeops$get("copy", outnum = 2),
  po("select")
)) %>>%
  gunion(list(
    po("pca"),
    po("nop"),
    po("imputemean")
  ))

```

mlr_pipeops_datefeatures

Preprocess Date Features

Description

Based on POSIXct columns of the data, a set of date related features is computed and added to the feature set of the output task. If no POSIXct column is found, the original task is returned unaltered. This functionality is based on the `add_datepart()` and `add_cyclic_datepart()` functions from the `fastai` library. If operation on only particular POSIXct columns is requested, use the `affect_columns` parameter inherited from [PipeOpTaskPreprocSimple](#).

If `cyclic = TRUE`, cyclic features are computed for the features "month", "week_of_year", "day_of_year", "day_of_month", "day_of_week", "hour", "minute" and "second". This means that for each feature `x`, two additional features are computed, namely the sine and cosine transformation of $2 * \pi * x / \max_x$ (here `max_x` is the largest possible value the feature could take on + 1, assuming the lowest possible value is given by 0, e.g., for hours from 0 to 23, this is 24). This is useful to respect the cyclical nature of features such as seconds, i.e., second 21 and second 22 are one second apart, but so are second 60 and second 1 of the next minute.

Format

[R6Class](#) object inheriting from [PipeOpTaskPreprocSimple](#)/[PipeOpTaskPreproc](#)/[PipeOp](#).

Construction

```
PipeOpDateFeatures$new(id = "datefeatures", param_vals = list())
```

- `id` :: character(1)
Identifier of resulting object, default "datefeatures".
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpTaskPreprocSimple](#).

The output is the input [Task](#) with date-related features computed and added to the feature set of the output task and the POSIXct columns of the data removed from the feature set (depending on the value of `keep_date_var`).

State

The `$state` is a named list with the `$state` elements inherited from [PipeOpTaskPreprocSimple](#).

Parameters

The parameters are the parameters inherited from [PipeOpTaskPreprocSimple](#), as well as:

- `keep_date_var :: logical(1)`
Should the POSIXct columns be kept as features? Default FALSE.
- `cyclic :: logical(1)`
Should cyclic features be computed? See Internals. Default FALSE.
- `year :: logical(1)`
Should the year be extracted as a feature? Default TRUE.
- `month :: logical(1)`
Should the month be extracted as a feature? Default TRUE.
- `week_of_year :: logical(1)`
Should the week of the year be extracted as a feature? Default TRUE.
- `day_of_year :: logical(1)`
Should the day of the year be extracted as a feature? Default TRUE.
- `day_of_month :: logical(1)`
Should the day of the month be extracted as a feature? Default TRUE.
- `day_of_week :: logical(1)`
Should the day of the week be extracted as a feature? Default TRUE.
- `hour :: logical(1)`
Should the hour be extracted as a feature? Default TRUE.
- `minute :: logical(1)`
Should the minute be extracted as a feature? Default TRUE.
- `second :: logical(1)`
Should the second be extracted as a feature? Default TRUE.
- `is_day :: logical(1)`
Should a feature be extracted indicating whether it is day time (06:00am - 08:00pm)? Default TRUE.

Internals

The cyclic feature transformation always assumes that values range from 0, so some values (e.g. day of the month) are shifted before sine/cosine transform.

Methods

Only methods inherited from [PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp](#).

Fields

Only fields inherited from [PipeOpTaskPreproc/PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_encodelmer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputeconstant](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunit](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconstant](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalemaxabs](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#), [mlr_pipeops_select](#), [mlr_pipeops_smote](#), [mlr_pipeops_spatialsign](#), [mlr_pipeops_subsample](#), [mlr_pipeops_targetinvert](#), [mlr_pipeops_targetmutate](#), [mlr_pipeops_targettrafoscale](#), [mlr_pipeops_textvectorizer](#), [mlr_pipeops_threshold](#), [mlr_pipeops_tunethreshold](#), [mlr_pipeops_unbranch](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops_vtreat](#), [mlr_pipeops_yeojohnson](#), [mlr_pipeops](#)

Examples

```
library("mlr3")
dat = iris
set.seed(1)
dat$date = sample(seq(as.POSIXct("2020-02-01"), to = as.POSIXct("2020-02-29"), by = "hour"),
  size = 150L)
task = TaskClassif$new("iris_date", backend = dat, target = "Species")
pop = po("datefeatures", param_vals = list(cyclic = FALSE, minute = FALSE, second = FALSE))
pop$train(list(task))
pop$state
```

Description

Encodes columns of type factor, character and ordered.

Possible encodings are "one-hot" encoding, as well as encoding according to `stats::contr.helmert()`, `stats::contr.poly()`, `stats::contr.sum()` and `stats::contr.treatment()`. Newly created columns are named via pattern `[column-name].[x]` where `x` is the respective factor level for "one-hot" and "treatment" encoding, and an integer sequence otherwise.

Use the [PipeOpTaskPreproc](#) `$affect_columns` functionality to only encode a subset of columns, or only encode columns of a certain type.

Format

[R6Class](#) object inheriting from [PipeOpTaskPreprocSimple](#)/[PipeOpTaskPreproc](#)/[PipeOp](#).

Construction

```
PipeOpEncode$new(id = "encode", param_vals = list())
```

- `id` :: `character(1)`
Identifier of resulting object, default "encode".
- `param_vals` :: `named list`
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpTaskPreproc](#).

The output is the input [Task](#) with all affected factor, character or ordered parameters encoded according to the method parameter.

State

The `$state` is a `named list` with the `$state` elements inherited from [PipeOpTaskPreproc](#), as well as:

- `contrasts` :: `named list of matrix`
List of contrast matrices, one for each affected discrete feature. The rows of each matrix correspond to (training task) levels, the the columns to the new columns that replace the old discrete feature. See [stats::contrasts](#).

Parameters

The parameters are the parameters inherited from [PipeOpTaskPreproc](#), as well as:

- `method` :: `character(1)`
Initialized to "one-hot". One of:
 - "one-hot": create a new column for each factor level.
 - "treatment": create $n-1$ columns leaving out the first factor level of each factor variable (see `stats::contr.treatment()`).

- "helmert": create columns according to Helmert contrasts (see `stats::contr.helmert()`).
- "poly": create columns with contrasts based on orthogonal polynomials (see `stats::contr.poly()`).
- "sum": create columns with contrasts summing to zero, (see `stats::contr.sum()`).

Internals

Uses the `stats::contrasts` functions. This is relatively inefficient for features with a large number of levels.

Methods

Only methods inherited from `PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp`.

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreprocSimple`, `PipeOpTaskPreproc`, `PipeOp`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_encodelmer`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputeconstant`, `mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_mutate`, `mlr_pipeops_nmf`, `mlr_pipeops_nop`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunite`, `mlr_pipeops_pca`, `mlr_pipeops_proxy`, `mlr_pipeops_quantilebin`, `mlr_pipeops_randomprojection`, `mlr_pipeops_randomresponse`, `mlr_pipeops_regravg`, `mlr_pipeops_removeconstant`, `mlr_pipeops_renamecolumns`, `mlr_pipeops_replicate`, `mlr_pipeops_scalemaxabs`, `mlr_pipeops_scalerange`, `mlr_pipeops_scale`, `mlr_pipeops_select`, `mlr_pipeops_smote`, `mlr_pipeops_spatialsign`, `mlr_pipeops_subsample`, `mlr_pipeops_targetinvert`, `mlr_pipeops_targetmutate`, `mlr_pipeops_targettrafoscale`, `mlr_pipeops_textvectorizer`, `mlr_pipeops_threshold`, `mlr_pipeops_tunethreshold`, `mlr_pipeops_unbranch`, `mlr_pipeops_updatetarget`, `mlr_pipeops_vtreat`, `mlr_pipeops_yeojohnson`, `mlr_pipeops`

Examples

```
library("mlr3")

data = data.table::data.table(x = factor(letters[1:3]), y = factor(letters[1:3]))
task = TaskClassif$new("task", data, "x")

poe = po("encode")

# poe is initialized with encoding: "one-hot"
poe$train(list(task))[[1]]$data()

# other kinds of encoding:
poe$param_set$values$method = "treatment"
poe$train(list(task))[[1]]$data()
```



```

poe$param_set$values$method = "helmert"
poe$train(list(task))[[1]]$data()

poe$param_set$values$method = "poly"
poe$train(list(task))[[1]]$data()

poe$param_set$values$method = "sum"
poe$train(list(task))[[1]]$data()

```

mlr_pipeops_encodeimpact

Conditional Target Value Impact Encoding

Description

Encodes columns of type factor, character and ordered.

Impact coding for [classification Tasks](#) converts factor levels of each (factorial) column to the difference between each target level's conditional log-likelihood given this level, and the target level's global log-likelihood.

Impact coding for [regression Tasks](#) converts factor levels of each (factorial) column to the difference between the target's conditional mean given this level, and the target's global mean.

Treats new levels during prediction like missing values.

Format

[R6Class](#) object inheriting from [PipeOpTaskPreprocSimple](#)/[PipeOpTaskPreproc](#)/[PipeOp](#).

Construction

```
PipeOpEncodeImpact$new(id = "encodeimpact", param_vals = list())
```

- `id` :: `character(1)`
Identifier of resulting object, default "encodeimpact".
- `param_vals` :: `named list`
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpTaskPreproc](#).

The output is the input [Task](#) with all affected factor, character or ordered parameters encoded.

State

The `$state` is a named list with the `$state` elements inherited from `PipeOpTaskPreproc`, as well as:

- `impact` :: a named list
A list with an element for each affected feature:
For regression each element is a single column matrix of impact values for each level of that feature.
For classification, it is a list with an element for each *feature level*, which is a vector giving the impact of this feature level on each *outcome level*.

Parameters

- `smoothing` :: `numeric(1)`
A finite positive value used for smoothing. Mostly relevant for `classification Tasks` if a factor does not coincide with a target factor level (and would otherwise give an infinite logit value). Initialized to `1e-4`.
- `impute_zero` :: `logical(1)`
If TRUE, impute missing values as impact 0; otherwise the respective impact is coded as NA. Default FALSE.

Internals

Uses Laplace smoothing, mostly to avoid infinite values for `classification Task`.

Methods

Only methods inherited `PipeOpTaskPreproc/PipeOp`.

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreprocSimple`, `PipeOpTaskPreproc`, `PipeOp`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_ensodelmer`, `mlr_pipeops_encode`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputeconstant`, `mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_mutate`, `mlr_pipeops_nmf`, `mlr_pipeops_nop`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunite`, `mlr_pipeops_pca`, `mlr_pipeops_proxy`, `mlr_pipeops_quantilebin`, `mlr_pipeops_randomprojection`, `mlr_pipeops_randomresponse`, `mlr_pipeops_regravg`, `mlr_pipeops_removeconstant`, `mlr_pipeops_renamecolumns`, `mlr_pipeops_replicate`, `mlr_pipeops_scalemaxabs`, `mlr_pipeops_scalerange`, `mlr_pipeops_scale`, `mlr_pipeops_select`, `mlr_pipeops_smote`, `mlr_pipeops_spatialsign`, `mlr_pipeops_subsample`, `mlr_pipeops_targetinvert`, `mlr_pipeops_targetmutate`, `mlr_pipeops_targettrafoscale`, `mlr_pipeops_textvectorizer`, `mlr_pipeops_threshold`, `mlr_pipeops_tunethreshold`, `mlr_pipeops_unbranch`, `mlr_pipeops_updatetarget`, `mlr_pipeops_vtreat`, `mlr_pipeops_yeojohnson`, `mlr_pipeops`

Examples

```
library("mlr3")
poe = po("encodeimpact")

task = TaskClassif$new("task",
  data.table::data.table(
    x = factor(c("a", "a", "a", "b", "b")),
    y = factor(c("a", "a", "b", "b", "b")),
    "x")

poe$train(list(task))[[1]]$data()

poe$state
```

mlr_pipeops_encode_lmer

*Impact Encoding with Random Intercept Models***Description**

Encodes columns of type factor, character and ordered.

`PipeOpEncodeLmer()` converts factor levels of each factorial column to the estimated coefficients of a simple random intercept model. Models are fitted with the `glmer` function of the `lme4` package and are of the type $\text{target} \sim 1 + (1 | \text{factor})$. If the task is a regression task, the numeric target variable is used as dependent variable and the factor is used for grouping. If the task is a classification task, the target variable is used as dependent variable and the factor is used for grouping. If the target variable is multiclass, for each level of the multiclass target variable, binary "one vs. rest" models are fitted.

For training, multiple models can be estimated in a cross-validation scheme to ensure that the same factor level does not always result in identical values in the converted numerical feature. For prediction, a global model (which was fitted on all observations during training) is used for each factor. New factor levels are converted to the value of the intercept coefficient of the global model for prediction. NAs are ignored by the CPO.

Use the `PipeOpTaskPreproc` `$affect_columns` functionality to only encode a subset of columns, or only encode columns of a certain type.

Format

`R6Class` object inheriting from `PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp`.

Construction

```
PipeOpEncodeLmer$new(id = "encode_lmer", param_vals = list())
```

- `id` :: character(1)
Identifier of resulting object, default "encode_lmer".

- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpTaskPreproc](#).

The output is the input [Task](#) with all affected factor, character or ordered parameters encoded according to the method parameter.

State

The `$state` is a named list with the `$state` elements inherited from [PipeOpTaskPreproc](#), as well as:

- `target_levels` :: character
Levels of the target columns.
- `control` :: a named list
List of coefficients learned via `glmer`

Parameters

- `fast_optim` :: `logical(1)`
Initialized to `TRUE`. If "fast_optim" is `TRUE` (default), a faster (up to 50 percent) optimizer from the `nloptr` package is used when fitting the `lmer` models. This uses additional stopping criteria which can give suboptimal results.

Internals

Uses the `lme4::glmer`. This is relatively inefficient for features with a large number of levels.

Methods

Only methods inherited [PipeOpTaskPreproc/PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputeconstant](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#),

```
mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstant,
mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_scalexmaxabs, mlr_pipeops_scalerange,
mlr_pipeops_scale, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_spatialsign,
mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscale,
mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch,
mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson, mlr_pipeops
```

Examples

```
library("mlr3")
poe = po("encodelmer")

task = TaskClassif$new("task",
  data.table::data.table(
    x = factor(c("a", "a", "a", "b", "b")),
    y = factor(c("a", "a", "b", "b", "b"))),
  "x")

poe$train(list(task)[[1]]$data())

poe$state
```

```
mlr_pipeops_featureunion
```

Aggregate Features from Multiple Inputs

Description

Aggregates features from all input tasks by `cbind()`ing them together into a single `Task`.

`DataBackend` primary keys and `Task` targets have to be equal across all `Tasks`. Only the target column(s) of the first `Task` are kept.

If `assert_targets_equal` is TRUE then target column names are compared and an error is thrown if they differ across inputs.

If input tasks share some feature names but these features are not identical an error is thrown. This check is performed by first comparing the features names and if duplicates are found, also the values of these possibly duplicated features. True duplicated features are only added a single time to the output task.

Format

`R6Class` object inheriting from `PipeOp`.

Construction

```
PipeOpFeatureUnion$new(innum = 0, collect_multiplicity = FALSE, id = "featureunion", param_vals = list(
  assert_targets_equal = TRUE))
```

- `innum :: numeric(1) | character`
Determines the number of input channels. If `innum` is 0 (default), a `vararg` input channel is created that can take an arbitrary number of inputs. If `innum` is a character vector, the number of input channels is the length of `innum`, and the columns of the result are prefixed with the values.
- `collect_multiplicity :: logical(1)`
If TRUE, the input is a `Multiplicity` collecting channel. This means, a `Multiplicity` input, instead of multiple normal inputs, is accepted and the members are aggregated. This requires `innum` to be 0. Default is FALSE.
- `id :: character(1)`
Identifier of the resulting object, default "featureunion".
- `param_vals :: named list`
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.
- `assert_targets_equal :: logical(1)`
If `assert_targets_equal` is TRUE (Default), task target column names are checked for agreement. Disagreeing target column names are usually a bug, so this should often be left at the default.

Input and Output Channels

`PipeOpFeatureUnion` has multiple input channels depending on the `innum` construction argument, named "input1", "input2", ... if `innum` is nonzero; if `innum` is 0, there is only one `vararg` input channel named "...". All input channels take a `Task` both during training and prediction.

`PipeOpFeatureUnion` has one output channel named "output", producing a `Task` both during training and prediction.

The output is a `Task` constructed by `cbind()`ing all features from all input `Tasks`, both during training and prediction.

State

The `$state` is left empty (`list()`).

Parameters

`PipeOpFeatureUnion` has no Parameters.

Internals

`PipeOpFeatureUnion` uses the `Task $cbind()` method to bind the input values beyond the first input to the first `Task`. This means if the `Tasks` are database-backed, all of them except the first will be fetched into R memory for this. This behaviour may change in the future.

Fields

Only fields inherited from `PipeOp`.

Methods

Only methods inherited from `PipeOp`.

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreprocSimple`, `PipeOpTaskPreproc`, `PipeOp`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_encodelmer`, `mlr_pipeops_encode`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputeconstant`, `mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_mutate`, `mlr_pipeops_nmf`, `mlr_pipeops_nop`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunite`, `mlr_pipeops_pca`, `mlr_pipeops_proxy`, `mlr_pipeops_quantilebin`, `mlr_pipeops_randomprojection`, `mlr_pipeops_randomresponse`, `mlr_pipeops_regravg`, `mlr_pipeops_removeconstant`, `mlr_pipeops_renamecolumns`, `mlr_pipeops_replicate`, `mlr_pipeops_scalemaxabs`, `mlr_pipeops_scalerange`, `mlr_pipeops_scale`, `mlr_pipeops_select`, `mlr_pipeops_smote`, `mlr_pipeops_spatialsign`, `mlr_pipeops_subsample`, `mlr_pipeops_targetinvert`, `mlr_pipeops_targetmutate`, `mlr_pipeops_targettrafoscale`, `mlr_pipeops_textvectorizer`, `mlr_pipeops_threshold`, `mlr_pipeops_tunethreshold`, `mlr_pipeops_unbranch`, `mlr_pipeops_updatetarget`, `mlr_pipeops_vtreat`, `mlr_pipeops_yeojohnson`, `mlr_pipeops`

Other Multiplicity PipeOps: `Multiplicity()`, `PipeOpEnsemble`, `mlr_pipeops_classifavg`, `mlr_pipeops_multiplicity`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunite`, `mlr_pipeops_regravg`, `mlr_pipeops_replicate`

Examples

```
library("mlr3")

task1 = tsk("iris")
gr = gunion(list(
  po("nop"),
  po("pca")
)) %>% po("featureunion")

gr$train(task1)

task2 = tsk("iris")
task3 = tsk("iris")
po = po("featureunion", innum = c("a", "b"))

po$train(list(task2, task3))
```

mlr_pipeops_filter *Feature Filtering*

Description

Feature filtering using a `mlr3filters::Filter` object, see the `mlr3filters` package.

If a `Filter` can only operate on a subset of columns based on column type, then only these features are considered and filtered. `nfeat` and `frac` will count for the features of the type that the `Filter` can operate on; this means e.g. that setting `nfeat` to 0 will only remove features of the type that the `Filter` can work with.

Format

`R6Class` object inheriting from `PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp`.

Construction

```
PipeOpFilter$new(filter, id = filter$id, param_vals = list())
```

- `filter` :: `Filter`
`Filter` used for feature filtering. This argument is always cloned; to access the `Filter` inside `PipeOpFilter` by-reference, use `$filter`.
- `id` :: `character(1)` Identifier of the resulting object, defaulting to the `id` of the `Filter` being used.
- `param_vals` :: `named list`
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`.

The output is the input `Task` with features removed that were filtered out.

State

The `$state` is a `named list` with the `$state` elements inherited from `PipeOpTaskPreproc`, as well as:

- `scores` :: `named numeric`
Scores calculated for all features of the training `Task` which are being used as cutoff for feature filtering. If `frac` or `nfeat` is given, the underlying `Filter` may choose to not calculate scores for all features that are given. This only includes features on which the `Filter` can operate; e.g. if the `Filter` can only operate on numeric features, then scores for factorial features will not be given.
- `features` :: `character`
Names of features that are being kept. Features of types that the `Filter` can not operate on are always being kept.

Parameters

The parameters are the parameters inherited from the [PipeOpTaskPreproc](#), as well as the parameters of the [Filter](#) used by this object. Besides, parameters introduced are:

- `filter.nfeat` :: `numeric(1)`
Number of features to select. Mutually exclusive with `frac`, `cutoff`, and `permuted`.
- `filter.frac` :: `numeric(1)`
Fraction of features to keep. Mutually exclusive with `nfeat`, `cutoff`, and `permuted`.
- `filter.cutoff` :: `numeric(1)`
Minimum value of filter heuristic for which to keep features. Mutually exclusive with `nfeat`, `frac`, and `permuted`.
- `filter.permuted` :: `integer(1)`
If this parameter is set, a random permutation of each feature is added to the task before applying the filter. All features selected before the `permuted`-th permuted features is selected are kept. This is similar to the approach in Wu (2007) and Thomas (2017). Mutually exclusive with `nfeat`, `frac`, and `cutoff`.

Note that at least one of `filter.nfeat`, `filter.frac`, `filter.cutoff`, and `filter.permuted` must be given.

Internals

This does *not* use the `$.select_cols` feature of [PipeOpTaskPreproc](#) to select only features compatible with the [Filter](#); instead the whole [Task](#) is used by `private$.get_state()` and subset internally.

Fields

Fields inherited from [PipeOpTaskPreproc](#), as well as:

- `filter` :: [Filter](#)
[Filter](#) that is being used for feature filtering. Do *not* use this slot to get to the feature filtering scores after training; instead, use `$state$scores`. Read-only.

Methods

Methods inherited from [PipeOpTaskPreprocSimple](#)/[PipeOpTaskPreproc](#)/[PipeOp](#).

References

Wu Y, Boos DD, Stefanski LA (2007). “Controlling Variable Selection by the Addition of Pseudovariates.” *Journal of the American Statistical Association*, **102**(477), 235–243. doi: [10.1198/016214506000000843](https://doi.org/10.1198/016214506000000843).

Thomas J, Hepp T, Mayr A, Bischl B (2017). “Probing for Sparse and Fast Variable Selection with Model-Based Boosting.” *Computational and Mathematical Methods in Medicine*, **2017**, 1–8. doi: [10.1155/2017/1421409](https://doi.org/10.1155/2017/1421409).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreprocSimple`, `PipeOpTaskPreproc`, `PipeOp`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_encodelmer`, `mlr_pipeops_encode`, `mlr_pipeops_featureunion`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputeconstant`, `mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_mutate`, `mlr_pipeops_nmf`, `mlr_pipeops_nop`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunite`, `mlr_pipeops_pca`, `mlr_pipeops_proxy`, `mlr_pipeops_quantilebin`, `mlr_pipeops_randomprojection`, `mlr_pipeops_randomresponse`, `mlr_pipeops_regravg`, `mlr_pipeops_removeconstant`, `mlr_pipeops_renamecolumns`, `mlr_pipeops_replicate`, `mlr_pipeops_scalexmaxabs`, `mlr_pipeops_scalerange`, `mlr_pipeops_scale`, `mlr_pipeops_select`, `mlr_pipeops_smote`, `mlr_pipeops_spatialsign`, `mlr_pipeops_subsample`, `mlr_pipeops_targetinvert`, `mlr_pipeops_targetmutate`, `mlr_pipeops_targettrafoscale`, `mlr_pipeops_textvectorizer`, `mlr_pipeops_threshold`, `mlr_pipeops_tunethreshold`, `mlr_pipeops_unbranch`, `mlr_pipeops_updatetarget`, `mlr_pipeops_vtreat`, `mlr_pipeops_yeojohnson`, `mlr_pipeops`

Examples

```
library("mlr3")
library("mlr3filters")

# setup PipeOpFilter to keep the 5 most important
# features of the spam task w.r.t. their AUC
task = tsk("spam")
filter = flt("auc")
po = po("filter", filter = filter)
po$param_set
po$param_set$values$filter.nfeat = 5

# filter the task
filtered_task = po$train(list(task))[[1]]

# filtered task + extracted AUC scores
filtered_task$feature_names
head(po$state$scores, 10)

# feature selection embedded in a 3-fold cross validation
# keep 30% of features based on their AUC score
task = tsk("spam")
gr = po("filter", filter = flt("auc"), filter.frac = 0.5) %>>%
  po("learner", lrn("classif.rpart"))
learner = GraphLearner$new(gr)
rr = resample(task, learner, rsmpl("holdout"), store_models = TRUE)
rr$learners[[1]]$model$auc$scores
```

mlr_pipeops_fixfactors
Fix Factor Levels

Description

Fixes factors of type `factor`, ordered: Makes sure the factor levels during prediction are the same as during training; possibly dropping empty training factor levels before.

Note this may introduce *missing values* during prediction if unseen factor levels are found.

Format

`R6Class` object inheriting from `PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp`.

Construction

```
PipeOpFixFactors$new(id = "fixfactors", param_vals = list())
```

- `id` :: `character(1)`
Identifier of resulting object, default `"fixfactors"`.
- `param_vals` :: `named list`
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`.

The output is the input `Task` with all affected factor and ordered feature levels fixed.

State

The `$state` is a `named list` with the `$state` elements inherited from `PipeOpTaskPreproc`, as well as:

- `levels` :: `named list of character`
List of factor levels of each affected factor or ordered feature that will be fixed.

Parameters

The parameters are the parameters inherited from `PipeOpTaskPreproc`, as well as:

- `droplevels` :: `logical(1)`
Whether to drop empty factor levels of the training task. Default `TRUE`

Internals

Changes factor levels of columns and attaches them with a new `data.table` backend and the virtual `cbind()` backend.

Methods

Only methods inherited from [PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_encodelmer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputeconstant](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconstant](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalemaxabs](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#), [mlr_pipeops_select](#), [mlr_pipeops_smote](#), [mlr_pipeops_spatialsign](#), [mlr_pipeops_subsample](#), [mlr_pipeops_targetinvert](#), [mlr_pipeops_targetmutate](#), [mlr_pipeops_targettrafoscale](#), [mlr_pipeops_textvectorizer](#), [mlr_pipeops_threshold](#), [mlr_pipeops_tunethreshold](#), [mlr_pipeops_unbranch](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops_vtreat](#), [mlr_pipeops_yeojohnson](#), [mlr_pipeops](#)

Examples

```
library("mlr3")
```

```
mlr_pipeops_histbin     Split Numeric Features into Equally Spaced Bins
```

Description

Splits numeric features into equally spaced bins. See [graphics::hist\(\)](#) for details. Values that fall out of the training data range during prediction are binned with the lowest / highest bin respectively.

Format

[R6Class](#) object inheriting from [PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp](#).

Construction

```
PipeOpHistBin$new(id = "histbin", param_vals = list())
```

- `id` :: character(1)
Identifier of resulting object, default "histbin".
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpTaskPreproc](#).

The output is the input [Task](#) with all affected numeric features replaced by their binned versions.

State

The `$state` is a named list with the `$state` elements inherited from [PipeOpTaskPreproc](#), as well as:

- `breaks :: list`
List of intervals representing the bins for each numeric feature.

Parameters

The parameters are the parameters inherited from [PipeOpTaskPreproc](#), as well as:

- `breaks :: character(1) | numeric | function`
Either a `character(1)` string naming an algorithm to compute the number of cells, a `numeric(1)` giving the number of breaks for the histogram, a vector `numeric` giving the breakpoints between the histogram cells, or a function to compute the vector of breakpoints or to compute the number of cells. Default is algorithm "Sturges" (see [grDevices::nclass.Sturges\(\)](#)). For details see [hist\(\)](#).

Internals

Uses the [graphics::hist](#) function.

Methods

Only methods inherited from [PipeOpTaskPreprocSimple](#)/[PipeOpTaskPreproc](#)/[PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_ensemblmer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputeconstant](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconstant](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalemaxabs](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#), [mlr_pipeops_select](#), [mlr_pipeops_smote](#), [mlr_pipeops_spatialsign](#), [mlr_pipeops_subsample](#), [mlr_pipeops_targetinvert](#), [mlr_pipeops_targetmutate](#), [mlr_pipeops_targettrafoscale](#)

[mlr_pipeops_textvectorizer](#), [mlr_pipeops_threshold](#), [mlr_pipeops_tunethreshold](#), [mlr_pipeops_unbranch](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops_vtreat](#), [mlr_pipeops_yeojohnson](#), [mlr_pipeops](#)

Examples

```
library("mlr3")

task = tsk("iris")
pop = po("histbin")

task$data()
pop$train(list(task))[[1]]$data()

pop$state
```

mlr_pipeops_ica *Independent Component Analysis*

Description

Extracts statistically independent components from data. Only affects numerical features. See [fastICA::fastICA](#) for details.

Format

[R6Class](#) object inheriting from [PipeOpTaskPreproc/PipeOp](#).

Construction

```
PipeOpICA$new(id = "ica", param_vals = list())
```

- `id` :: `character(1)`
Identifier of resulting object, default "ica".
- `param_vals` :: `named list`
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpTaskPreproc](#).

The output is the input [Task](#) with all affected numeric parameters replaced by independent components.

State

The `$state` is a named list with the `$state` elements inherited from `PipeOpTaskPreproc`, as well as the elements of the function `fastICA::fastICA()`, with the exception of the `$X` and `$S` slots. These are in particular:

- `K :: matrix`
Matrix that projects data onto the first `n.comp` principal components. See `fastICA()`.
- `W :: matrix`
Estimated un-mixing matrix. See `fastICA()`.
- `A :: matrix`
Estimated mixing matrix. See `fastICA()`.
- `center :: numeric`
The mean of each numeric feature during training.

Parameters

The parameters are the parameters inherited from `PipeOpTaskPreproc`, as well as the following parameters based on `fastICA()`:

- `n.comp :: numeric(1)`
Number of components to extract. Default is `NULL`, which sets it to the number of available numeric columns.
- `alg.typ :: character(1)`
Algorithm type. One of "parallel" (default) or "deflation".
- `fun :: character(1)`
One of "logcosh" (default) or "exp".
- `alpha :: numeric(1)`
In range [1, 2], Used for negentropy calculation when `fun` is "logcosh". Default is 1.0.
- `method :: character(1)`
Internal calculation method. "C" (default) or "R". See `fastICA()`.
- `row.norm :: logical(1)`
Logical value indicating whether rows should be standardized beforehand. Default is `FALSE`.
- `maxit :: numeric(1)`
Maximum number of iterations. Default is 200.
- `tol :: numeric(1)`
Tolerance for convergence, default is `1e-4`.
- `verbose :: logical(1)`
Logical value indicating the level of output during the run of the algorithm. Default is `FALSE`.
- `w.init :: matrix`
Initial un-mixing matrix. See `fastICA()`. Default is `NULL`.

Internals

Uses the `fastICA()` function.

Methods

Only methods inherited from [PipeOpTaskPreproc/PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_ensemblmer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_imputeconstant](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconstant](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalemaxabs](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#), [mlr_pipeops_select](#), [mlr_pipeops_smote](#), [mlr_pipeops_spatialsign](#), [mlr_pipeops_subsample](#), [mlr_pipeops_targetinvert](#), [mlr_pipeops_targetmutate](#), [mlr_pipeops_targettrafoscale](#), [mlr_pipeops_textvectorizer](#), [mlr_pipeops_threshold](#), [mlr_pipeops_tunethreshold](#), [mlr_pipeops_unbranch](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops_vtreat](#), [mlr_pipeops_yeojohnson](#), [mlr_pipeops](#)

Examples

```
library("mlr3")

task = tsk("iris")
pop = po("ica")

task$data()
pop$train(list(task))[[1]]$data()

pop$state
```

```
mlr_pipeops_imputeconstant
```

Impute Features by a Constant

Description

Impute features by a constant value.

Format

[R6Class](#) object inheriting from [PipeOpImpute/PipeOp](#).

Construction

```
PipeOpImputeConstant$new(id = "imputeconstant", param_vals = list())
```

- `id` :: character(1)
Identifier of resulting object, default "imputeconstant".
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpImpute](#).

The output is the input [Task](#) with all affected features missing values imputed by the value of the constant parameter.

State

The `$state` is a named list with the `$state` elements inherited from [PipeOpImpute](#).

The `$state$model` contains the value of the constant parameter that is used for imputation.

Parameters

The parameters are the parameters inherited from [PipeOpImpute](#), as well as:

- `constant` :: atomic(1)
The constant value that should be used for the imputation, atomic vector of length 1. The atomic mode must match the type of the features that will be selected by the `affect_columns` parameter and this will be checked during imputation. Initialized to ".MISSING".
- `check_levels` :: logical(1)
Should be checked whether the constant value is a valid level of factorial features (i.e., it already is a level)? Raises an error if unsuccessful. This check is only performed for factorial features (i.e., factor, ordered; skipped for character). Initialized to TRUE.

Internals

Adds an explicit new level to factor and ordered features, but not to character features, if `check_levels` is FALSE and the level is not already present.

Methods

Only methods inherited from [PipeOpImpute](#)/[PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#),

```
mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures,
mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encode, mlr_pipeops_featureunion,
mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputehist,
mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode,
mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_kernelpca, mlr_pipeops_learner,
mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityin,
mlr_pipeops_mutate, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite,
mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection,
mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns,
mlr_pipeops_replicate, mlr_pipeops_scalexaxabs, mlr_pipeops_scalerange, mlr_pipeops_scale,
mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_spatialsign, mlr_pipeops_subsample,
mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange,
mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch,
mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson, mlr_pipeops
```

Other Imputation PipeOps: `PipeOpImpute`, `mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`,
`mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`,
`mlr_pipeops_imputesample`

Examples

```
library("mlr3")

task = tsk("pima")
task$missings()

# impute missing values of the numeric feature "glucose" by the constant value -999
po = po("imputeconstant", param_vals = list(
  constant = -999, affect_columns = selector_name("glucose"))
)
new_task = po$train(list(task = task))[[1]]
new_task$missings()
new_task$data(cols = "glucose")[[1]]
```

```
mlr_pipeops_imputehist
```

Impute Numerical Features by Histogram

Description

Impute numerical features by histogram.

During training, a histogram is fitted using R's `hist()` function. The fitted histogram is then sampled from for imputation. This is an approximation to sampling from the empirical training data distribution (i.e. sampling from training data with replacement), but is much more memory efficient for large datasets, since the `$state` does not need to save the training data.

Format

`R6Class` object inheriting from `PipeOpImpute/PipeOp`.

Construction

```
PipeOpImputeHist$new(id = "imputehist", param_vals = list())
```

- `id` :: character(1)
Identifier of resulting object, default "imputehist".
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpImpute](#).

The output is the input [Task](#) with all affected numeric features missing values imputed by (column-wise) histogram.

State

The `$state` is a named list with the `$state` elements inherited from [PipeOpImpute](#).

The `$state$model` is a named list of lists containing elements `$counts` and `$breaks`.

Parameters

The parameters are the parameters inherited from [PipeOpImpute](#).

Internals

Uses the [graphics::hist\(\)](#) function. Features that are entirely NA are imputed as 0.

Methods

Only methods inherited from [PipeOpImpute/PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_ensemblmer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputecons](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityin](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconstants](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalemaxabs](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#),

mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_spatialsign, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson, mlr_pipeops

Other Imputation PipeOps: PipeOpImpute, mlr_pipeops_imputeconstant, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample

Examples

```
library("mlr3")

task = tsk("pima")
task$missings()

po = po("imputehist")
new_task = po$train(list(task = task))[[1]]
new_task$missings()

po$state$model
```

mlr_pipeops_imputelearner

Impute Features by Fitting a Learner

Description

Impute features by fitting a [Learner](#) for each feature. Uses the features indicated by the `context_columns` parameter as features to train the imputation [Learner](#). Note this parameter is part of the [PipeOpImpute](#) base class and explained there.

Additionally, only features supported by the learner can be imputed; i.e. learners of type `regr` can only impute features of type `integer` and `numeric`, while `classif` can impute features of type `factor`, `ordered` and `logical`.

The [Learner](#) used for imputation is trained on all `context_columns`; if these contain missing values, the [Learner](#) typically either needs to be able to handle missing values itself, or needs to do its own imputation (see examples).

Format

[R6Class](#) object inheriting from [PipeOpImpute/PipeOp](#).

Construction

`PipeOpImputeLearner$new(learner, id = NULL, param_vals = list())`

- `id` :: `character(1)`
Identifier of resulting object, default `"impute."`, followed by the id of the [Learner](#).

- `learner` :: `Learner` | character(1) `Learner` to wrap, or a string identifying a `Learner` in the `mlr3::mlr_learners` Dictionary. The `Learner` usually needs to be able to handle missing values, i.e. have the `missings` property, unless care is taken that `context_columns` do not contain missings; see examples.
This argument is always cloned; to access the `Learner` inside `PipeOpImputeLearner` by-reference, use `$learner`.
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpImpute`.

The output is the input `Task` with missing values from all affected features imputed by the trained model.

State

The `$state` is a named list with the `$state` elements inherited from `PipeOpImpute`.

The `$state$models` is a named list of models created by the `Learner`'s `$train()` function for each column. If a column consists of missing values only during training, the model is `0` or the levels of the feature; these are used for sampling during prediction.

Parameters

The parameters are the parameters inherited from `PipeOpImpute`, in addition to the parameters of the `Learner` used for imputation.

Internals

Uses the `$train` and `$predict` functions of the provided learner. Features that are entirely NA are imputed as `0` or randomly sampled from available (factor / logical) levels.

The `Learner` does *not* necessarily need to handle missing values in cases where `context_columns` is chosen well (or there is only one column with missing values present).

Fields

Fields inherited from `PipeOpTaskPreproc/PipeOp`, as well as:

- `learner` :: `Learner`
`Learner` that is being wrapped. Read-only.
- `learner_models` :: list of `Learner` | NULL
`Learner` that is being wrapped. This list is named by features for which a `Learner` was fitted, and contains the same `Learner`, but with different respective models for each feature. If this `PipeOp` is not trained, this is an empty list. For features that were entirely NA during training, the list contains NULL elements.

Methods

Only methods inherited from [PipeOpImpute/PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_encodelmer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputecons](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityin](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconstants](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalemaxabs](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#), [mlr_pipeops_select](#), [mlr_pipeops_smote](#), [mlr_pipeops_spatialsign](#), [mlr_pipeops_subsample](#), [mlr_pipeops_targetinvert](#), [mlr_pipeops_targetmutate](#), [mlr_pipeops_targettrafoscalerange](#), [mlr_pipeops_textvectorizer](#), [mlr_pipeops_threshold](#), [mlr_pipeops_tunethreshold](#), [mlr_pipeops_unbranch](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops_vtreat](#), [mlr_pipeops_yeojohnson](#), [mlr_pipeops](#)

Other Imputation PipeOps: [PipeOpImpute](#), [mlr_pipeops_imputeconstant](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#)

Examples

```
library("mlr3")

task = tsk("pima")
task$missings()

po = po("imputelearner", lrn("regr.rpart"))
new_task = po$train(list(task = task))[[1]]
new_task$missings()

# '$state' of the "regr.rpart" Learner, trained to predict the 'mass' column:
po$state$model$mass

library("mlr3learners")
# to use the "regr.kknn" Learner, prefix it with its own imputation method!
# The "imputehist" PipeOp is used to train "regr.kknn"; predictions of this
# trained Learner are then used to impute the missing values in the Task.
po = po("imputelearner",
  po("imputehist") %>>% lrn("regr.kknn")
)
```

```
new_task = po$train(list(task = task))[[1]]
new_task$missings()
```

mlr_pipeops_imputemean

Impute Numerical Features by their Mean

Description

Impute numerical features by their mean.

Format

[R6Class](#) object inheriting from [PipeOpImpute/PipeOp](#).

Construction

```
PipeOpImputeMean$new(id = "imputemean", param_vals = list())
```

- `id` :: character(1)
Identifier of resulting object, default "imputemean".
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpImpute](#).

The output is the input [Task](#) with all affected numeric features missing values imputed by (column-wise) mean.

State

The `$state` is a named list with the `$state` elements inherited from [PipeOpImpute](#).

The `$state$model` is a named list of `numeric(1)` indicating the mean of the respective feature.

Parameters

The parameters are the parameters inherited from [PipeOpImpute](#).

Internals

Uses the `mean()` function. Features that are entirely NA are imputed as 0.

Methods

Only methods inherited from [PipeOpImpute/PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_ensemblmer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputeconst](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityin](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconstants](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalemaxabs](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#), [mlr_pipeops_select](#), [mlr_pipeops_smote](#), [mlr_pipeops_spatialsign](#), [mlr_pipeops_subsample](#), [mlr_pipeops_targetinvert](#), [mlr_pipeops_targetmutate](#), [mlr_pipeops_targettrafoscalerange](#), [mlr_pipeops_textvectorizer](#), [mlr_pipeops_threshold](#), [mlr_pipeops_tunethreshold](#), [mlr_pipeops_unbranch](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops_vtreat](#), [mlr_pipeops_yeojohnson](#), [mlr_pipeops](#)

Other Imputation PipeOps: [PipeOpImpute](#), [mlr_pipeops_imputeconstant](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#)

Examples

```
library("mlr3")

task = tsk("pima")
task$missings()

po = po("imputemean")
new_task = po$train(list(task = task))[[1]]
new_task$missings()

po$state$model
```

```
mlr_pipeops_imputemedian
```

Impute Numerical Features by their Median

Description

Impute numerical features by their median.

Format

[R6Class](#) object inheriting from [PipeOpImpute/PipeOp](#).

Construction

```
PipeOpImputeMedian$new(id = "imputemedian", param_vals = list())
```

- `id` :: character(1)
Identifier of resulting object, default "imputemedian".
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpImpute](#).

The output is the input [Task](#) with all affected numeric features missing values imputed by (column-wise) median.

State

The `$state` is a named list with the `$state` elements inherited from [PipeOpImpute](#).

The `$state$model` is a named list of `numeric(1)` indicating the median of the respective feature.

Parameters

The parameters are the parameters inherited from [PipeOpImpute](#).

Internals

Uses the `stats::median()` function. Features that are entirely NA are imputed as 0.

Methods

Only methods inherited from [PipeOpImpute/PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_encodelmer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputecons](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityin](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconstants](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalemaxabs](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#),

mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_spatialsign, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson, mlr_pipeops

Other Imputation PipeOps: PipeOpImpute, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample

Examples

```
library("mlr3")

task = tsk("pima")
task$missings()

po = po("imputemedian")
new_task = po$train(list(task = task))[[1]]
new_task$missings()

po$state$model
```

mlr_pipeops_imputemode

Impute Features by their Mode

Description

Impute features by their mode. Supports factors as well as logical and numerical features. If multiple modes are present then imputed values are sampled randomly from them.

Format

[R6Class](#) object inheriting from [PipeOpImpute/PipeOp](#).

Construction

```
PipeOpImputeMode$new(id = "imputemode", param_vals = list())
```

- `id` :: character(1)
Identifier of resulting object, default "imputemode".
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpImpute](#).

The output is the input [Task](#) with all affected features missing values imputed by (column-wise) mode.

State

The `$state` is a named list with the `$state` elements inherited from `PipeOpImpute`.

The `$state$model` is a named list of a vector of length one of the type of the feature, indicating the mode of the respective feature.

Parameters

The parameters are the parameters inherited from `PipeOpImpute`.

Internals

Features that are entirely NA are imputed as the following: For factor or ordered, random levels are sampled uniformly at random. For logicals, TRUE or FALSE are sampled uniformly at random. Numerics and integers are imputed as 0.

Note that every random imputation is drawn independently, so different values may be imputed if multiple values are missing.

Methods

Only methods inherited from `PipeOpImpute/PipeOp`.

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreprocSimple`, `PipeOpTaskPreproc`, `PipeOp`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_encodeimr`, `mlr_pipeops_encode`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputecons`, `mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityin`, `mlr_pipeops_mutate`, `mlr_pipeops_nmf`, `mlr_pipeops_nop`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunite`, `mlr_pipeops_pca`, `mlr_pipeops_proxy`, `mlr_pipeops_quantilebin`, `mlr_pipeops_randomprojection`, `mlr_pipeops_randomresponse`, `mlr_pipeops_regravg`, `mlr_pipeops_removeconstants`, `mlr_pipeops_renamecolumns`, `mlr_pipeops_replicate`, `mlr_pipeops_scalexabs`, `mlr_pipeops_scalerange`, `mlr_pipeops_scale`, `mlr_pipeops_select`, `mlr_pipeops_smote`, `mlr_pipeops_spatialsign`, `mlr_pipeops_subsample`, `mlr_pipeops_targetinvert`, `mlr_pipeops_targetmutate`, `mlr_pipeops_targettrafoscalerange`, `mlr_pipeops_textvectorizer`, `mlr_pipeops_threshold`, `mlr_pipeops_tunethreshold`, `mlr_pipeops_unbranch`, `mlr_pipeops_updatetarget`, `mlr_pipeops_vtreat`, `mlr_pipeops_yeojohnson`, `mlr_pipeops`

Other Imputation PipeOps: `PipeOpImpute`, `mlr_pipeops_imputeconstant`, `mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`

Examples

```
library("mlr3")

task = tsk("pima")
task$missings()

po = po("imputemode")
new_task = po$train(list(task = task))[[1]]
new_task$missings()

po$state$model
```

mlr_pipeops_imputeoor *Out of Range Imputation*

Description

Impute factorial features by adding a new level ".MISSING".

Impute numerical features by constant values shifted below the minimum or above the maximum by using $\min(x) - offset - multiplier * \text{diff}(\text{range}(x))$ or $\max(x) + offset + multiplier * \text{diff}(\text{range}(x))$.

This type of imputation is especially sensible in the context of tree-based methods, see also Ding & Simonoff (2010).

Format

[R6Class](#) object inheriting from [PipeOpImpute/PipeOp](#).

Construction

```
PipeOpImputeOOR$new(id = "imputeoor", param_vals = list())
```

- `id` :: character(1)
Identifier of resulting object, default "imputeoor".
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpImpute](#).

The output is the input [Task](#) with all affected features having missing values imputed as described above.

State

The `$state` is a named list with the `$state` elements inherited from `PipeOpImpute`.

The `$state$model` contains either `".MISSING"` used for character and factor (also ordered) features or `numeric(1)` indicating the constant value used for imputation of integer and numeric features.

Parameters

The parameters are the parameters inherited from `PipeOpImpute`, as well as:

- `min :: logical(1)`
Should integer and numeric features be shifted below the minimum? Initialized to `TRUE`. If `FALSE` they are shifted above the maximum. See also the description above.
- `offset :: numeric(1)`
Numerical non-negative offset as used in the description above for integer and numeric features. Initialized to 1.
- `multiplier :: numeric(1)`
Numerical non-negative multiplier as used in the description above for integer and numeric features. Initialized to 1.

Internals

Adds an explicit new `level()` to factor and ordered features, but not to character features. For integer and numeric features uses the `min`, `max`, `diff` and `range` functions. integer and numeric features that are entirely NA are imputed as 0.

Methods

Only methods inherited from `PipeOpImpute/PipeOp`.

References

Ding Y, Simonoff JS (2010). "An Investigation of Missing Data Methods for Classification Trees Applied to Binary Response Data." *Journal of Machine Learning Research*, **11**(6), 131-170. <https://jmlr.org/papers/v11/ding10a.html>.

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreprocSimple`, `PipeOpTaskPreproc`, `PipeOp`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_ensemblmer`, `mlr_pipeops_encode`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputecons`, `mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputesample`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityin`

```
mlr_pipeops_mutate, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite,
mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection,
mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns,
mlr_pipeops_replicate, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_scale,
mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_spatialsign, mlr_pipeops_subsample,
mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange,
mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch,
mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson, mlr_pipeops
```

Other Imputation PipeOps: `PipeOpImpute`, `mlr_pipeops_imputeconstant`, `mlr_pipeops_imputehist`,
`mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`,
`mlr_pipeops_imputesample`

Examples

```
library("mlr3")
set.seed(2409)
data = tsk("pima")$data()
data$y = factor(c(NA, sample(letters, size = 766, replace = TRUE), NA))
data$z = ordered(c(NA, sample(1:10, size = 767, replace = TRUE)))
task = TaskClassif$new("task", backend = data, target = "diabetes")
task$missings()
po = po("imputeoor")
new_task = po$train(list(task = task))[[1]]
new_task$missings()
new_task$data()
```

```
mlr_pipeops_imputesample
```

Impute Features by Sampling

Description

Impute features by sampling from non-missing training data.

Format

[R6Class](#) object inheriting from [PipeOpImpute/PipeOp](#).

Construction

```
PipeOpImputeSample$new(id = "imputesample", param_vals = list())
```

- `id` :: character(1)
Identifier of resulting object, default "imputesample".
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpImpute](#).

The output is the input [Task](#) with all affected numeric features missing values imputed by values sampled (column-wise) from training data.

State

The `$state` is a named list with the `$state` elements inherited from [PipeOpImpute](#).

The `$state$model` is a named list of training data with missings removed.

Parameters

The parameters are the parameters inherited from [PipeOpImpute](#).

Internals

Uses the `sample()` function. Features that are entirely NA are imputed as the following: For factor or ordered, random levels are sampled uniformly at random. For logicals, TRUE or FALSE are sampled uniformly at random. Numerics and integers are imputed as \emptyset .

Methods

Only methods inherited from [PipeOpImpute/PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_encodeimr](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputeconst](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityin](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconstants](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalexaxabs](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#), [mlr_pipeops_select](#), [mlr_pipeops_smote](#), [mlr_pipeops_spatialsign](#), [mlr_pipeops_subsample](#), [mlr_pipeops_targetinvert](#), [mlr_pipeops_targetmutate](#), [mlr_pipeops_targettrafoscalerange](#), [mlr_pipeops_textvectorizer](#), [mlr_pipeops_threshold](#), [mlr_pipeops_tunethreshold](#), [mlr_pipeops_unbranch](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops_vtreat](#), [mlr_pipeops_yeojohnson](#), [mlr_pipeops](#)

Other Imputation PipeOps: [PipeOpImpute](#), [mlr_pipeops_imputeconstant](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#)

Examples

```
library("mlr3")

task = tsk("pima")
task$missings()

po = po("imputesample")
new_task = po$train(list(task = task))[[1]]
new_task$missings()
```

mlr_pipeops_kernelpca *Kernelized Principle Component Analysis*

Description

Extracts kernel principle components from data. Only affects numerical features. See [kernlab::kpca](#) for details.

Format

[R6Class](#) object inheriting from [PipeOpTaskPreproc/PipeOp](#).

Construction

```
PipeOpKernelPCA$new(id = "kernelpca", param_vals = list())
```

- `id` :: `character(1)`
Identifier of resulting object, default "kernelpca".
- `param_vals` :: `named list`
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpTaskPreproc](#).

The output is the input [Task](#) with all affected numeric parameters replaced by their principal components.

State

The `$state` is a `named list` with the `$state` elements inherited from [PipeOpTaskPreproc](#), as well as the returned [S4](#) object of the function `kernlab::kpca()`.

The `@rotated` slot of the "kpca" object is overwritten with an empty matrix for memory efficiency.

The slots of the [S4](#) object can be accessed by accessor function. See [kernlab::kpca](#).

Parameters

The parameters are the parameters inherited from [PipeOpTaskPreproc](#), as well as:

- `kernel :: character(1)`
The standard deviations of the principal components. See [kpca\(\)](#).
- `kpar :: list`
List of hyper-parameters that are used with the kernel function. See [kpca\(\)](#).
- `features :: numeric(1)`
Number of principal components to return. Default 0 means that all principal components are returned. See [kpca\(\)](#).
- `th :: numeric(1)`
The value of eigenvalue under which principal components are ignored. Default is 0.0001. See [kpca\(\)](#).
- `na.action :: function`
Function to specify NA action. Default is `na.omit`. See [kpca\(\)](#).

Internals

Uses the [kpca\(\)](#) function.

Methods

Only methods inherited from [PipeOpTaskPreproc/PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_ensemblmer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputecons](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityin](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconstants](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalexmaxabs](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#), [mlr_pipeops_select](#), [mlr_pipeops_smote](#), [mlr_pipeops_spatialsign](#), [mlr_pipeops_subsample](#), [mlr_pipeops_targetinvert](#), [mlr_pipeops_targetmutate](#), [mlr_pipeops_targettrafoscalerange](#), [mlr_pipeops_textvectorizer](#), [mlr_pipeops_threshold](#), [mlr_pipeops_tunethreshold](#), [mlr_pipeops_unbranch](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops_vtreat](#), [mlr_pipeops_yeojohnson](#), [mlr_pipeops](#)

Examples

```
library("mlr3")

task = tsk("iris")
pop = po("kernelpca", features = 3) # only keep top 3 components

task$data()
pop$train(list(task)[[1]]$data())
```

mlr_pipeops_learner *Wrap a Learner into a PipeOp*

Description

Wraps an `mlr3::Learner` into a `PipeOp`.

Inherits the `$param_set` (and therefore `$param_set$values`) from the `Learner` it is constructed from.

Using `PipeOpLearner`, it is possible to embed `mlr3::Learners` into `Graphs`, which themselves can be turned into `Learners` using `GraphLearner`. This way, preprocessing and ensemble methods can be included into a machine learning pipeline which then can be handled as singular object for resampling, benchmarking and tuning.

Format

`R6Class` object inheriting from `PipeOp`.

Construction

```
PipeOpLearner$new(learner, id = NULL, param_vals = list())
```

- `learner` :: `Learner` | character(1) `Learner` to wrap, or a string identifying a `Learner` in the `mlr3::mlr_learners Dictionary`. This argument is always cloned; to access the `Learner` inside `PipeOpLearner` by-reference, use `$learner`.
- `id` :: character(1) Identifier of the resulting object, internally defaulting to the `id` of the `Learner` being wrapped.
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

`PipeOpLearner` has one input channel named "input", taking a `Task` specific to the `Learner` type given to `learner` during construction; both during training and prediction.

`PipeOpLearner` has one output channel named "output", producing `NULL` during training and a `Prediction` subclass during prediction; this subclass is specific to the `Learner` type given to `learner` during construction.

The output during prediction is the [Prediction](#) on the prediction input data, produced by the [Learner](#) trained on the training input data.

State

The `$state` is set to the `$state` slot of the [Learner](#) object. It is a named list with members:

- `model` :: any
Model created by the [Learner](#)'s `$.train()` function.
- `train_log` :: [data.table](#) with columns `class` (character), `msg` (character)
Errors logged during training.
- `train_time` :: `numeric(1)`
Training time, in seconds.
- `predict_log` :: `NULL` | [data.table](#) with columns `class` (character), `msg` (character)
Errors logged during prediction.
- `predict_time` :: `NULL` | `numeric(1)` Prediction time, in seconds.

Parameters

The parameters are exactly the parameters of the [Learner](#) wrapped by this object.

Internals

The `$state` is currently not updated by prediction, so the `$state$predict_log` and `$state$predict_time` will always be `NULL`.

Fields

Fields inherited from [PipeOp](#), as well as:

- `learner` :: [Learner](#)
[Learner](#) that is being wrapped. Read-only.
- `learner_model` :: [Learner](#)
[Learner](#) that is being wrapped. This learner contains the model if the [PipeOp](#) is trained. Read-only.

Methods

Methods inherited from [PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other [PipeOps](#): [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_ensemblmer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputecons](#)

mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_kernelpca, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityj, mlr_pipeops_mutate, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_scalexmaxabs, mlr_pipeops_scalerange, mlr_pipeops_scale, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_spatialsign, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson, mlr_pipeops

Other Meta PipeOps: `mlr_pipeops_learner_cv`

Examples

```
library("mlr3")

task = tsk("iris")
learner = lrn("classif.rpart", cp = 0.1)
lrn_po = mlr_pipeops$get("learner", learner)

lrn_po$train(list(task))
lrn_po$predict(list(task))
```

`mlr_pipeops_learner_cv`

Wrap a Learner into a PipeOp with Cross-validated Predictions as Features

Description

Wraps an `mlr3:Learner` into a `PipeOp`.

Returns cross-validated predictions during training as a `Task` and stores a model of the `Learner` trained on the whole data in `$state`. This is used to create a similar `Task` during prediction.

The `Task` gets features depending on the capsuled `Learner`'s `$predict_type`. If the `Learner`'s `$predict.type` is "response", a feature `<ID>.response` is created, for `$predict.type` "prob" the `<ID>.prob.<CLASS>` features are created, and for `$predict.type` "se" the new columns are `<ID>.response` and `<ID>.se`. `<ID>` denotes the `$id` of the `PipeOpLearnerCV` object.

Inherits the `$param_set` (and therefore `$param_set$values`) from the `Learner` it is constructed from.

`PipeOpLearnerCV` can be used to create "stacking" or "super learning" `Graphs` that use the output of one `Learner` as feature for another `Learner`. Because the `PipeOpLearnerCV` erases the original input features, it is often useful to use `PipeOpFeatureUnion` to bind the prediction `Task` to the original input `Task`.

Format

R6Class object inheriting from PipeOpTaskPreproc/PipeOp.

Construction

```
PipeOpLearnerCV$new(learner, id = NULL, param_vals = list())
```

- learner :: [Learner](#)
Learner to use for cross validation / prediction, or a string identifying a [Learner](#) in the `mlr3::mlr_learners Dictionary`. This argument is always cloned; to access the [Learner](#) inside `PipeOpLearnerCV` by-reference, use `$learner`.
- id :: character(1) Identifier of the resulting object, internally defaulting to the id of the [Learner](#) being wrapped.
- param_vals :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

`PipeOpLearnerCV` has one input channel named "input", taking a [Task](#) specific to the [Learner](#) type given to learner during construction; both during training and prediction.

`PipeOpLearnerCV` has one output channel named "output", producing a [Task](#) specific to the [Learner](#) type given to learner during construction; both during training and prediction.

The output is a task with the same target as the input task, with features replaced by predictions made by the [Learner](#). During training, this prediction is the out-of-sample prediction made by `resample`, during prediction, this is the ordinary prediction made on the data by a [Learner](#) trained on the training phase data.

State

The `$state` is set to the `$state` slot of the [Learner](#) object, together with the `$state` elements inherited from the `PipeOpTaskPreproc`. It is a named list with the inherited members, as well as:

- model :: any
Model created by the [Learner](#)'s `$train()` function.
- train_log :: [data.table](#) with columns class (character), msg (character)
Errors logged during training.
- train_time :: numeric(1)
Training time, in seconds.
- predict_log :: NULL | [data.table](#) with columns class (character), msg (character)
Errors logged during prediction.
- predict_time :: NULL | numeric(1) Prediction time, in seconds.

Parameters

The parameters are the parameters inherited from the [PipeOpTaskPreproc](#), as well as the parameters of the [Learner](#) wrapped by this object. Besides that, parameters introduced are:

- `resampling.method` :: `character(1)`
Which resampling method do we want to use. Currently only supports "cv" and "insample". "insample" generates predictions with the model trained on all training data.
- `resampling.folds` :: `numeric(1)`
Number of cross validation folds. Initialized to 3. Only used for `resampling.method = "cv"`.
- `keep_response` :: `logical(1)`
Only effective during "prob" prediction: Whether to keep response values, if available. Initialized to FALSE.

Internals

The `$state` is currently not updated by prediction, so the `$state$predict_log` and `$state$predict_time` will always be NULL.

Fields

Fields inherited from [PipeOp](#), as well as:

- `learner` :: [Learner](#)
[Learner](#) that is being wrapped. Read-only.
- `learner_model` :: [Learner](#)
[Learner](#) that is being wrapped. This learner contains the model if the [PipeOp](#) is trained. Read-only.

Methods

Methods inherited from [PipeOpTaskPreproc/PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other Meta PipeOps: [mlr_pipeops_learner](#)

Examples

```
library("mlr3")

task = tsk("iris")
learner = lrn("classif.rpart")

lrncv_po = po("learner_cv", learner)
lrncv_po$learner$predict_type = "response"

nop = mlr_pipeops$get("nop")
```

```

graph = gunion(list(
  lrncv_po,
  nop
)) %>>% po("featureunion")

graph$train(task)

graph$pipeops$classif.rpart$learner$predict_type = "prob"

graph$train(task)

```

mlr_pipeops_missind *Add Missing Indicator Columns*

Description

Add missing indicator columns ("dummy columns") to the [Task](#). Drops original features; should probably be used in combination with [PipeOpFeatureUnion](#) and imputation [PipeOps](#) (see examples).

Note the `affect_columns` is initialized with `selector_invert(selector_type(c("factor", "ordered", "character")))`, since missing values in factorial columns are often indicated by out-of-range imputation ([PipeOpImputeOOR](#)).

Format

[R6Class](#) object inheriting from [PipeOpTaskPreprocSimple](#)/[PipeOpTaskPreproc](#)/[PipeOp](#).

Construction

```
PipeOpMissInd$new(id = "missind", param_vals = list())
```

- `id` :: `character(1)` Identifier of the resulting object, defaulting to "missind".
- `param_vals` :: `named list`
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

State

`$state` is a `named list` with the `$state` elements inherited from [PipeOpTaskPreproc](#), as well as:

- `indicand_cols` :: `character`
Names of columns for which indicator columns are added. If the `which` parameter is "all", this is just the names of all features, otherwise it is the names of all features that had missing values during training.

Parameters

The parameters are the parameters inherited from the [PipeOpTaskPreproc](#), as well as:

- `which :: character(1)`
Determines for which features the indicator columns are added. Can either be "missing_train" (default), adding indicator columns for each feature that actually has missing values, or "all", adding indicator columns for all features.
- `type :: character(1)`
Determines the type of the newly created columns. Can be one of "factor" (default), "integer", "logical", "numeric".

Internals

This [PipeOp](#) should cover most cases where "dummy columns" or "missing indicators" are desired. Some edge cases:

- If imputation for factorial features is performed and only numeric features should gain missing indicators, the `affect_columns` parameter can be set to `selector_type("numeric")`.
- If missing indicators should only be added for features that have more than a fraction of `x` missing values, the [PipeOpRemoveConstants](#) can be used with `affect_columns = selector_grep("^missing_")` and `ratio = x`.

Fields

Fields inherited from [PipeOpTaskPreproc/PipeOp](#).

Methods

Methods inherited from [PipeOpTaskPreproc/PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_encydelmer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputecons](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityin](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconstants](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalemaxabs](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#), [mlr_pipeops_select](#), [mlr_pipeops_smote](#), [mlr_pipeops_spatialsign](#), [mlr_pipeops_subsample](#), [mlr_pipeops_targetinvert](#), [mlr_pipeops_targetmutate](#), [mlr_pipeops_targettrafoscalerange](#),

[mlr_pipeops_textvectorizer](#), [mlr_pipeops_threshold](#), [mlr_pipeops_tunethreshold](#), [mlr_pipeops_unbranch](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops_vtreat](#), [mlr_pipeops_yeojohnson](#), [mlr_pipeops](#)

Examples

```
library("mlr3")

task = tsk("pima")$select(c("insulin", "triceps"))
sum(complete.cases(task$data()))
task$missings()
tail(task$data())

po = po("missind")
new_task = po$train(list(task))[[1]]

tail(new_task$data())

# proper imputation + missing indicators

impgraph = list(
  po("imputesample"),
  po("missind")
) %>>% po("featureunion")

tail(impgraph$train(task)[[1]]$data())
```

mlr_pipeops_modelmatrix

Transform Columns by Constructing a Model Matrix

Description

Transforms columns using a given formula using the `stats::model.matrix()` function.

Format

[R6Class](#) object inheriting from [PipeOpTaskPreprocSimple](#)/[PipeOpTaskPreproc](#)/[PipeOp](#).

Construction

```
PipeOpModelMatrix$new(id = "modelmatrix", param_vals = list())
```

- `id` :: character(1)
Identifier of resulting object, default "modelmatrix".
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpTaskPreproc](#).

The output is the input [Task](#) with transformed columns according to the used formula.

State

The `$state` is a named list with the `$state` elements inherited from [PipeOpTaskPreproc](#).

Parameters

The parameters are the parameters inherited from [PipeOpTaskPreproc](#), as well as:

- `formula` :: formula
Formula to use. Higher order interactions can be created using constructs like `~. ^ 2`. By default, an (Intercept) column of all 1s is created, which can be avoided by adding `0 +` to the term. See [model.matrix\(\)](#).

Internals

Uses the [model.matrix\(\)](#) function.

Methods

Only methods inherited from [PipeOpTaskPreprocSimple](#)/[PipeOpTaskPreproc](#)/[PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_encodelmer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputecons](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconstants](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalemaxabs](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#), [mlr_pipeops_select](#), [mlr_pipeops_smote](#), [mlr_pipeops_spatialsign](#), [mlr_pipeops_subsample](#), [mlr_pipeops_targetinvert](#), [mlr_pipeops_targetmutate](#), [mlr_pipeops_targettrafoscalerange](#), [mlr_pipeops_textvectorizer](#), [mlr_pipeops_threshold](#), [mlr_pipeops_tunethreshold](#), [mlr_pipeops_unbranch](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops_vtreat](#), [mlr_pipeops_yeojohnson](#), [mlr_pipeops](#)

Examples

```
library("mlr3")

task = tsk("iris")
pop = po("modelmatrix", formula = ~ . ^ 2)

task$data()
pop$train(list(task))[[1]]$data()

pop$param_set$values$formula = ~ 0 + . ^ 2
pop$train(list(task))[[1]]$data()
```

mlr_pipeops_multiplicityexply
Explicate a Multiplicity

Description

Explicate a [Multiplicity](#) by turning the input [Multiplicity](#) into multiple outputs.

This [PipeOp](#) has multiple output channels; the members of the input [Multiplicity](#) are forwarded each along a single edge. Therefore, only multiplicities with exactly as many members as outnum are accepted.

Note that [Multiplicity](#) is currently an experimental features and the implementation or UI may change.

Format

[R6Class](#) object inheriting from [PipeOp](#).

Construction

```
PipeOpMultiplicityExply$new(outnum , id = "multiplicityexply", param_vals = list())
```

- `outnum` :: `numeric(1) | character`
Determines the number of output channels.
- `id` :: `character(1)`
Identifier of the resulting object, default "multiplicityexply".
- `param_vals` :: `named list`
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

`PipeOpMultiplicityExply` has a single input channel named "input", collecting a `Multiplicity` of type any ("[*]") both during training and prediction.

`PipeOpMultiplicityExply` has multiple output channels depending on the `outnum` construction argument, named "output1", "output2" returning the elements of the unclassed input `Multiplicity`.

State

The `$state` is left empty (`list()`).

Parameters

`PipeOpMultiplicityExply` has no Parameters.

Internals

`outnum` should match the number of elements of the unclassed input `Multiplicity`.

Fields

Only fields inherited from `PipeOp`.

Methods

Only methods inherited from `PipeOp`.

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other `PipeOps`: `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreprocSimple`, `PipeOpTaskPreproc`, `PipeOp`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_encodeimlmer`, `mlr_pipeops_encode`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputecons`, `mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_mutate`, `mlr_pipeops_nmf`, `mlr_pipeops_nop`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunite`, `mlr_pipeops_pca`, `mlr_pipeops_proxy`, `mlr_pipeops_quantilebin`, `mlr_pipeops_randomprojection`, `mlr_pipeops_randomresponse`, `mlr_pipeops_regravg`, `mlr_pipeops_removeconstants`, `mlr_pipeops_renamecolumns`, `mlr_pipeops_replicate`, `mlr_pipeops_scalemaxabs`, `mlr_pipeops_scalerange`, `mlr_pipeops_scale`, `mlr_pipeops_select`, `mlr_pipeops_smote`, `mlr_pipeops_spatialsign`, `mlr_pipeops_subsample`, `mlr_pipeops_targetinvert`, `mlr_pipeops_targetmutate`, `mlr_pipeops_targettrafoscalerange`, `mlr_pipeops_textvectorizer`, `mlr_pipeops_threshold`, `mlr_pipeops_tunethreshold`, `mlr_pipeops_unbranch`, `mlr_pipeops_updatetarget`, `mlr_pipeops_vtreat`, `mlr_pipeops_yeojohnson`, `mlr_pipeops`

Other `Multiplicity PipeOps`: `Multiplicity()`, `PipeOpEnsemble`, `mlr_pipeops_classifavg`, `mlr_pipeops_featureunion`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunite`, `mlr_pipeops_regravg`, `mlr_pipeops_replicate`

Other Experimental Features: [Multiplicity\(\)](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_replicate](#)

Examples

```
library("mlr3")
task1 = tsk("iris")
task2 = tsk("mtcars")
po = po("multiplicityexply", outnum = 2)
po$train(list(Multiplicity(task1, task2)))
po$predict(list(Multiplicity(task1, task2)))
```

mlr_pipeops_multiplicityimply
Implicate a Multiplicity

Description

Implicate a [Multiplicity](#) by returning the input(s) converted to a [Multiplicity](#).

This [PipeOp](#) has multiple input channels; all inputs are collected into a [Multiplicity](#) and then are forwarded along a single edge, causing the following [PipeOps](#) to be called multiple times, once for each [Multiplicity](#) member.

Note that [Multiplicity](#) is currently an experimental features and the implementation or UI may change.

Format

[R6Class](#) object inheriting from [PipeOp](#).

Construction

```
PipeOpMultiplicityImPLY$new(innum = 0, id = "multiplicityimply", param_vals = list())
```

- `innum` :: `numeric(1) | character`
Determines the number of input channels. If `innum` is 0 (default), a `vararg` input channel is created that can take an arbitrary number of inputs. If `innum` is a character vector, the number of input channels is the length of `innum`.
- `id` :: `character(1)`
Identifier of the resulting object, default "multiplicityimply".
- `param_vals` :: `named list`
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

`PipeOpMultiplicityImply` has multiple input channels depending on the `innum` construction argument, named "input1", "input2", ... if `innum` is nonzero; if `innum` is 0, there is only one *vararg* input channel named "...". All input channels take any input ("*") both during training and prediction.

`PipeOpMultiplicityImply` has one output channel named "output", emitting a `Multiplicity` of type any ("[*]"), i.e., returning the input(s) converted to a `Multiplicity` both during training and prediction.

State

The `$state` is left empty (`list()`).

Parameters

`PipeOpMultiplicityImply` has no Parameters.

Internals

If `innum` is not numeric, e.g., a character, the output `Multiplicity` will be named based on the input channel names

Fields

Only fields inherited from `PipeOp`.

Methods

Only methods inherited from `PipeOp`.

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreprocSimple`, `PipeOpTaskPreproc`, `PipeOp`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_ensemblemer`, `mlr_pipeops_encode`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputecons`, `mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_mutate`, `mlr_pipeops_nmf`, `mlr_pipeops_nop`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunite`, `mlr_pipeops_pca`, `mlr_pipeops_proxy`, `mlr_pipeops_quantilebin`, `mlr_pipeops_randomprojection`, `mlr_pipeops_randomresponse`, `mlr_pipeops_regravg`, `mlr_pipeops_removeconstants`, `mlr_pipeops_renamecolumns`, `mlr_pipeops_replicate`, `mlr_pipeops_scalemaxabs`, `mlr_pipeops_scalerange`, `mlr_pipeops_scale`, `mlr_pipeops_select`, `mlr_pipeops_smote`, `mlr_pipeops_spatialsign`, `mlr_pipeops_subsample`, `mlr_pipeops_targetinvert`, `mlr_pipeops_targetmutate`, `mlr_pipeops_targettrafoscalerange`,

[mlr_pipeops_textvectorizer](#), [mlr_pipeops_threshold](#), [mlr_pipeops_tunethreshold](#), [mlr_pipeops_unbranch](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops_vtreat](#), [mlr_pipeops_yeojohnson](#), [mlr_pipeops](#)

Other Multiplicity PipeOps: [Multiplicity\(\)](#), [PipeOpEnsemble](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_regravg](#), [mlr_pipeops_replicate](#)

Other Experimental Features: [Multiplicity\(\)](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_replicate](#)

Examples

```
library("mlr3")
task1 = tsk("iris")
task2 = tsk("mtcars")
po = po("multiplicityimply")
po$train(list(task1, task2))
po$predict(list(task1, task2))
```

`mlr_pipeops_mutate` *Add Features According to Expressions*

Description

Adds features according to expressions given as formulas that may depend on values of other features. This can add new features, or can change existing features.

Format

[R6Class](#) object inheriting from [PipeOpTaskPreprocSimple](#)/[PipeOpTaskPreproc](#)/[PipeOp](#).

Construction

```
PipeOpMutate$new(id = "mutate", param_vals = list())
```

- `id` :: character(1)
Identifier of resulting object, default "mutate".
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpTaskPreproc](#).

The output is the input [Task](#) with added and/or mutated features according to the mutation parameter.

State

The `$state` is a named list with the `$state` elements inherited from [PipeOpTaskPreproc](#).

Parameters

The parameters are the parameters inherited from [PipeOpTaskPreproc](#), as well as:

- `mutation` :: named list of formula
Expressions for new features to create (or present features to change), in the form of formula. Each element of the list is a formula with the name of the element naming the feature to create or change, and the formula expression determining the result. This expression may reference other features, as well as variables visible at the creation of the formula (see examples). Initialized to `list()`.
- `delete_originals` :: `logical(1)`
Whether to delete original features. Even when this is `FALSE`, present features may still be overwritten. Initialized to `FALSE`.

Internals

A formula created using the `~` operator always contains a reference to the environment in which the formula is created. This makes it possible to use variables in the `~`-expressions that both reference either column names or variable names.

Note that the formulas in `mutation` are evaluated sequentially. This allows for using variables that were constructed during evaluation of a previous formula. However, if existing features are changed, precedence is given to the original ones before the newly constructed ones.

Fields

Only fields inherited from [PipeOpTaskPreproc/PipeOp](#).

Methods

Only methods inherited from [PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_ensemblmer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputeconst](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconst](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalemaxabs](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#), [mlr_pipeops_select](#), [mlr_pipeops_smote](#), [mlr_pipeops_spatialsign](#), [mlr_pipeops_subsample](#), [mlr_pipeops_targetinvert](#), [mlr_pipeops_targetmutate](#), [mlr_pipeops_targettrafoscale](#)


```
mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch,
mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson, mlr_pipeops
```

Examples

```
library("mlr3")

constant = 1
pom = po("mutate")
pom$param_set$values$mutation = list(
  Sepal.Length_plus_constant = ~ Sepal.Length + constant,
  Sepal.Area = ~ Sepal.Width * Sepal.Length,
  Petal.Area = ~ Petal.Width * Petal.Length,
  Sepal.Area_plus_Petal.Area = ~ Sepal.Area + Petal.Area
)

pom$train(list(tsk("iris")))[[1]]$data()
```

mlr_pipeops_nmf

Non-negative Matrix Factorization

Description

Extracts non-negative components from data by performing non-negative matrix factorization. Only affects non-negative numerical features. See [nmf\(\)](#) for details.

Format

[R6Class](#) object inheriting from [PipeOpTaskPreproc/PipeOp](#).

Construction

```
PipeOpNMF$new(id = "nmf", param_vals = list())
```

- `id` :: character(1)
Identifier of resulting object, default "nmf".
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpTaskPreproc](#).

The output is the input [Task](#) with all affected numeric features replaced by their non-negative components.

State

The `$state` is a named list with the `$state` elements inherited from `PipeOpTaskPreproc`, as well as the elements of the object returned by `nmf()`.

Parameters

The parameters are the parameters inherited from `PipeOpTaskPreproc`, as well as:

- `rank :: integer(1)`
Factorization rank, i.e., number of components. Initialized to 2. See `nmf()`.
- `method :: character(1)`
Specification of the NMF algorithm. Initialized to "brunet". See `nmf()`.
- `seed :: character(1) | integer(1) | list() | object of class NMF | function()`
Specification of the starting point. See `nmf()`.
- `nrun :: integer(1)`
Number of runs to performs. Default is 1. More than a single run allows for the computation of a consensus matrix which will also be stored in the `$state`. See `nmf()`.
- `debug :: logical(1)`
Whether to toggle debug mode. Default is FALSE. See `nmf()`.
- `keep.all :: logical(1)`
Whether all factorizations are to be saved and returned. Default is FALSE. Only has an effect if `nrun > 1`. See `nmf()`.
- `parallel :: character(1) | integer(1) | logical(1)`
Specification of parallel handling if `nrun > 1`. Initialized to FALSE, as it is recommended to use mlr3's future-based parallelization. See `nmf()`.
- `parallel.required :: character(1) | integer(1) | logical(1)`
Same as `parallel`, but an error is thrown if the computation cannot be performed in parallel or with the specified number of processors. Initialized to FALSE, as it is recommended to use mlr3's future-based parallelization. See `nmf()`.
- `shared.memory :: logical(1)`
Whether shared memory should be enabled. See `nmf()`.
- `simplifyCB :: logical(1)`
Whether callback results should be simplified. Default is TRUE. See `nmf()`.
- `track :: logical(1)`
Whether error tracking should be enabled. Default is FALSE. See `nmf()`.
- `verbose :: integer(1) | logical(1)`
Specification of verbosity. Default is FALSE. See `nmf()`.
- `pbackend :: character(1) | integer(1) | NULL`
Specification of the parallel backend. It is recommended to use mlr3's future-based parallelization. See `nmf()`.
- `callback | function()`
Callback function that is called after each run (if `nrun > 1`). See `nmf()`.

Internals

Uses the `nmf()` function as well as `basis()`, `coef()` and `ginv()`.

Methods

Only methods inherited from [PipeOpTaskPreproc/PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_encodeimlmer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputecon](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunit](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconst](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalemaxabs](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#), [mlr_pipeops_select](#), [mlr_pipeops_smote](#), [mlr_pipeops_spatialsign](#), [mlr_pipeops_subsample](#), [mlr_pipeops_targetinvert](#), [mlr_pipeops_targetmutate](#), [mlr_pipeops_targettrafoscale](#), [mlr_pipeops_textvectorizer](#), [mlr_pipeops_threshold](#), [mlr_pipeops_tunethreshold](#), [mlr_pipeops_unbranch](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops_vtreat](#), [mlr_pipeops_yeojohnson](#), [mlr_pipeops](#)

Examples

```
if (requireNamespace("NMF")) {
  library("mlr3")

  task = tsk("iris")
  pop = po("nmf")

  task$data()
  pop$train(list(task))[[1]]$data()

  pop$state
}
```

mlr_pipeops_nop

Simply Push Input Forward

Description

Simply pushes the input forward. Can be useful during [Graph](#) construction using the `%>>%`-operator to specify which [PipeOp](#) gets connected to which.

Format

[R6Class](#) object inheriting from [PipeOp](#).

Construction

```
PipeOpNOP$new(id = "nop", param_vals = list())
```

- `id` :: character(1)
Identifier of resulting object, default "nop".
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

[PipeOpNOP](#) has one input channel named "input", taking any input ("*") both during training and prediction.

[PipeOpNOP](#) has one output channel named "output", producing the object given as input ("*") without changes.

State

The `$state` is left empty (`list()`).

Parameters

[PipeOpNOP](#) has no parameters.

Internals

[PipeOpNOP](#) is a useful "default" stand-in for a [PipeOp/Graph](#) that does nothing.

Fields

Only fields inherited from [PipeOp](#).

Methods

Only methods inherited from [PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_ensemblemer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputecons](#)

```
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian,
mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_kernelpca,
mlr_pipeops_learner, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply,
mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nmf, mlr_pipeops_ovrsplit,
mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin,
mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconst,
mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange,
mlr_pipeops_scale, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_spatialsign,
mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscale,
mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch,
mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson, mlr_pipeops
```

Other Placeholder Pipeops: `mlr_pipeops_copy`

Examples

```
library("mlr3")

nop = po("nop")

nop$train(list(1))

# use `gunion` and `%>%` to create a "bypass"
# next to "pca"
gr = gunion(list(
  po("pca"),
  nop
)) %>% po("featureunion")

gr$train(tsk("iris"))[[1]]$data()
```

`mlr_pipeops_ovrsplit` *Split a Classification Task into Binary Classification Tasks*

Description

Splits a [classification Task](#) into several binary [classification Tasks](#) to perform "One vs. Rest" classification. This works in combination with [PipeOpOVRUnite](#).

For each target level a new binary [classification Task](#) is constructed with the respective target level being the positive class and all other target levels being the new negative class "rest".

This [PipeOp](#) creates a [Multiplicity](#), which means that subsequent [PipeOps](#) are executed multiple times, once for each created [binary Task](#), until a [PipeOpOVRUnite](#) is reached.

Note that [Multiplicity](#) is currently an experimental features and the implementation or UI may change.

Format

[R6Class](#) inheriting from [PipeOp](#).

Construction

```
PipeOpOVRSplit$new(id = "ovrsplit", param_vals = list())
```

- `id` :: character(1)
Identifier of the resulting object, default "ovrsplit".
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default list().

Input and Output Channels

`PipeOpOVRSplit` has one input channel named "input" taking a `TaskClassif` both during training and prediction.

`PipeOpOVRSplit` has one output channel named "output" returning a `Multiplicity` of `TaskClassifs` both during training and prediction, i.e., the newly constructed binary `classification Tasks`.

State

The `$state` contains the original target levels of the `TaskClassif` supplied during training.

Parameters

`PipeOpOVRSplit` has no parameters.

Internals

The original target levels stored in the `$state` are also used during prediction when creating the new binary `classification Tasks`.

The names of the element of the output `Multiplicity` are given by the levels of the target.

If a target level "rest" is present in the input `TaskClassif`, the negative class will be labeled as "rest." (using as many "." postfixes needed to yield a valid label).

Should be used in combination with `PipeOpOVRUnite`.

Fields

Only fields inherited from `PipeOp`.

Methods

Only methods inherited from `PipeOp`.

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreprocSimple`, `PipeOpTaskPreproc`, `PipeOp`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`,

mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encode, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputeconst, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconst, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_scale, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_spatialsign, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscale, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson, mlr_pipeops

Other Multiplicity PipeOps: `Multiplicity()`, `PipeOpEnsemble`, `mlr_pipeops_classifavg`, `mlr_pipeops_featureunion`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_ovrunite`, `mlr_pipeops_regravg`, `mlr_pipeops_replicate`

Other Experimental Features: `Multiplicity()`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_ovrunite`, `mlr_pipeops_replicate`

Examples

```
library(mlr3)
task = tsk("iris")
po = po("ovrsplit")
po$train(list(task))
po$predict(list(task))
```

mlr_pipeops_ovrunite *Unite Binary Classification Tasks*

Description

Perform "One vs. Rest" classification by (weighted) majority vote prediction from [classification Predictions](#). This works in combination with [PipeOpOVRSplit](#).

Weights can be set as a parameter; if none are provided, defaults to equal weights for each prediction.

Always returns a "prob" prediction, regardless of the incoming [Learner](#)'s `$predict_type`. The label of the class with the highest predicted probability is selected as the "response" prediction.

Missing values during prediction are treated as each class label being equally likely.

This [PipeOp](#) uses a [Multiplicity](#) input, which is created by [PipeOpOVRSplit](#) and causes [PipeOps](#) on the way to this [PipeOp](#) to be called once for each individual [binary Task](#).

Note that [Multiplicity](#) is currently an experimental features and the implementation or UI may change.

Format

[R6Class](#) inheriting from [PipeOpEnsemble/PipeOp](#).

Construction

```
PipeOpOVRUnite$new(id = "ovrunite", param_vals = list())
```

- `id` :: character(1)
Identifier of the resulting object, default "ovrunite".
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpEnsemble](#). Instead of a [Prediction](#), a [PredictionClassif](#) is used as input and output during prediction and [PipeOpEnsemble](#)'s `collect` parameter is initialized with `TRUE` to allow for collecting a [Multiplicity](#) input.

State

The `$state` is left empty (`list()`).

Parameters

The parameters are the parameters inherited from the [PipeOpEnsemble](#).

Internals

Inherits from [PipeOpEnsemble](#) by implementing the `private$.predict()` method.
Should be used in combination with [PipeOpOVRSplit](#).

Fields

Only fields inherited from [PipeOpEnsemble/PipeOp](#).

Methods

Only methods inherited from [PipeOpEnsemble/PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_ensemblmer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputecons](#)

mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstant, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_scalexmaxabs, mlr_pipeops_scalerange, mlr_pipeops_scale, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_spatialsign, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscale, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson, mlr_pipeops

Other Ensembles: PipeOpEnsemble, mlr_learners_avg, mlr_pipeops_classifavg, mlr_pipeops_regravg

Other Multiplicity PipeOps: Multiplicity(), PipeOpEnsemble, mlr_pipeops_classifavg, mlr_pipeops_featureunion, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_ovrsplit, mlr_pipeops_regravg, mlr_pipeops_replicate

Other Experimental Features: Multiplicity(), mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_ovrsplit, mlr_pipeops_replicate

Examples

```
library(mlr3)
task = tsk("iris")
gr = po("ovrsplit") %>% lrn("classif.rpart") %>% po("ovrunite")
gr$train(task)
gr$predict(task)
gr$pipeops$classif.rpart$learner$predict_type = "prob"
gr$predict(task)
```

mlr_pipeops_pca

Principle Component Analysis

Description

Extracts principle components from data. Only affects numerical features. See `stats::prcomp()` for details.

Format

`R6Class` object inheriting from `PipeOpTaskPreproc/PipeOp`.

Construction

```
PipeOpPCA$new(id = "pca", param_vals = list())
```

- `id` :: character(1)
Identifier of resulting object, default "pca".
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpTaskPreproc](#).

The output is the input [Task](#) with all affected numeric features replaced by their principal components.

State

The `$state` is a named list with the `$state` elements inherited from [PipeOpTaskPreproc](#), as well as the elements of the class `stats::prcomp`, with the exception of the `$x` slot. These are in particular:

- `sdev :: numeric`
The standard deviations of the principal components.
- `rotation :: matrix`
The matrix of variable loadings.
- `center :: numeric | logical(1)`
The centering used, or FALSE.
- `scale :: numeric | logical(1)`
The scaling used, or FALSE.

Parameters

The parameters are the parameters inherited from [PipeOpTaskPreproc](#), as well as:

- `center :: logical(1)`
Indicating whether the features should be centered. Default is FALSE. See [prcomp\(\)](#).
- `scale. :: logical(1)`
Whether to scale features to unit variance before analysis. Default is FALSE, but scaling is advisable. See [prcomp\(\)](#).
- `rank. :: integer(1)`
Maximal number of principal components to be used. Default is NULL: use all components. See [prcomp\(\)](#).

Internals

Uses the [prcomp\(\)](#) function.

Methods

Only methods inherited from [PipeOpTaskPreproc/PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_encodeimer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#),

```
mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons,
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian,
mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_kernelpca,
mlr_pipeops_learner, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply,
mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nmf, mlr_pipeops_nop,
mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_proxy, mlr_pipeops_quantilebin,
mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconst,
mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange,
mlr_pipeops_scale, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_spatialsign,
mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscale,
mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch,
mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson, mlr_pipeops
```

Examples

```
library("mlr3")

task = tsk("iris")
pop = po("pca")

task$data()
pop$train(list(task))[[1]]$data()

pop$state
```

mlr_pipeops_proxy	<i>Wrap another PipeOp or Graph as a Hyperparameter</i>
-------------------	---

Description

Wraps another [PipeOp](#) or [Graph](#) as determined by the content hyperparameter. Input is routed through the content and the contents' output is returned. The content hyperparameter can be changed during tuning, this is useful as an alternative to [PipeOpBranch](#).

Format

Abstract [R6Class](#) inheriting from [PipeOp](#).

Construction

```
PipeOpProxy$new(innum = 0, outnum = 1, id = "proxy", param_vals = list())
```

- `innum` :: `numeric(1)` \cr Determines the number of input channels. If `innum` is 0 (default), a vararg input channel is created that can take an arbitrary number of inputs.
- `outnum` :: `numeric(1)` \cr Determines the number of output channels.
- `id` :: `character(1)` \cr Identifier of resulting object. See `$id` slot of [PipeOp](#).

- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

`PipeOpProxy` has multiple input channels depending on the `innum` construction argument, named "input1", "input2", ... if `innum` is nonzero; if `innum` is 0, there is only one *vararg* input channel named "...".

`PipeOpProxy` has multiple output channels depending on the `outnum` construction argument, named "output1", "output2", ... The output is determined by the output of the content operation (a `PipeOp` or `Graph`).

State

The `$state` is the trained content `PipeOp` or `Graph`.

Parameters

- `content` :: `PipeOp` | `Graph`
The `PipeOp` or `Graph` that is being proxied (or an object that is converted to a `Graph` by `as_graph()`). Defaults to an instance of `PipeOpFeatureUnion` (combines all input if they are `Tasks`).

Internals

The content will internally be coerced to a graph via `as_graph()` prior to train and predict.

The default value for `content` is `PipeOpFeatureUnion`,

Fields

Fields inherited from `PipeOp`.

Methods

Only methods inherited from `PipeOp`.

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other `PipeOps`: `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreprocSimple`, `PipeOpTaskPreproc`, `PipeOp`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_ensemblmer`, `mlr_pipeops_encode`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputecons`, `mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityexply`,

```
mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nmf, mlr_pipeops_nop,
mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_quantilebin,
mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconst,
mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_scalexmaxabs, mlr_pipeops_scalerange,
mlr_pipeops_scale, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_spatialsign,
mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscale,
mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch,
mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson, mlr_pipeops
```

Examples

```
library("mlr3")
library("mlr3learners")

set.seed(1234)
task = tsk("iris")

# use a proxy for preprocessing and a proxy for learning, i.e.,
# no preprocessing and classif.kknn
g = po("proxy", id = "preproc", param_vals = list(content = po("nop"))) %>>%
  po("proxy", id = "learner", param_vals = list(content = lrn("classif.kknn")))
rr_kknn = resample(task, learner = GraphLearner$new(g), resampling = rsmpl("cv", folds = 3))
rr_kknn$aggregate(msr("classif.ce"))

# use pca for preprocessing and classif.rpart as the learner
g$param_set$values$preproc.content = po("pca")
g$param_set$values$learner.content = lrn("classif.rpart")
rr_pca_rpart = resample(task, learner = GraphLearner$new(g), resampling = rsmpl("cv", folds = 3))
rr_pca_rpart$aggregate(msr("classif.ce"))
```

```
mlr_pipeops_quantilebin
```

Split Numeric Features into Quantile Bins

Description

Splits numeric features into quantile bins.

Format

[R6Class](#) object inheriting from [PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp](#).

Construction

```
PipeOpQuantileBin$new(id = "quantilebin", param_vals = list())
```

- `id`: character(1)
Identifier of resulting object, default "quantilebin".

- `param_vals :: named list`
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpTaskPreproc](#).

The output is the input [Task](#) with all affected numeric features replaced by their binned versions.

State

The `$state` is a named list with the `$state` elements inherited from [PipeOpTaskPreproc](#), as well as:

- `bins :: list`
List of intervals representing the bins for each numeric feature.

Parameters

The parameters are the parameters inherited from [PipeOpTaskPreproc](#), as well as:

- `numsplits :: numeric(1)`
Number of bins to create. Default is 2.

Internals

Uses the `stats::quantile` function.

Methods

Only methods inherited from [PipeOpTaskPreprocSimple](#)/[PipeOpTaskPreproc](#)/[PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_ensemblemer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputecons](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_randomprojec](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconstants](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalemaxabs](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#), [mlr_pipeops_select](#), [mlr_pipeops_smote](#), [mlr_pipeops_spatialsign](#), [mlr_pipeops_subsample](#), [mlr_pipeops_targetinvert](#), [mlr_pipeops_targetmutate](#), [mlr_pipeops_targettrafoscalerange](#),

[mlr_pipeops_textvectorizer](#), [mlr_pipeops_threshold](#), [mlr_pipeops_tunethreshold](#), [mlr_pipeops_unbranch](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops_vtreat](#), [mlr_pipeops_yeojohnson](#), [mlr_pipeops](#)

Examples

```
library("mlr3")

task = tsk("iris")
pop = po("quantilebin")

task$data()
pop$train(list(task))[[1]]$data()

pop$state
```

```
mlr_pipeops_randomprojection
```

Project Numeric Features onto a Randomly Sampled Subspace

Description

Projects numeric features onto a randomly sampled subspace. All numeric features (or the ones selected by `affect_columns`) are replaced by numeric features PR1, PR2, ... PRn

Samples with features that contain missing values result in all PR1..PRn being NA for that sample, so it is advised to do imputation *before* random projections if missing values can be expected.

Format

[R6Class](#) object inheriting from [PipeOpTaskPreprocSimple](#)/[PipeOpTaskPreproc](#)/[PipeOp](#).

Construction

```
PipeOpRandomProjection$new(id = "randomprojection", param_vals = list())
```

- `id` :: character(1)
Identifier of resulting object, default "randomprojection".
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpTaskPreproc](#).

The output is the input [Task](#) with affected numeric features projected onto a random subspace.

State

The `$state` is a named list with the `$state` elements inherited from [PipeOpTaskPreproc](#), as well as an element `$projection`, a matrix.

Parameters

The parameters are the parameters inherited from `PipeOpTaskPreproc`, as well as:

- `rank :: integer(1)`
The dimension of the subspace to project onto. Initialized to 1.

Internals

If there are n (affected) numeric features in the input `Task`, then `$state$projection` is a rank \times m matrix. The output is calculated as `input %*% state$projection`.

The random projection matrix is obtained through Gram-Schmidt orthogonalization from a matrix with values standard normally distributed, which gives a distribution that is rotation invariant, as per Eaton: *Multivariate Statistics, A Vector Space Approach*, Pg. 234.

Methods

Only methods inherited from `PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp`.

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreprocSimple`, `PipeOpTaskPreproc`, `PipeOp`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_ensemblmer`, `mlr_pipeops_encode`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputecons`, `mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_mutate`, `mlr_pipeops_nmf`, `mlr_pipeops_nop`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunite`, `mlr_pipeops_pca`, `mlr_pipeops_proxy`, `mlr_pipeops_quantilebin`, `mlr_pipeops_randomresponse`, `mlr_pipeops_regravg`, `mlr_pipeops_removeconstants`, `mlr_pipeops_renamecolumns`, `mlr_pipeops_replicate`, `mlr_pipeops_scalexmaxabs`, `mlr_pipeops_scalerange`, `mlr_pipeops_scale`, `mlr_pipeops_select`, `mlr_pipeops_smote`, `mlr_pipeops_spatialsign`, `mlr_pipeops_subsample`, `mlr_pipeops_targetinvert`, `mlr_pipeops_targetmutate`, `mlr_pipeops_targettrafoscalerange`, `mlr_pipeops_textvectorizer`, `mlr_pipeops_threshold`, `mlr_pipeops_tunethreshold`, `mlr_pipeops_unbranch`, `mlr_pipeops_updatetarget`, `mlr_pipeops_vtreat`, `mlr_pipeops_yeojohnson`, `mlr_pipeops`

Examples

```
library("mlr3")

task = tsk("iris")
pop = po("randomprojection", rank = 2)

task$data()
pop$train(list(task))[[1]]$data()

pop$state
```

`mlr_pipeops_randomresponse`*Generate a Randomized Response Prediction*

Description

Takes in a [Prediction](#) of `predict_type` "prob" (for [PredictionClassif](#)) or "se" (for [PredictionRegr](#)) and generates a randomized "response" prediction.

For "prob", the responses are sampled according to the probabilities of the input [PredictionClassif](#). For "se", responses are randomly drawn according to the `rdistfun` parameter (default is `rnorm`) by using the original responses of the input [PredictionRegr](#) as the mean and the original standard errors of the input [PredictionRegr](#) as the standard deviation (sampling is done observation-wise).

Format

[R6Class](#) object inheriting from [PipeOp](#).

Construction

```
PipeOpRandomResponse$new(id = "randomresponse", param_vals = list(), packages = character(0))
```

- `id` :: `character(1)`
Identifier of the resulting object, default "randomresponse".
- `param_vals` :: `named list`
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.
- `packages` :: `character`
Set of all required packages for the `private$.predict()` methods related to the `rdistfun` parameter. Default is `character(0)`.

Input and Output Channels

[PipeOpRandomResponse](#) has one input channel named "input", taking `NULL` during training and a [Prediction](#) during prediction.

[PipeOpRandomResponse](#) has one output channel named "output", producing `NULL` during training and a [Prediction](#) with random responses during prediction.

State

The `$state` is left empty (`list()`).

Parameters

- `rdistfun` :: `function`
A function for generating random responses when the `predict` type is "se". This function must accept the arguments `n` (integerish number of responses), `mean` (numeric for the mean), and `sd` (numeric for the standard deviation), and must *vectorize* over `mean` and `sd`. Default is `rnorm`.

Internals

If the `predict_type` of the input `Prediction` does not match "prob" or "se", the input `Prediction` will be returned unaltered.

Fields

Only fields inherited from `PipeOp`.

Methods

Only methods inherited from `PipeOp`.

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other `PipeOps`: `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreprocSimple`, `PipeOpTaskPreproc`, `PipeOp`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_encodelmer`, `mlr_pipeops_encode`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputecons`, `mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_mutate`, `mlr_pipeops_nmf`, `mlr_pipeops_nop`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunite`, `mlr_pipeops_pca`, `mlr_pipeops_proxy`, `mlr_pipeops_quantilebin`, `mlr_pipeops_randomprojection`, `mlr_pipeops_regravg`, `mlr_pipeops_removeconstants`, `mlr_pipeops_renamecolour`, `mlr_pipeops_replicate`, `mlr_pipeops_scalemaxabs`, `mlr_pipeops_scalerange`, `mlr_pipeops_scale`, `mlr_pipeops_select`, `mlr_pipeops_smote`, `mlr_pipeops_spatialsign`, `mlr_pipeops_subsample`, `mlr_pipeops_targetinvert`, `mlr_pipeops_targetmutate`, `mlr_pipeops_targettrafoscalerange`, `mlr_pipeops_textvectorizer`, `mlr_pipeops_threshold`, `mlr_pipeops_tunethreshold`, `mlr_pipeops_unbranch`, `mlr_pipeops_updatetarget`, `mlr_pipeops_vtreat`, `mlr_pipeops_yeojohnson`, `mlr_pipeops`

Examples

```
library(mlr3)
library(mlr3learners)

task1 = tsk("iris")
g1 = LearnerClassifRpart$new() %>>% PipeOpRandomResponse$new()
g1$train(task1)
g1$pipeops$classif.rpart$learner$predict_type = "prob"
set.seed(2409)
g1$predict(task1)

task2 = tsk("mtcars")
g2 = LearnerRegrLM$new() %>>% PipeOpRandomResponse$new()
g2$train(task2)
g2$pipeops$regr.lm$learner$predict_type = "se"
set.seed(2906)
```

```
g2$predict(task2)
```

```
mlr_pipeops_regravg    Weighted Prediction Averaging
```

Description

Perform (weighted) prediction averaging from regression [Predictions](#) by connecting [PipeOpRegrAvg](#) to multiple [PipeOpLearner](#) outputs.

The resulting "response" prediction is a weighted average of the incoming "response" predictions. "se" prediction is currently not aggregated but discarded if present.

Weights can be set as a parameter; if none are provided, defaults to equal weights for each prediction. Defaults to equal weights for each model.

Format

[R6Class](#) inheriting from [PipeOpEnsemble/PipeOp](#).

Construction

```
PipeOpRegrAvg$new(innum = 0, collect_multiplicity = FALSE, id = "regravg", param_vals = list())
```

- `innum :: numeric(1)`
Determines the number of input channels. If `innum` is 0 (default), a vararg input channel is created that can take an arbitrary number of inputs.
- `collect_multiplicity :: logical(1)`
If TRUE, the input is a [Multiplicity](#) collecting channel. This means, a [Multiplicity](#) input, instead of multiple normal inputs, is accepted and the members are aggregated. This requires `innum` to be 0. Default is FALSE.
- `id :: character(1)` Identifier of the resulting object, default "regravg".
- `param_vals :: named list`
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpEnsemble](#). Instead of a [Prediction](#), a [PredictionRegr](#) is used as input and output during prediction.

State

The `$state` is left empty (`list()`).

Parameters

The parameters are the parameters inherited from the [PipeOpEnsemble](#).

Internals

Inherits from [PipeOpEnsemble](#) by implementing the private `$weighted_avg_predictions()` method.

Fields

Only fields inherited from [PipeOpEnsemble/PipeOp](#).

Methods

Only methods inherited from [PipeOpEnsemble/PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_ensemblmer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputecons](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_removeconstants](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalemaxabs](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#), [mlr_pipeops_select](#), [mlr_pipeops_smote](#), [mlr_pipeops_spatialsign](#), [mlr_pipeops_subsample](#), [mlr_pipeops_targetinvert](#), [mlr_pipeops_targetmutate](#), [mlr_pipeops_targettrafoscale](#), [mlr_pipeops_textvectorizer](#), [mlr_pipeops_threshold](#), [mlr_pipeops_tunethreshold](#), [mlr_pipeops_unbranch](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops_vtreat](#), [mlr_pipeops_yeojohnson](#), [mlr_pipeops](#)

Other Multiplicity PipeOps: [Multiplicity\(\)](#), [PipeOpEnsemble](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_replicate](#)

Other Ensembles: [PipeOpEnsemble](#), [mlr_learners_avg](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_ovrunite](#)

Examples

```
library("mlr3")

# Simple Bagging
gr = ppl("grePLICATE",
  po("subsample") %>>%
  po("learner", lrn("classif.rpart")),
  n = 5
) %>>%
  po("classifavg")

resample(tsk("iris"), GraphLearner$new(gr), rsmp("holdout"))
```

mlr_pipeops_removeconstants

Remove Constant Features

Description

Remove constant features from a [mlr3::Task](#). For each feature, calculates the ratio of features which differ from their mode value. All features with a ratio below a settable threshold are removed from the task. Missing values can be ignored or treated as a regular value distinct from non-missing values.

Format

[R6Class](#) object inheriting from [PipeOpTaskPreprocSimple](#)/[PipeOpTaskPreproc](#)/[PipeOp](#).

Construction

`PipeOpRemoveConstants$new(id = "removeconstants")`

- `id` :: `character(1)` Identifier of the resulting object, defaulting to "removeconstants".
- `param_vals` :: `named list`
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

State

`$state` is a `named list` with the `$state` elements inherited from [PipeOpTaskPreproc](#), as well as:

- `features` :: `character()`
Names of features that are being kept. Features of types that the [Filter](#) can not operate on are always being kept.

Parameters

The parameters are the parameters inherited from the [PipeOpTaskPreproc](#), as well as:

- `ratio` :: `numeric(1)`
Ratio of values which must be different from the mode value in order to keep a feature in the task. Initialized to 0, which means only constant features with exactly one observed level are removed.
- `rel_tol` :: `numeric(1)`
Relative tolerance within which to consider a numeric feature constant. Set to 0 to disregard relative tolerance. Initialized to $1e-8$.
- `abs_tol` :: `numeric(1)`
Absolute tolerance within which to consider a numeric feature constant. Set to 0 to disregard absolute tolerance. Initialized to $1e-8$.
- `na_ignore` :: `logical(1)`
If TRUE, the ratio is calculated after removing all missing values first, so a column can be "constant" even if some but not all values are NA. Initialized to TRUE.

Fields

Fields inherited from [PipeOpTaskPreproc/PipeOp](#).

Methods

Methods inherited from [PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_ensemblemer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputecons](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalexmaxabs](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#), [mlr_pipeops_select](#), [mlr_pipeops_smote](#), [mlr_pipeops_spatialsign](#), [mlr_pipeops_subsample](#), [mlr_pipeops_targetinvert](#), [mlr_pipeops_targetmutate](#), [mlr_pipeops_targettrafoscalerange](#), [mlr_pipeops_textvectorizer](#), [mlr_pipeops_threshold](#), [mlr_pipeops_tunethreshold](#), [mlr_pipeops_unbranch](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops_vtreat](#), [mlr_pipeops_yeojohnson](#), [mlr_pipeops](#)

Examples

```
library("mlr3")
data = data.table::data.table(y = runif(10), a = 1:10, b = rep(1, 10), c = rep(1:2, each = 5))

task = TaskRegr$new("example", data, target = "y")

po = po("removeconstants")

po$train(list(task = task))[[1]]$data()

po$state
```

mlr_pipeops_renamecolumns

Rename Columns

Description

Renames the columns of a [Task](#) both during training and prediction. Uses the `$rename()` mutator of the [Task](#).

Format

[R6Class](#) object inheriting from [PipeOpTaskPreprocSimple/PipeOp](#).

Construction

```
PipeOpRenameColumns$new(id = "renamecolumns", param_vals = list())
```

- `id` :: `character(1)`
Identifier of resulting object, default "renamecolumns".
- `param_vals` :: `named list`
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpTaskPreprocSimple](#).

The output is the input [Task](#) with the old column names changed to the new ones.

State

The `$state` is a `named list` with the `$state` elements inherited from [PipeOpTaskPreprocSimple](#).

Parameters

The parameters are the parameters inherited from [PipeOpTaskPreprocSimple](#), as well as:

- `renaming` :: `named character`
Named character vector. The names of the vector specify the old column names that should be changed to the new column names as given by the elements of the vector. Initialized to the empty character vector.
- `ignore_missing` :: `logical(1)`
Ignore if columns named in `renaming` are not found in the input [Task](#). If this is `FALSE`, then names found in `renaming` not found in the [Task](#) cause an error. Initialized to `FALSE`.

Internals

Uses the `$rename()` mutator of the [Task](#) to set the new column names.

Fields

Only fields inherited from [PipeOpTaskPreprocSimple/PipeOp](#).

Methods

Only methods inherited from [PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_encodeimlmer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputecon](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconst](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalemaxabs](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#), [mlr_pipeops_select](#), [mlr_pipeops_smote](#), [mlr_pipeops_spatialsign](#), [mlr_pipeops_subsample](#), [mlr_pipeops_targetinvert](#), [mlr_pipeops_targetmutate](#), [mlr_pipeops_targettrafoscalerange](#), [mlr_pipeops_textvectorizer](#), [mlr_pipeops_threshold](#), [mlr_pipeops_tunethreshold](#), [mlr_pipeops_unbranch](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops_vtreat](#), [mlr_pipeops_yeojohnson](#), [mlr_pipeops](#)

Examples

```
library("mlr3")

task = tsk("iris")
pop = po("renamecolumns", param_vals = list(renaming = c("Petal.Length" = "PL")))
pop$train(list(task))
```

mlr_pipeops_replicate *Replicate the Input as a Multiplicity*

Description

Replicate the input as a [Multiplicity](#), causing subsequent [PipeOps](#) to be executed multiple reps times.

Note that [Multiplicity](#) is currently an experimental features and the implementation or UI may change.

Format

[R6Class](#) object inheriting from [PipeOp](#).

Construction

```
PipeOpReplicate$new(id = "replicate", param_vals = list())
```

- `id` :: character(1) Identifier of the resulting object, default "replicate".

- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

`PipeOpReplicate` has one input channel named "input", taking any input ("*") both during training and prediction.

`PipeOpReplicate` has one output channel named "output" returning the replicated input as a `Multiplicity` of type any ("[*]") both during training and prediction.

State

The `$state` is left empty (`list()`).

Parameters

- `reps` :: `numeric(1)`
Integer indicating the number of times the input should be replicated.

Fields

Only fields inherited from `PipeOp`.

Methods

Only methods inherited from `PipeOp`.

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other `PipeOps`: `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreprocSimple`, `PipeOpTaskPreproc`, `PipeOp`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_encodelmer`, `mlr_pipeops_encode`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputeconst`, `mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_mutate`, `mlr_pipeops_nmf`, `mlr_pipeops_nop`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunite`, `mlr_pipeops_pca`, `mlr_pipeops_proxy`, `mlr_pipeops_quantilebin`, `mlr_pipeops_randomprojection`, `mlr_pipeops_randomresponse`, `mlr_pipeops_regravg`, `mlr_pipeops_removeconst`, `mlr_pipeops_renamecolumns`, `mlr_pipeops_scalemaxabs`, `mlr_pipeops_scalerange`, `mlr_pipeops_scale`, `mlr_pipeops_select`, `mlr_pipeops_smote`, `mlr_pipeops_spatialsign`, `mlr_pipeops_subsample`, `mlr_pipeops_targetinvert`, `mlr_pipeops_targetmutate`, `mlr_pipeops_targettrafoscalerange`, `mlr_pipeops_textvectorizer`, `mlr_pipeops_threshold`, `mlr_pipeops_tunethreshold`, `mlr_pipeops_unbranch`, `mlr_pipeops_updatetarget`, `mlr_pipeops_vtreat`, `mlr_pipeops_yeojohnson`, `mlr_pipeops`

Other Multiplicity PipeOps: [Multiplicity\(\)](#), [PipeOpEnsemble](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_regravg](#)

Other Experimental Features: [Multiplicity\(\)](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#)

Examples

```
library("mlr3")
task = tsk("iris")
po = po("replicate", param_vals = list(reps = 3))
po$train(list(task))
po$predict(list(task))
```

mlr_pipeops_scale

Center and Scale Numeric Features

Description

Centers all numeric features to mean = 0 (if center parameter is TRUE) and scales them by dividing them by their root-mean-square (if scale parameter is TRUE).

The root-mean-square here is defined as $\sqrt{\text{sum}(x^2)/(\text{length}(x)-1)}$. If the center parameter is TRUE, this corresponds to the [sd\(\)](#).

Format

[R6Class](#) object inheriting from [PipeOpTaskPreproc/PipeOp](#).

Construction

```
PipeOpScale$new(id = "scale", param_vals = list())
```

- `id` :: character(1)
Identifier of resulting object, default "scale".
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpTaskPreproc](#).

The output is the input [Task](#) with all affected numeric parameters centered and/or scaled.

State

The `$state` is a named list with the `$state` elements inherited from `PipeOpTaskPreproc`, as well as:

- `center` :: numeric
The mean / median (depending on `robust`) of each numeric feature during training, or 0 if `center` is `FALSE`. Will be subtracted during the predict phase.
- `scale` :: numeric
The value by which features are divided. 1 if `scale` is `FALSE`
If `robust` is `FALSE`, this is the root mean square, defined as $\sqrt{\text{sum}(x^2)/(\text{length}(x)-1)}$, of each feature, possibly after centering. If `robust` is `TRUE`, this is the mean absolute deviation multiplied by 1.4826 (see `stats::mad` of each feature, possibly after centering. This is 1 for features that are constant during training if `center` is `TRUE`, to avoid division-by-zero.

Parameters

The parameters are the parameters inherited from `PipeOpTaskPreproc`, as well as:

- `center` :: `logical(1)`
Whether to center features, i.e. subtract their `mean()` from them. Default `TRUE`.
- `scale` :: `logical(1)`
Whether to scale features, i.e. divide them by $\sqrt{\text{sum}(x^2)/(\text{length}(x)-1)}$. Default `TRUE`.
- `robust` :: `logical(1)`
Whether to use robust scaling; instead of scaling / centering with mean / standard deviation, median and median absolute deviation `mad` are used. Initialized to `FALSE`.

Internals

Imitates the `scale()` function for `robust = FALSE` and alternatively subtracts the median and divides by `mad` for `robust = TRUE`.

Methods

Only methods inherited from `PipeOpTaskPreproc/PipeOp`.

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreprocSimple`, `PipeOpTaskPreproc`, `PipeOp`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_ensemblmer`, `mlr_pipeops_encode`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputecons`, `mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityexply`,

```
mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nmf, mlr_pipeops_nop,
mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin,
mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconst,
mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange,
mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_spatialsign, mlr_pipeops_subsample,
mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange,
mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch,
mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson, mlr_pipeops
```

Examples

```
library("mlr3")

task = tsk("iris")
pos = po("scale")

pos$train(list(task))[[1]]$data()

one_line_of_iris = task$filter(13)

one_line_of_iris$data()

pos$predict(list(one_line_of_iris))[[1]]$data()
```

```
mlr_pipeops_scalemaxabs
```

Scale Numeric Features with Respect to their Maximum Absolute Value

Description

Scales the numeric data columns so their maximum absolute value is maxabs, if possible. NA, Inf are ignored, and features that are constant 0 are not scaled.

Format

R6Class object inheriting from [PipeOpTaskPreprocSimple](#)/[PipeOpTaskPreproc](#)/[PipeOp](#).

Construction

```
PipeOpScaleMaxAbs$new(id = "scalemaxabs", param_vals = list())
```

- `id` :: character(1)
Identifier of resulting object, default "scalemaxabs".
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default list().

Input and Output Channels

Input and output channels are inherited from [PipeOpTaskPreproc](#).

The output is the input [Task](#) with scaled numeric features.

State

The `$state` is a named list with the `$state` elements inherited from [PipeOpTaskPreproc](#), as well as the maximum absolute values of each numeric feature.

Parameters

The parameters are the parameters inherited from [PipeOpTaskPreproc](#), as well as:

- `maxabs :: numeric(1)`
The maximum absolute value for each column after transformation. Default is 1.

Methods

Only methods inherited from [PipeOpTaskPreprocSimple](#)/[PipeOpTaskPreproc](#)/[PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_encodeimer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputecons](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconst](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#), [mlr_pipeops_select](#), [mlr_pipeops_smote](#), [mlr_pipeops_spatialsign](#), [mlr_pipeops_subsample](#), [mlr_pipeops_targetinvert](#), [mlr_pipeops_targetmutate](#), [mlr_pipeops_targettrafoscalerange](#), [mlr_pipeops_textvectorizer](#), [mlr_pipeops_threshold](#), [mlr_pipeops_tunethreshold](#), [mlr_pipeops_unbranch](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops_vtreat](#), [mlr_pipeops_yeojohnson](#), [mlr_pipeops](#)

Examples

```
library("mlr3")

task = tsk("iris")
pop = po("scalemaxabs")

task$data()
```

```
pop$train(list(task))[[1]]$data()
pop$state
```

```
mlr_pipeops_scalerange
```

Linearly Transform Numeric Features to Match Given Boundaries

Description

Linearly transforms numeric data columns so they are between lower and upper. The formula for this is $x' = offset + x * scale$, where $scale$ is $(upper - lower) / (max(x) - min(x))$ and $offset$ is $-min(x) * scale + lower$. The same transformation is applied during training and prediction.

Format

R6Class object inheriting from [PipeOpTaskPreprocSimple](#)/[PipeOpTaskPreproc](#)/[PipeOp](#).

Construction

```
PipeOpScaleRange$new(id = "scalerange", param_vals = list())
```

- `id` :: character(1)
Identifier of resulting object, default "scalerange".
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpTaskPreproc](#).

The output is the input [Task](#) with scaled numeric features.

State

The `$state` is a named list with the `$state` elements inherited from [PipeOpTaskPreproc](#), as well as the two transformation parameters $scale$ and $offset$ for each numeric feature.

Parameters

The parameters are the parameters inherited from [PipeOpTaskPreproc](#), as well as:

- `lower` :: numeric(1)
Target value of smallest item of input data. Initialized to 0.
- `upper` :: numeric(1)
Target value of greatest item of input data. Initialized to 1.

Methods

Only methods inherited from [PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_ensemblmer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputecons](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconst](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalemaxabs](#), [mlr_pipeops_scale](#), [mlr_pipeops_select](#), [mlr_pipeops_smote](#), [mlr_pipeops_spatialsign](#), [mlr_pipeops_subsample](#), [mlr_pipeops_targetinvert](#), [mlr_pipeops_targetmutate](#), [mlr_pipeops_targettrafoscalerange](#), [mlr_pipeops_textvectorizer](#), [mlr_pipeops_threshold](#), [mlr_pipeops_tunethreshold](#), [mlr_pipeops_unbranch](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops_vtreat](#), [mlr_pipeops_yeojohnson](#), [mlr_pipeops](#)

Examples

```
library("mlr3")

task = tsk("iris")
pop = po("scalerange", param_vals = list(lower = -1, upper = 1))

task$data()
pop$train(list(task))[[1]]$data()

pop$state
```

mlr_pipeops_select	<i>Remove Features Depending on a Selector</i>
--------------------	--

Description

Removes features from [Task](#) depending on a [Selector](#) function: The selector parameter gives the features to keep. See [Selector](#) for selectors that are provided and how to write custom [Selectors](#).

Format

[R6Class](#) object inheriting from [PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp](#).

Construction

```
PipeOpSelect$new(id = "select", param_vals = list())
```

- `id` :: character(1)
Identifier of resulting object, default "select".
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpTaskPreproc](#).

The output is the input [Task](#) with features removed that were not selected by the [Selector](#)/function in selector.

State

The `$state` is a named list with the `$state` elements inherited from [PipeOpTaskPreproc](#), as well as:

- `selection` :: character
A vector of all feature names that are kept (i.e. not dropped) in the [Task](#). Initialized to [selector_all\(\)](#)

Parameters

- `selector` :: function | [Selector](#)
[Selector](#) function, takes a [Task](#) as argument and returns a character of features to keep. See [Selector](#) for example functions. Defaults to `selector_all()`.

Internals

Uses `task$select()`.

Fields

Only fields inherited from [PipeOpTaskPreproc/PipeOp](#).

Methods

Only methods inherited from [PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#),


```
mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encode, mlr_pipeops_featureunion,
mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputeconst,
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian,
mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_kernelpca,
mlr_pipeops_learner, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply,
mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nmf, mlr_pipeops_nop,
mlr_pipeops_ovrsplit, mlr_pipeops_ovrunit, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin,
mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconst,
mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_scalexmaxabs, mlr_pipeops_scalerange,
mlr_pipeops_scale, mlr_pipeops_smote, mlr_pipeops_spatialsign, mlr_pipeops_subsample,
mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange,
mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch,
mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson, mlr_pipeops
```

Other Selectors: [Selector](#)

Examples

```
library("mlr3")

task = tsk("boston_housing")
pos = po("select")

pos$param_set$values$selector = selector_all()
pos$train(list(task))[[1]]$feature_names

pos$param_set$values$selector = selector_type("factor")
pos$train(list(task))[[1]]$feature_names

pos$param_set$values$selector = selector_invert(selector_type("factor"))
pos$train(list(task))[[1]]$feature_names

pos$param_set$values$selector = selector_grep("^r")
pos$train(list(task))[[1]]$feature_names
```

mlr_pipeops_smote	<i>SMOTE Balancing</i>
-------------------	------------------------

Description

Generates a more balanced data set by creating synthetic instances of the minority class using the SMOTE algorithm. The algorithm samples for each minority instance a new data point based on the K nearest neighbors of that data point. It can only be applied to tasks with purely numeric features. See [smotefamily::SMOTE](#) for details.

Format

[R6Class](#) object inheriting from [PipeOpTaskPreproc/PipeOp](#).

Construction

```
PipeOpSmote$new(id = "smote", param_vals = list())
```

- `id` :: `character(1)`
Identifier of resulting object, default "smote".
- `param_vals` :: `named list`
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpTaskPreproc](#).

The output during training is the input `Task` with added synthetic rows for the minority class. The output during prediction is the unchanged input.

State

The `$state` is a `named list` with the `$state` elements inherited from [PipeOpTaskPreproc](#).

Parameters

The parameters are the parameters inherited from [PipeOpTaskPreproc](#), as well as:

- `K` :: `numeric(1)`
The number of nearest neighbors used for sampling new values. See [SMOTE\(\)](#).
- `dup_size` :: `numeric`
Desired times of synthetic minority instances over the original number of majority instances. See [SMOTE\(\)](#).

Fields

Only fields inherited from [PipeOpTaskPreproc/PipeOp](#).

Methods

Only methods inherited from [PipeOpTaskPreproc/PipeOp](#).

References

Chawla NV, Bowyer KW, Hall LO, Kegelmeyer WP (2002). "SMOTE: Synthetic Minority Over-sampling Technique." *Journal of Artificial Intelligence Research*, **16**, 321–357. doi: [10.1613/jair.953](https://doi.org/10.1613/jair.953).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_ensemblmer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputecon](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconst](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalemaxabs](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#), [mlr_pipeops_select](#), [mlr_pipeops_spatialsign](#), [mlr_pipeops_subsample](#), [mlr_pipeops_targetinvert](#), [mlr_pipeops_targetmutate](#), [mlr_pipeops_targettrafoscalerange](#), [mlr_pipeops_textvectorizer](#), [mlr_pipeops_threshold](#), [mlr_pipeops_tunethreshold](#), [mlr_pipeops_unbranch](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops_vtreat](#), [mlr_pipeops_yeojohnson](#), [mlr_pipeops](#)

Examples

```
library("mlr3")

# Create example task
data = smotefamily::sample_generator(1000, ratio = 0.80)
data$result = factor(data$result)
task = TaskClassif$new(id = "example", backend = data, target = "result")
task$data()
table(task$data()$result)

# Generate synthetic data for minority class
pop = po("smote")
smotedata = pop$train(list(task))[[1]]$data()
table(smotedata$result)
```

mlr_pipeops_spatialsign

Normalize Data Row-wise

Description

Normalizes the data row-wise. This is a natural generalization of the "sign" function to higher dimensions.

Format

R6Class object inheriting from [PipeOpTaskPreprocSimple](#)/[PipeOpTaskPreproc](#)/[PipeOp](#).

Construction

```
PipeOpSpatialSign$new(id = "spatialsign", param_vals = list())
```

- `id` :: `character(1)`
Identifier of resulting object, default "spatialsign".
- `param_vals` :: `named list`
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpTaskPreproc](#).

The output is the input `Task` with all affected numeric features replaced by their normalized versions.

State

The `$state` is a named list with the `$state` elements inherited from [PipeOpTaskPreproc](#).

Parameters

The parameters are the parameters inherited from [PipeOpTaskPreproc](#), as well as:

- `length` :: `numeric(1)`
Length to scale rows to. Default is 1.
- `norm` :: `numeric(1)`
Norm to use. Rows are scaled to $\sum(x^{\text{norm}})^{(1/\text{norm})} == \text{length}$ for finite norm, or to $\max(\text{abs}(x)) == \text{length}$ if norm is Inf. Default is 2.

Methods

Only methods inherited from [PipeOpTaskPreprocSimple](#)/[PipeOpTaskPreproc](#)/[PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_ensemblemer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputecons](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconst](#)

```
mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange,
mlr_pipeops_scale, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_subsample, mlr_pipeops_targetinver,
mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer,
mlr_pipeops_threshold, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget,
mlr_pipeops_vtreat, mlr_pipeops_yeojohnson, mlr_pipeops
```

Examples

```
library("mlr3")

task = tsk("iris")

task$data()

pop = po("spatialsign")

pop$train(list(task)[[1]]$data())
```

mlr_pipeops_subsample *Subsampling*

Description

Subsamples a [Task](#) to use a fraction of the rows.

Sampling happens only during training phase. Subsampling a [Task](#) may be beneficial for training time at possibly (depending on original [Task](#) size) negligible cost of predictive performance.

Format

[R6Class](#) object inheriting from [PipeOpTaskPreproc/PipeOp](#).

Construction

```
PipeOpSubsample$new(id = "subsample", param_vals = list())
```

- `id` :: character(1) Identifier of the resulting object, default "subsample"
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpTaskPreproc](#).

The output during training is the input [Task](#) with added or removed rows according to the sampling. The output during prediction is the unchanged input.

State

The `$state` is a named list with the `$state` elements inherited from [PipeOpTaskPreproc](#).

Parameters

The parameters are the parameters inherited from [PipeOpTaskPreproc](#); however, the `affect_columns` parameter is *not* present. Further parameters are:

- `frac` :: `numeric(1)`
Fraction of rows in the [Task](#) to keep. May only be greater than 1 if `replace` is `TRUE`. Initialized to $(1 - \exp(-1)) \approx 0.6321$.
- `stratify` :: `logical(1)`
Should the subsamples be stratified by target? Initialized to `FALSE`. May only be `TRUE` for [TaskClassif](#) input.
- `replace` :: `logical(1)`
Sample with replacement? Initialized to `FALSE`.

Internals

Uses `task$filter()` to remove rows. If `replace` is `TRUE` and identical rows are added, then the `taskrow_rolesuse` can *not* be used to duplicate rows because of [inaudible]; instead the `task$rbind()` function is used, and a new [data.table](#) is attached that contains all rows that are being duplicated exactly as many times as they are being added.

Fields

Only fields inherited from [PipeOpTaskPreproc/PipeOp](#).

Methods

Only methods inherited from [PipeOpTaskPreproc/PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_ensemblmer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputeconst](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconst](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalemaxabs](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#), [mlr_pipeops_select](#), [mlr_pipeops_smote](#), [mlr_pipeops_spatialsign](#), [mlr_pipeops_targetinvert](#), [mlr_pipeops_targetmutate](#), [mlr_pipeops_targettrafoscalerange](#), [mlr_pipeops_textvectorizer](#), [mlr_pipeops_threshold](#), [mlr_pipeops_tunethreshold](#), [mlr_pipeops_unbranch](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops_vtreat](#), [mlr_pipeops_yeojohnson](#), [mlr_pipeops](#)

Examples

```
library("mlr3")

pos = mlr_pipeops$get("subsample", param_vals = list(frac = 0.7, stratify = TRUE))

pos$train(list(tsk("iris")))
```

mlr_pipeops_targetinvert

Invert Target Transformations

Description

Inverts target-transformations done during training based on a supplied inversion function. Typically should be used in combination with a subclass of [PipeOpTargetTrafo](#).

During prediction phase the function supplied through "fun" is called with a list containing the "prediction" as a single element, and should return a list with a single element (a [Prediction](#)) that is returned by [PipeOpTargetInvert](#).

Format

[R6Class](#) object inheriting from [PipeOp](#).

Construction

```
PipeOpTargetInvert$new(id = "targetinvert", param_vals = list())
```

- `id` :: character(1)
Identifier of resulting object, default "targetinvert".
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

[PipeOpTargetInvert](#) has two input channels named "fun" and "prediction". During training, both take NULL as input. During prediction, "fun" takes a function and "prediction" takes a [Prediction](#).

[PipeOpTargetInvert](#) has one output channel named "output" and returns NULL during training and a [Prediction](#) during prediction.

State

The `$state` is left empty (`list()`).

Parameters

[PipeOpTargetInvert](#) has no parameters.

Internals

Should be used in combination with a subclass of [PipeOpTargetTrafo](#).

Fields

Only fields inherited from [PipeOp](#).

Methods

Only methods inherited from [PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_encodedelmer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputecons](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconst](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalemaxabs](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#), [mlr_pipeops_select](#), [mlr_pipeops_smote](#), [mlr_pipeops_spatialsign](#), [mlr_pipeops_subsample](#), [mlr_pipeops_targetmutate](#), [mlr_pipeops_targettrafoscalerange](#), [mlr_pipeops_textvectorizer](#), [mlr_pipeops_threshold](#), [mlr_pipeops_tunethreshold](#), [mlr_pipeops_unbranch](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops_vtreat](#), [mlr_pipeops_yeojohnson](#), [mlr_pipeops](#)

mlr_pipeops_targetmutate

Transform a Target by a Function

Description

Changes the *target* of a [Task](#) according to a function given as hyperparameter. An inverter-function that undoes the transformation during prediction must also be given.

Format

[R6Class](#) object inheriting from [PipeOpTargetTrafo](#)/[PipeOp](#)

Construction

`PipeOpTargetMutate$new(id = "targetmutate", param_vals = list(), new_task_type = NULL)`

- `id` :: `character(1)`
Identifier of resulting object, default "targetmutate".
- `param_vals` :: `named list`
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.
- `new_task_type` :: `character(1) | NULL`
The task type to which the output is converted, must be one of `mlr_reflections$task_types$type`. Defaults to `NULL`: no change in task type.

Input and Output Channels

Input and output channels are inherited from [PipeOpTargetTrafo](#).

State

The `$state` is left empty (`list()`).

Parameters

The parameters are the parameters inherited from [PipeOpTargetTrafo](#), as well as:

- `trafo` :: `function data.table -> data.table`
Transformation function for the target. Should only be a function of the target, i.e., taking a single `data.table` argument, typically with one column. The return value is used as the new target of the resulting [Task](#). To change target names, change the column name of the data using e.g. `setnames()`.
Note that this function also gets called during prediction and should thus gracefully handle NA values.
Initialized to `identity()`.
- `inverter` :: `function data.table -> data.table | named list`
Inversion of the transformation function for the target. Called on a `data.table` created from a [Prediction](#) using `as.data.table()`, without the `$row_ids` and `$truth` columns, and should return a `data.table` or `named list` that contains the new relevant slots of a [Prediction](#) subclass (e.g., `$response`, `$prob`, `$se`, ...). Initialized to `identity()`.

Internals

Overloads [PipeOpTargetTrafo](#)'s `.transform()` and `.invert()` functions. Should be used in combination with [PipeOpTargetInvert](#).

Fields

Fields inherited from [PipeOp](#), as well as:

- `new_task_type` :: `character(1)`
`new_task_type` construction argument. Read-only.

Methods

Only methods inherited from [PipeOpTargetTrafo/PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_encodeimer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputecons](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunitite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconst](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalemaxabs](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#), [mlr_pipeops_select](#), [mlr_pipeops_smote](#), [mlr_pipeops_spatialsign](#), [mlr_pipeops_subsample](#), [mlr_pipeops_targetinvert](#), [mlr_pipeops_targettrafoscalerange](#), [mlr_pipeops_textvectorizer](#), [mlr_pipeops_threshold](#), [mlr_pipeops_tunethreshold](#), [mlr_pipeops_unbranch](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops_vtreat](#), [mlr_pipeops_yeojohnson](#), [mlr_pipeops](#)

Examples

```
library(mlr3)
task = tsk("boston_housing")
po = PipeOpTargetMutate$new("logtrafo", param_vals = list(
  trafo = function(x) log(x, base = 2),
  inverter = function(x) list(response = 2 ^ x$response))
)
# Note that this example is ill-equipped to work with
# `predict_type == "se"` predictions.

po$train(list(task))
po$predict(list(task))

g = Graph$new()
g$add_pipeop(po)
g$add_pipeop(LearnerRegrRpart$new())
g$add_pipeop(PipeOpTargetInvert$new())
g$add_edge(src_id = "logtrafo", dst_id = "targetinvert",
  src_channel = 1, dst_channel = 1)
g$add_edge(src_id = "logtrafo", dst_id = "regr.rpart",
  src_channel = 2, dst_channel = 1)
g$add_edge(src_id = "regr.rpart", dst_id = "targetinvert",
  src_channel = 1, dst_channel = 2)

g$train(task)
```

```

g$predict(task)

#syntactic sugar using ppl():
tt = ppl("targettrafo", graph = PipeOpLearner$new(LearnerRegrRpart$new()))
tt$param_set$values$targetmutate.trafo = function(x) log(x, base = 2)
tt$param_set$values$targetmutate.inverter = function(x) list(response = 2 ^ x$response)

```

mlr_pipeops_targettrafoscalerange

Linearly Transform a Numeric Target to Match Given Boundaries

Description

Linearly transforms a numeric target of a [TaskRegr](#) so it is between lower and upper. The formula for this is $x' = offset + x * scale$, where *scale* is $(upper - lower) / (max(x) - min(x))$ and *offset* is $-min(x) * scale + lower$. The same transformation is applied during training and prediction.

Format

[R6Class](#) object inheriting from [PipeOpTargetTrafo](#)/[PipeOp](#)

Construction

```
PipeOpTargetTrafoScaleRange$new(id = "targettrafoscalerange", param_vals = list())
```

- `id` :: `character(1)`
Identifier of resulting object, default "targettrafoscalerange".
- `param_vals` :: `named list`
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpTargetTrafo](#).

State

The `$state` is a `named list` containing the slots `$offset` and `$scale`.

Parameters

The parameters are the parameters inherited from [PipeOpTargetTrafo](#), as well as:

- `lower` :: `numeric(1)`
Target value of smallest item of input target. Initialized to 0.
- `upper` :: `numeric(1)`
Target value of greatest item of input target. Initialized to 1.

Internals

Overloads `PipeOpTargetTrafo`'s `.get_state()`, `.transform()`, and `.invert()`. Should be used in combination with `PipeOpTargetInvert`.

Methods

Only methods inherited from `PipeOpTargetTrafo/PipeOp`.

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreprocSimple`, `PipeOpTaskPreproc`, `PipeOp`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_encodeimer`, `mlr_pipeops_encode`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputeconst`, `mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_mutate`, `mlr_pipeops_nmf`, `mlr_pipeops_nop`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunit`, `mlr_pipeops_pca`, `mlr_pipeops_proxy`, `mlr_pipeops_quantilebin`, `mlr_pipeops_randomprojection`, `mlr_pipeops_randomresponse`, `mlr_pipeops_regravg`, `mlr_pipeops_removeconst`, `mlr_pipeops_renamecolumns`, `mlr_pipeops_replicate`, `mlr_pipeops_scalemaxabs`, `mlr_pipeops_scalerange`, `mlr_pipeops_scale`, `mlr_pipeops_select`, `mlr_pipeops_smote`, `mlr_pipeops_spatialsign`, `mlr_pipeops_subsample`, `mlr_pipeops_targetinvert`, `mlr_pipeops_targetmutate`, `mlr_pipeops_textvectorizer`, `mlr_pipeops_threshold`, `mlr_pipeops_tunethreshold`, `mlr_pipeops_unbranch`, `mlr_pipeops_updatetarget`, `mlr_pipeops_vtreat`, `mlr_pipeops_yeojohnson`, `mlr_pipeops`

Examples

```
library(mlr3)
task = tsk("boston_housing")
po = PipeOpTargetTrafoScaleRange$new()

po$train(list(task))
po$predict(list(task))

#syntactic sugar for a graph using ppl():
ttscalerange = ppl("targettrafo", trafo_pipeop = PipeOpTargetTrafoScaleRange$new(),
  graph = PipeOpLearner$new(LearnerRegrRpart$new()))
ttscalerange$train(task)
ttscalerange$predict(task)
ttscalerange$state$regr.rpart
```

mlr_pipeops_textvectorizer

Bag-of-word Representation of Character Features

Description

Computes a bag-of-word representation from a (set of) columns. Columns of type character are split up into words. Uses the `quanteda::dfm()`, `quanteda::dfm_trim()` from the 'quanteda' package. TF-IDF computation works similarly to `quanteda::dfm_tfidf()` but has been adjusted for train/test data split using `quanteda::docfreq()` and `quanteda::dfm_weight()`

In short:

- Per default, produces a bag-of-words representation
- If `n` is set to values > 1 , ngrams are computed
- If `df_trim` parameters are set, the bag-of-words is trimmed.
- The `scheme_tf` parameter controls term-frequency (per-document, i.e. per-row) weighting
- The `scheme_df` parameter controls the document-frequency (per token, i.e. per-column) weighting.

Parameters specify arguments to `quanteda`'s `dfm`, `dfm_trim`, `docfreq` and `dfm_weight`. What belongs to what can be obtained from each `params` tags where `tokenizer` are arguments passed on to `quanteda::dfm()`. Defaults to a bag-of-words representation with token counts as matrix entries.

In order to perform the *default* `dfm_tfidf` weighting, set the `scheme_df` parameter to "inverse". The `scheme_df` parameter is initialized to "unary", which disables document frequency weighting.

The pipeop works as follows:

1. Words are tokenized using `quanteda::tokens`.
2. Ngrams are computed using `quanteda::tokens_ngrams`
3. A document-frequency matrix is computed using `quanteda::dfm`
4. The document-frequency matrix is trimmed using `quanteda::dfm_trim` during train-time.
5. The document-frequency matrix is re-weighted (similar to `quanteda::dfm_tfidf`) if `scheme_df` is not set to "unary".

Format

`R6Class` object inheriting from `PipeOpTaskPreproc/PipeOp`.

Construction

```
PipeOpTextVectorizer$new(id = "textvectorizer", param_vals = list())
```

- `id` :: character(1)
Identifier of resulting object, default "textvectorizer".
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpTaskPreproc](#).

The output is the input [Task](#) with all affected features converted to a bag-of-words representation.

State

The `$state` is a list with element `'cols'`: A vector of extracted columns.

Parameters

The parameters are the parameters inherited from [PipeOpTaskPreproc](#), as well as:

- `return_type :: character(1)`
Whether to return an integer representation ("integer-sequence") or a Bag-of-words ("bow"). If set to "integer_sequence", tokens are replaced by an integer and padded/truncated to `sequence_length`. If set to "factor_sequence", tokens are replaced by a factor and padded/truncated to `sequence_length`. If set to 'bow', a possibly weighted bag-of-words matrix is returned. Defaults to bow.
- `stopwords_language :: character(1)`
Language to use for stopword filtering. Needs to be either "none", a language identifier listed in `stopwords::stopwords_getlanguages("snowball")` ("de", "en", ...) or "smart". "none" disables language-specific stopwords. "smart" corresponds to `stopwords::stopwords(source = "smart")`, which contains *English* stopwords and also removes one-character strings. Initialized to "smart".
- `extra_stopwords :: character`
Extra stopwords to remove. Must be a character vector containing individual tokens to remove. Initialized to `character(0)`. When `n` is set to values greater than 1, this can also contain stop-ngrams.
- `tolower :: logical(1)`
Convert to lower case? See [quanteda::dfm](#). Default: TRUE.
- `stem :: logical(1)`
Perform stemming? See [quanteda::dfm](#). Default: FALSE.
- `what :: character(1)`
Tokenization splitter. See [quanteda::tokens](#). Default: word.
- `remove_punct :: logical(1)`
See [quanteda::tokens](#). Default: FALSE.
- `remove_url :: logical(1)`
See [quanteda::tokens](#). Default: FALSE.
- `remove_symbols :: logical(1)`
See [quanteda::tokens](#). Default: FALSE.
- `remove_numbers :: logical(1)`
See [quanteda::tokens](#). Default: FALSE.
- `remove_separators :: logical(1)`
See [quanteda::tokens](#). Default: TRUE.

- `split_hypens :: logical(1)`
See `quanteda::tokens`. Default: FALSE.
- `n :: integer`
Vector of ngram lengths. See `quanteda::tokens_ngrams`. Initialized to 1, deviating from the base function's default. Note that this can be a *vector* of multiple values, to construct ngrams of multiple orders.
- `skip :: integer`
Vector of skips. See `quanteda::tokens_ngrams`. Default: 0. Note that this can be a *vector* of multiple values.
- `sparsity :: numeric(1)`
Desired sparsity of the 'tfm' matrix. See `quanteda::dfm_trim`. Default: NULL.
- `max_termfreq :: numeric(1)`
Maximum term frequency in the 'tfm' matrix. See `quanteda::dfm_trim`. Default: NULL.
- `min_termfreq :: numeric(1)`
Minimum term frequency in the 'tfm' matrix. See `quanteda::dfm_trim`. Default: NULL.
- `termfreq_type :: character(1)`
How to assess term frequency. See `quanteda::dfm_trim`. Default: "count".
- `scheme_df :: character(1)`
Weighting scheme for document frequency: See `quanteda::docfreq`. Initialized to "unary" (1 for each document, deviating from base function default).
- `smoothing_df :: numeric(1)`
See `quanteda::docfreq`. Default: 0.
- `k_df :: numeric(1)`
k parameter given to `quanteda::docfreq` (see there). Default is 0.
- `threshold_df :: numeric(1)`
See `quanteda::docfreq`. Default: 0. Only considered for `scheme_df = "count"`.
- `base_df :: numeric(1)`
The base for logarithms in `quanteda::docfreq` (see there). Default: 10.
- `scheme_tf :: character(1)`
Weighting scheme for term frequency: See `quanteda::dfm_weight`. Default: "count".
- `k_tf :: numeric(1)`
k parameter given to `quanteda::dfm_weight` (see there). Default behaviour is 0.5.
- `base_df :: numeric(1)`
The base for logarithms in `quanteda::dfm_weight` (see there). Default: 10.

#' * `sequence_length :: integer(1)`

The length of the integer sequence. Defaults to Inf, i.e. all texts are padded to the length of the longest text. Only relevant for "return_type" : "integer_sequence"

Internals

See Description. Internally uses the `quanteda` package. Calls `quanteda::tokens`, `quanteda::tokens_ngrams` and `quanteda::dfm`. During training, `quanteda::dfm_trim` is also called. Tokens not seen during training are dropped during prediction.

Methods

Only methods inherited from [PipeOpTaskPreproc/PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_ensemblmer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputecons](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconst](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalemaxabs](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#), [mlr_pipeops_select](#), [mlr_pipeops_smote](#), [mlr_pipeops_spatialsign](#), [mlr_pipeops_subsample](#), [mlr_pipeops_targetinvert](#), [mlr_pipeops_targetmutate](#), [mlr_pipeops_targettrafoscale](#), [mlr_pipeops_threshold](#), [mlr_pipeops_tunethreshold](#), [mlr_pipeops_unbranch](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops_vtreat](#), [mlr_pipeops_yeojohnson](#), [mlr_pipeops](#)

Examples

```
library("mlr3")
library("data.table")
# create some text data
dt = data.table(
  txt = replicate(150, paste0(sample(letters, 3), collapse = " "))
)
task = tsk("iris")$cbind(dt)

pos = po("textvectorizer", param_vals = list(stopwords_language = "en"))

pos$train(list(task))[[1]]$data()

one_line_of_iris = task$filter(13)

one_line_of_iris$data()

pos$predict(list(one_line_of_iris))[[1]]$data()
```


Description

Change the threshold of a Prediction during the predict step. The incoming `Learner`'s `$predict_type` needs to be "prob". Internally calls `PredictionClassif$set_threshold`.

Format

`R6Class` inheriting from `PipeOp`.

Construction

```
PipeOpThreshold$new(id = "threshold", param_vals = list())
```

- `id` :: `character(1)` Identifier of the resulting object, default "threshold".
- `param_vals` :: `named list`
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Defaults to `numeric(0)`.

Input and Output Channels

During training, the input and output are NULL. A `PredictionClassif` is required as input and returned as output during prediction.

State

The `$state` is left empty (`list()`).

Parameters

- `thresholds` :: `numeric`
A numeric vector of thresholds for the different class levels. May have length 1 for binary classification predictions, must otherwise have length of the number of target classes; see `PredictionClassif`'s `$set_threshold()` method. Initialized to 0.5, i.e. thresholding for binary classification at level 0.5.

Fields

Only fields inherited from `PipeOp`.

Methods

Only methods inherited from `PipeOp`.

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreprocSimple`, `PipeOpTaskPreproc`, `PipeOp`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`,

```
mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encode, mlr_pipeops_featureunion,
mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons,
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian,
mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_kernelpca,
mlr_pipeops_learner, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply,
mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nmf, mlr_pipeops_nop,
mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin,
mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconst,
mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_scalexmaxabs, mlr_pipeops_scalerange,
mlr_pipeops_scale, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_spatialsign,
mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscale,
mlr_pipeops_textvectorizer, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget,
mlr_pipeops_vtreat, mlr_pipeops_yeojohnson, mlr_pipeops
```

Examples

```
library("mlr3")
t = tsk("german_credit")
gr = po(lrn("classif.rpart", predict_type = "prob")) %>%
  po("threshold", param_vals = list(thresholds = 0.9))
gr$train(t)
gr$predict(t)
```

```
mlr_pipeops_tunethreshold
```

Tune the Threshold of a Classification Prediction

Description

Tunes optimal probability thresholds over different [PredictionClassifs](#).

[mlr3::Learner](#) `predict_type`: "prob" is required. Thresholds for each learner are optimized using the [Optimizer](#) supplied via the `param_set`. Defaults to [GenSA](#). Returns a single [PredictionClassif](#).

This `PipeOp` should be used in conjunction with [PipeOpLearnerCV](#) in order to optimize thresholds of cross-validated predictions. In order to optimize thresholds without cross-validation, use [PipeOpLearnerCV](#) in conjunction with [ResamplingInsample](#).

Format

[R6Class](#) object inheriting from [PipeOp](#).

Construction

```
* `PipeOpTuneThreshold$new(id = "tunethreshold", param_vals = list())` \cr
(`character(1)`, `list`) -> `self` \cr
```

- `id`: `character(1)`
Identifier of resulting object. Default: "tunethreshold".

- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOp](#).

State

The `$state` is a named list with elements

- `thresholds` :: numeric learned thresholds

Parameters

The parameters are the parameters inherited from [PipeOp](#), as well as:

- `measure` :: [Measure](#) | character
[Measure](#) to optimize for. Will be converted to a [Measure](#) in case it is character. Initialized to "classif.ce", i.e. misclassification error.
- `optimizer` :: [Optimizer](#) | character(1)
[Optimizer](#) used to find optimal thresholds. If character, converts to [Optimizer](#) via `opt`. Initialized to [OptimizerGenSA](#).
- `log_level` :: character(1) | integer(1)
Set a temporary log-level for `lgr::get_logger("bbotk")`. Initialized to: "warn".

Internals

Uses the optimizer provided as a `param_val` in order to find an optimal threshold. See the optimizer parameter for more info.

Methods

Only methods inherited from [PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_encodejmer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputecons](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#),

```
mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconst,
mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange,
mlr_pipeops_scale, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_spatialsign,
mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscale,
mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget,
mlr_pipeops_vtreat, mlr_pipeops_yeojohnson, mlr_pipeops
```

Examples

```
library("mlr3")

task = tsk("iris")
pop = po("learner_cv", lrn("classif.rpart", predict_type = "prob")) %>>%
  po("tunethreshold")

task$data()
pop$train(task)

pop$state
```

mlr_pipeops_unbranch *Unbranch Different Paths*

Description

Used to bring together different paths created by [PipeOpBranch](#).

Format

[R6Class](#) object inheriting from [PipeOp](#).

Construction

```
PipeOpUnbranch$new(options, id = "unbranch", param_vals = list())
```

- `options` :: `numeric(1) | character`
If `options` is 0, a `vararg` input channel is created that can take any number of inputs. If `options` is a nonzero integer number, it determines the number of input channels / options that are created, named `input1...input<n>`. The If `options` is a character, it determines the names of channels directly. The difference between these three is purely cosmetic if the user chooses to produce channel names matching with the corresponding [PipeOpBranch](#). However, it is not necessary to have matching names and the `vararg` option is always viable.
- `id` :: `character(1)`
Identifier of resulting object, default "unbranch".
- `param_vals` :: `named list`
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output

`PipeOpUnbranch` has multiple input channels depending on the options construction argument, named "input1", "input2", ... if options is a nonzero integer and named after each options value if options is a character; if options is 0, there is only one *vararg* input channel named "...". All input channels take any argument ("*") both during training and prediction.

`PipeOpUnbranch` has one output channel named "output", producing the only `NO_OP` object received as input ("*"), both during training and prediction.

State

The `$state` is left empty (`list()`).

Parameters

`PipeOpUnbranch` has no parameters.

Internals

See `PipeOpBranch` Internals on how alternative path branching works.

Fields

Only fields inherited from `PipeOp`.

Methods

Only methods inherited from `PipeOp`.

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreprocSimple`, `PipeOpTaskPreproc`, `PipeOp`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_encodelearner`, `mlr_pipeops_encode`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputecons`, `mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_mutate`, `mlr_pipeops_nmf`, `mlr_pipeops_nop`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunit`, `mlr_pipeops_pca`, `mlr_pipeops_proxy`, `mlr_pipeops_quantilebin`, `mlr_pipeops_randomprojection`, `mlr_pipeops_randomresponse`, `mlr_pipeops_regravg`, `mlr_pipeops_removeconst`, `mlr_pipeops_renamecolumns`, `mlr_pipeops_replicate`, `mlr_pipeops_scalexmaxabs`, `mlr_pipeops_scalerange`, `mlr_pipeops_scale`, `mlr_pipeops_select`, `mlr_pipeops_smote`, `mlr_pipeops_spatialsign`, `mlr_pipeops_subsample`, `mlr_pipeops_targetinvert`, `mlr_pipeops_targetmutate`, `mlr_pipeops_targettrafoscale`, `mlr_pipeops_textvectorizer`, `mlr_pipeops_threshold`, `mlr_pipeops_tunethreshold`, `mlr_pipeops_updatetarget`, `mlr_pipeops_vtreat`, `mlr_pipeops_yeojohnson`, `mlr_pipeops`

Other Path Branching: `NO_OP`, `filter_noop()`, `is_noop()`, `mlr_pipeops_branch`

Examples

```
# See PipeOpBranch for a complete branching example
pou = po("unbranch")

pou$train(list(NO_OP, NO_OP, "hello", NO_OP, NO_OP))
```

mlr_pipeops_updatetarget

Transform a Target without an Explicit Inversion

Description

EXPERIMENTAL, API SUBJECT TO CHANGE

Handles target transformation operations that do not need explicit inversion. In case the new target is required during predict, creates a vector of NA. Works similar to [PipeOpTargetTrafo](#) and [PipeOpTargetMutate](#), but forgoes the inversion step. In case target after the trafo is a factor, levels are saved to \$state.

During prediction: Sets all target values to NA before calling the trafo again. In case target after the trafo is a factor, levels saved in the state are set during prediction.

As a special case when trafo is identity and new_target_name matches an existing column name of the data of the input [Task](#), this column is set as the new target. Depending on drop_original_target the original target is then either dropped or added to the features.

Format

Abstract [R6Class](#) inheriting from [PipeOp](#).

Construction

```
PipeOpUpdateTarget$new(id, param_set = ParamSet$new(),
  param_vals = list(), packages = character(0))
```

- `id` :: `character(1)`
Identifier of resulting object. See `$id` slot of [PipeOp](#).
- `param_vals` :: `named list`
List of hyperparameter settings, overwriting the hyperparameter settings given in `param_set`. The subclass should have its own `param_vals` parameter and pass it on to `super$initialize()`. Default `list()`.

Parameters

The parameters are the parameters inherited from [PipeOpTargetTrafo](#), as well as:

- `trafo` :: function
Transformation function for the target. Should only be a function of the target, i.e., taking a single argument. Default is identity. Note, that the data passed on to the target is a `data.table` consisting of all target column.
- `new_target_name` :: character(1)
Optionally give the transformed target a new name. By default the original name is used.
- `new_task_type` :: character(1)
Optionally a new task type can be set. Legal types are listed in `mlr_reflections$task_types$type`.
#’ `drop_original_target` :: logical(1)
Whether to drop the original target column. Default: TRUE.

State

The `$state` is a list of class levels for each target after `trafo`. `list()` if none of the targets have levels.

Methods

Only methods inherited from `PipeOp`.

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other mlr3pipelines backend related: `Graph`, `PipeOpTargetTrafo`, `PipeOpTaskPreprocSimple`, `PipeOpTaskPreproc`, `PipeOp`, `mlr_graphs`, `mlr_pipeops`

Other PipeOps: `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreprocSimple`, `PipeOpTaskPreproc`, `PipeOp`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_encodelmer`, `mlr_pipeops_encode`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputecons`, `mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_mutate`, `mlr_pipeops_nmf`, `mlr_pipeops_nop`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunite`, `mlr_pipeops_pca`, `mlr_pipeops_proxy`, `mlr_pipeops_quantilebin`, `mlr_pipeops_randomprojection`, `mlr_pipeops_randomresponse`, `mlr_pipeops_regravg`, `mlr_pipeops_removeconst`, `mlr_pipeops_renamecolumns`, `mlr_pipeops_replicate`, `mlr_pipeops_scalexmaxabs`, `mlr_pipeops_scalerange`, `mlr_pipeops_scale`, `mlr_pipeops_select`, `mlr_pipeops_smote`, `mlr_pipeops_spatialsign`, `mlr_pipeops_subsample`, `mlr_pipeops_targetinvert`, `mlr_pipeops_targetmutate`, `mlr_pipeops_targettrafoscale`, `mlr_pipeops_textvectorizer`, `mlr_pipeops_threshold`, `mlr_pipeops_tunethreshold`, `mlr_pipeops_unbranch`, `mlr_pipeops_vtreat`, `mlr_pipeops_yeojohnson`, `mlr_pipeops`

Examples

```
## Not run:
# Create a binary class task from iris
library(mlr3)
```

```

trafo_fun = function(x) {factor(iffelse(x$Species == "setosa", "setosa", "other"))}
po = PipeOpUpdateTarget$new(param_vals = list(trafo = trafo_fun, new_target_name = "setosa"))
po$train(list(tsk("iris")))
po$predict(list(tsk("iris")))

## End(Not run)

```

mlr_pipeops_vtreat *Interface to the vtreat Package*

Description

Provides an interface to the vtreat package.

`PipeOpVtreat` naturally works for [classification tasks](#) and [regression tasks](#). Internally, `PipeOpVtreat` follows the fit/prepare interface of vtreat, i.e., first creating a data treatment transform object via `vtreat::NumericOutcomeTreatment()`, `vtreat::BinomialOutcomeTreatment()`, or `vtreat::MultinomialOutcomeTreatment()` followed by calling `vtreat::fit_prepare()` on the training data and `vtreat::prepare()` during prediction.

Format

`R6Class` object inheriting from `PipeOpTaskPreproc/PipeOp`.

Construction

```
PipeOpVtreat$new(id = "vtreat", param_vals = list())
```

- `id` :: character(1)
Identifier of resulting object, default "vtreat".
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`.

The output is the input `Task` with all affected features "prepared" by vtreat. If vtreat found "no usable vars", the input `Task` is returned unaltered.

State

The `$state` is a named list with the `$state` elements inherited from `PipeOpTaskPreproc`, as well as:

- `treatment_plan` :: object of class `vtreat_pipe_step` | NULL
The treatment plan as constructed by vtreat based on the training data, i.e., an object of class `treatment_plan`. If vtreat found "no usable vars" and designing the treatment would have failed, this is NULL.

Parameters

The parameters are the parameters inherited from [PipeOpTaskPreproc](#), as well as:

- `recommended` :: `logical(1)`
Whether only the "recommended" prepared features should be returned, i.e., non constant variables with a significance value smaller than `vtreat`'s threshold. Initialized to `TRUE`.
- `cols_to_copy` :: `function | Selector`
`Selector` function, takes a `Task` as argument and returns a `character()` of features to copy. See `Selector` for example functions. Initialized to `selector_none()`.
- `minFraction` :: `numeric(1)`
Minimum frequency a categorical level must have to be converted to an indicator column.
- `smFactor` :: `numeric(1)`
Smoothing factor for impact coding models.
- `rareCount` :: `integer(1)`
Allow levels with this count or below to be pooled into a shared rare-level.
- `rareSig` :: `numeric(1)`
Suppress levels from pooling at this significance value greater.
- `collarProb` :: `numeric(1)`
What fraction of the data (pseudo-probability) to collar data at if `doCollar = TRUE`.
- `doCollar` :: `logical(1)`
If `TRUE` collar numeric variables by cutting off after a tail-probability specified by `collarProb` during treatment design.
- `codeRestriction` :: `character()`
What types of variables to produce.
- `customCoders` :: `named list`
Map from code names to custom categorical variable encoding functions.
- `splitFunction` :: `function`
Function taking arguments `nSplits`, `nRows`, `dframe`, and `y`; returning a user desired split.
- `ncross` :: `integer(1)`
Integer larger than one, number of cross-validation rounds to design.
- `forceSplit` :: `logical(1)`
If `TRUE` force cross-validated significance calculations on all variables.
- `catScaling` :: `logical(1)`
If `TRUE` use `stats::glm()` linkspace, if `FALSE` use `stats::lm()` for scaling.
- `verbose` :: `logical(1)`
If `TRUE` print progress.
- `use_parallel` :: `logical(1)`
If `TRUE` use parallel methods.
- `missingness_imputation` :: `function`
Function of signature `f(values: numeric, weights: numeric)`, simple missing value imputer. Typically, an imputation via a `PipeOp` should be preferred, see [PipeOpImpute](#).
- `pruneSig` :: `numeric(1)`
Suppress variables with significance above this level. Only effects [regression tasks [mlr3::TaskRegr](#) and binary [classification tasks](#)].

- `scale :: logical(1)`
If TRUE replace numeric variables with single variable model regressions ("move to outcome-scale"). These have mean zero and (for variables with significant less than 1) slope 1 when regressed (lm for regression problems/glm for classification problems) against outcome.
- `varRestriction :: list()`
List of treated variable names to restrict to. Only effects [regression tasksmlr3::TaskRegr and binary [classification tasks](#).
- `trackedValues :: named list()`
Named list mapping variables to know values, allows warnings upon novel level appearances (see `vtreat::track_values()`). Only effects [regression tasksmlr3::TaskRegr and binary [classification tasks](#).
- `y_dependent_treatments :: character()`
Character what treatment types to build per-outcome level. Only effects multiclass [classification tasks](#).
- `imputation_map :: named list`
List of map from column names to functions of signature `f(values: numeric, weights: numeric)`, simple missing value imputers.
Typically, an imputation via a [PipeOp](#) is to be preferred, see [PipeOpImpute](#).

For more information, see `vtreat::regression_parameters()`, `vtreat::classification_parameters()`, or `vtreat::multinomial_parameters()`.

Internals

Follows `vtreat`'s fit/prepare interface. See `vtreat::NumericOutcomeTreatment()`, `vtreat::BinomialOutcomeTreatment`, `vtreat::MultinomialOutcomeTreatment()`, `vtreat::fit_prepare()` and `vtreat::prepare()`.

Methods

Only methods inherited from [PipeOpTaskPreproc/PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_encydelmer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputecons](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconst](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalemaxabs](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#), [mlr_pipeops_select](#), [mlr_pipeops_smote](#), [mlr_pipeops_spatialsign](#),

[mlr_pipeops_subsample](#), [mlr_pipeops_targetinvert](#), [mlr_pipeops_targetmutate](#), [mlr_pipeops_targettrafoscale](#), [mlr_pipeops_textvectorizer](#), [mlr_pipeops_threshold](#), [mlr_pipeops_tunethreshold](#), [mlr_pipeops_unbranch](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops_yeojohnson](#), [mlr_pipeops](#)

Examples

```
library("mlr3")

set.seed(2020)

make_data <- function(nrows) {
  d <- data.frame(x = 5 * rnorm(nrows))
  d["y"] = sin(d[["x"]]) + 0.01 * d[["x"]] + 0.1 * rnorm(nrows)
  d[4:10, "x"] = NA # introduce NAs
  d["xc"] = paste0("level_", 5 * round(d$y / 5, 1))
  d["x2"] = rnorm(nrows)
  d[d["xc"] == "level_-1", "xc"] = NA # introduce a NA level
  return(d)
}

task = TaskRegr$new("vtreat_regr", backend = make_data(100), target = "y")

pop = PipeOpVtreat$new()
pop$train(list(task))
```

mlr_pipeops_yeojohnson

Yeo-Johnson Transformation of Numeric Features

Description

Conducts a Yeo-Johnson transformation on numeric features. It therefore estimates the optimal value of lambda for the transformation. See [bestNormalize::yeojohnson\(\)](#) for details.

Format

[R6Class](#) object inheriting from [PipeOpTaskPreproc/PipeOp](#).

Construction

`PipeOpYeoJohnson$new(id = "yeojohnson", param_vals = list())`

- `id` :: character(1)
Identifier of resulting object, default "yeojohnson".
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from [PipeOpTaskPreproc](#).

The output is the input [Task](#) with all affected numeric features replaced by their transformed versions.

State

The `$state` is a named list with the `$state` elements inherited from [PipeOpTaskPreproc](#), as well as a list of class `yeojohnson` for each column, which is transformed.

Parameters

The parameters are the parameters inherited from [PipeOpTaskPreproc](#), as well as:

- `eps :: numeric(1)`
Tolerance parameter to identify the lambda parameter as zero. For details see [yeojohnson\(\)](#).
- `standardize :: logical`
Whether to center and scale the transformed values to attempt a standard normal distribution. For details see [yeojohnson\(\)](#).
- `lower :: numeric(1)`
Lower value for estimation of lambda parameter. For details see [yeojohnson\(\)](#).
- `upper :: numeric(1)`
Upper value for estimation of lambda parameter. For details see [yeojohnson\(\)](#).

Internals

Uses the `bestNormalize::yeojohnson` function.

Methods

Only methods inherited from [PipeOpTaskPreproc/PipeOp](#).

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_encodelmer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputecons](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconst](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalemaxabs](#), [mlr_pipeops_scalerange](#),

```
mlr_pipeops_scale, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_spatialsign,
mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscald,
mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch,
mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops
```

Examples

```
library("mlr3")

task = tsk("iris")
pop = po("yeojohnson")

task$data()
pop$train(list(task))[[1]]$data()

pop$state
```

Multiplicity

Multiplicity

Description

A [Multiplicity](#) class S3 object.

The function of multiplicities is to indicate that [PipeOps](#) should be executed multiple times with multiple values.

A [Multiplicity](#) is a container, like a `list()`, that contains multiple values. If the message that is passed along the edge of a [Graph](#) is a [Multiplicity](#)-object, then the [PipeOp](#) that receives this object will *usually* be called once for each contained value. The result of each of these calls is then, again, packed in a [Multiplicity](#) and sent along the outgoing edge(s) of that [PipeOp](#). This means that a [Multiplicity](#) can cause multiple [PipeOps](#) in a row to be run multiple times, where the run for each element of the [Multiplicity](#) is independent from the others.

Most [PipeOps](#) only return a [Multiplicity](#) if their input was a [Multiplicity](#) (and after having run their code multiple times, once for each entry). However, there are a few special [PipeOps](#) that are "aware" of [Multiplicity](#) objects. These may either *create* a [Multiplicity](#) even though not having a [Multiplicity](#) input (e.g. [PipeOpReplicate](#) or [PipeOpOVRSplit](#)) – causing the subsequent [PipeOps](#) to be run multiple times – or *collect* a [Multiplicity](#), being called only once even though their input is a [Multiplicity](#) (e.g. [PipeOpOVRUnite](#) or [PipeOpFeatureUnion](#) if constructed with the `collect_multiplicity` argument set to `TRUE`). The combination of these mechanisms makes it possible for parts of a [Graph](#) to be called variably many times if "sandwiched" between [Multiplicity](#) creating and collecting [PipeOps](#).

Whether a [PipeOp](#) creates or collects a [Multiplicity](#) is indicated by the `$input` or `$output` slot (which indicate names and types of in/out channels). If the `train` and `predict` types of an input or output are surrounded by square brackets ("`[`", "`]`"), then this channel handles a [Multiplicity](#) explicitly. Depending on the function of the [PipeOp](#), it will usually collect (input channel) or create (output channel) a [Multiplicity](#). [PipeOps](#) without this indicator are [Multiplicity](#) agnostic and blindly execute their function multiple times when given a [Multiplicity](#).

If a [PipeOp](#) is trained on a [Multiplicity](#), the \$state slot is set to a [Multiplicity](#) as well; this [Multiplicity](#) contains the "original" \$state resulting from each individual call of the [PipeOp](#) with the input [Multiplicity](#)'s content. If a [PipeOp](#) was trained with a [Multiplicity](#), then the `predict()` argument must be a [Multiplicity](#) with the same number of elements.

Usage

```
Multiplicity(...)
```

Arguments

```
...          any
             Can be anything.
```

Value

[Multiplicity](#)

See Also

Other Special Graph Messages: [NO_OP](#)

Other Experimental Features: [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_replicate](#)

Other Multiplicity PipeOps: [PipeOpEnsemble](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_regravg](#), [mlr_pipeops_replicate](#)

NO_OP

No-Op Sentinel Used for Alternative Branching

Description

Special data type for no-ops. Distinct from NULL for easier debugging and distinction from unintentional NULL returns.

Usage

```
NO_OP
```

Format

[R6](#) object.

See Also

Other Path Branching: [filter_noop\(\)](#), [is_noop\(\)](#), [mlr_pipeops_branch](#), [mlr_pipeops_unbranch](#)

Other Special Graph Messages: [Multiplicity\(\)](#)

PipeOp

*PipeOp Base Class***Description**

A [PipeOp](#) represents a transformation of a given "input" into a given "output", with two stages: "training" and "prediction". It can be understood as a generalized function that not only has multiple inputs, but also multiple outputs (as well as two stages). The "training" stage is used when training a machine learning pipeline or fitting a statistical model, and the "predicting" stage is then used for making predictions on new data.

To perform training, the `$train()` function is called which takes inputs and transforms them, while simultaneously storing information in its `$state` slot. For prediction, the `$predict()` function is called, where the `$state` information can be used to influence the transformation of the new data.

A [PipeOp](#) is usually used in a [Graph](#) object, a representation of a computational graph. It can have multiple **input channels**—think of these as multiple arguments to a function, for example when averaging different models—, and multiple **output channels**—a transformation may return different objects, for example different subsets of a [Task](#). The purpose of the [Graph](#) is to connect different outputs of some [PipeOps](#) to inputs of other [PipeOps](#).

Input and output channel information of a [PipeOp](#) is defined in the `$input` and `$output` slots; each channel has a *name*, a required type during training, and a required type during prediction. The `$train()` and `$predict()` function are called with a `list` argument that has one entry for each declared channel (with one exception, see next paragraph). The `list` is automatically type-checked for each channel against `$input` and then passed on to the `private$.train()` or `private$.predict()` functions. There the data is processed and a result `list` is created. This `list` is again type-checked for declared output types of each channel. The length and types of the result `list` is as declared in `$output`.

A special input channel name is `"..."`, which creates a *vararg* channel that takes arbitrarily many arguments, all of the same type. If the `$input` table contains an `"..."`-entry, then the input given to `$train()` and `$predict()` may be longer than the number of declared input channels.

This class is an abstract base class that all [PipeOps](#) being used in a [Graph](#) should inherit from, and is not intended to be instantiated.

Format

Abstract [R6Class](#).

Construction

```
PipeOp$new(id, param_set = ParamSet$new(), param_vals = list(), input, output, packages = character(0),
```

- `id` :: `character(1)`
Identifier of resulting object. See `$id` slot.
- `param_set` :: [ParamSet](#) | `list` of expression
Parameter space description. This should be created by the subclass and given to `super$initialize()`. If this is a [ParamSet](#), it is used as the [PipeOp](#)'s [ParamSet](#) directly. Otherwise it must be a `list`

of expressions e.g. created by `alist()` that evaluate to `ParamSets`. These `ParamSet` are combined using a `ParamSetCollection`.

- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings given in `param_set`. The subclass should have its own `param_vals` parameter and pass it on to `super$initialize()`. Default `list()`.
- `input` :: `data.table` with columns `name` (character), `train` (character), `predict` (character)
Sets the `$input` slot of the resulting object; see description there.
- `output` :: `data.table` with columns `name` (character), `train` (character), `predict` (character)
Sets the `$output` slot of the resulting object; see description there.
- `packages` :: character
Set of all required packages for the `PipeOp`'s `$train` and `$predict` methods. See `$packages` slot. Default is `character(0)`.
- `tags` :: character
A set of tags associated with the `PipeOp`. Tags describe a `PipeOp`'s purpose. Can be used to filter as `as.data.table(mlr_pipeops)`. Default is "abstract", indicating an abstract `PipeOp`.

Internals

`PipeOp` is an abstract class with abstract functions `private$.train()` and `private$.predict()`. To create a functional `PipeOp` class, these two methods must be implemented. Each of these functions receives a named list according to the `PipeOp`'s input channels, and must return a list (names are ignored) with values in the order of output channels in `$output`. The `private$.train()` and `private$.predict()` function should not be called by the user; instead, a `$train()` and `$predict()` should be used. The most convenient usage is to add the `PipeOp` to a `Graph` (possibly as singleton in that `Graph`), and using the `Graph`'s `$train()` / `$predict()` methods.

`private$.train()` and `private$.predict()` should treat their inputs as read-only. If they are `R6` objects, they should be cloned before being manipulated in-place. Objects, or parts of objects, that are not changed, do not need to be cloned, and it is legal to return the same identical-by-reference objects to multiple outputs.

Fields

- `id` :: character
ID of the `PipeOp`. IDs are user-configurable, and IDs of `PipeOps` must be unique within a `Graph`. IDs of `PipeOps` must not be changed once they are part of a `Graph`, instead the `Graph`'s `$set_names()` method should be used.
- `packages` :: character
Packages required for the `PipeOp`. Functions that are not in base R should still be called using `::` (or explicitly attached using `require()`) in `private$.train()` and `private$.predict()`, but packages declared here are checked before any (possibly expensive) processing has started within a `Graph`.
- `param_set` :: `ParamSet`
Parameters and parameter constraints. Parameter values that influence the functioning of `$train` and / or `$predict` are in the `$param_set$values` slot; these are automatically checked against parameter constraints in `$param_set`.

- `state :: any | NULL`
 Method-dependent state obtained during training step, and usually required for the prediction step. This is `NULL` if and only if the `PipeOp` has not been trained. The `$state` is the *only* slot that can be reliably modified during `$train()`, because `private$.train()` may theoretically be executed in a different R-session (e.g. for parallelization). `$state` should furthermore always be set to something with copy-semantics, since it is never cloned. This is a limitation not of `PipeOp` or `mlr3pipelines`, but of the way the system as a whole works, together with `GraphLearner` and `mlr3`.
- `input :: data.table` with columns `name` (character), `train` (character), `predict` (character)
 Input channels of `PipeOp`. Column `name` gives the names (and order) of values in the list given to `$train()` and `$predict()`. Column `train` is the (S3) class that an input object must conform to during training, column `predict` is the (S3) class that an input object must conform to during prediction. Types are checked by the `PipeOp` itself and do not need to be checked by `private$.train()` / `private$.predict()` code.
 A special name is `"..."`, which creates a *vararg* input channel that accepts a variable number of inputs.
 If a row has both `train` and `predict` values enclosed by square brackets (`"["`, `"]`), then this channel is *Multiplicity-aware*. If the `PipeOp` receives a *Multiplicity* value on these channels, this *Multiplicity* is given to the `.train()` and `.predict()` functions directly. Otherwise, the *Multiplicity* is transparently unpacked and the `.train()` and `.predict()` functions are called multiple times, once for each *Multiplicity* element. The type enclosed by square brackets indicates that only a *Multiplicity* containing values of this type are accepted. See *Multiplicity* for more information.
- `output :: data.table` with columns `name` (character), `train` (character), `predict` (character)
 Output channels of `PipeOp`, in the order in which they will be given in the list returned by `$train` and `$predict` functions. Column `train` is the (S3) class that an output object must conform to during training, column `predict` is the (S3) class that an output object must conform to during prediction. The `PipeOp` checks values returned by `private$.train()` and `private$.predict()` against these types specifications.
 If a row has both `train` and `predict` values enclosed by square brackets (`"["`, `"]`), then this signals that the channel emits a *Multiplicity* of the indicated type. See *Multiplicity* for more information.
- `inum :: numeric(1)`
 Number of input channels. This equals `nrow($input)`.
- `outnum :: numeric(1)`
 Number of output channels. This equals `nrow($output)`.
- `is_trained :: logical(1)`
 Indicate whether the `PipeOp` was already trained and can therefore be used for prediction.
- `tags :: character`
 A set of tags associated with the `PipeOp`. Tags describe a `PipeOp`'s purpose. Can be used to filter as `data.table(mlr_pipeops)`. `PipeOp` tags are inherited and child classes can introduce additional tags.
- `hash :: character(1)`
 Checksum calculated on the `PipeOp`, depending on the `PipeOp`'s class and the slots `$id` and `$param_set$values`. If a `PipeOp`'s functionality may change depending on more than these values, it should inherit the `$hash` active binding and calculate the hash as `digest(list(super$hash, <OTHER THINGS>)`

- `.result :: list`
If the `Graph`'s `$keep_results` flag is set to `TRUE`, then the intermediate Results of `$train()` and `$predict()` are saved to this slot, exactly as they are returned by these functions. This is mainly for debugging purposes and done, if requested, by the `Graph` backend itself; it should *not* be done explicitly by `private$.train()` or `private$.predict()`.
- `man :: character(1)`
Identifying string of the help page that shows with `help()`.

Methods

- `train(input)`
(list) -> named list
Train `PipeOp` on inputs, transform it to output and store the learned `$state`. If the `PipeOp` is already trained, already present `$state` is overwritten. Input list is typechecked against the `$input` train column. Return value is a list with as many entries as `$output` has rows, with each entry named after the `$output` name column and class according to the `$output` train column. The workhorse function for training each `PipeOp` is the private `.train(input)`
: (named list) -> list
function. It's an Abstract function that must be implemented by concrete subclasses. `private$.train()` is called by `$train()` after typechecking. It must change the `$state` value to something non-NULL and return a list of transformed data according to the `$output` train column. Names of the returned list are ignored.
The `private$.train()` method should not be called by a user; instead, the `$train()` method should be used which does some checking and possibly type conversion.
- `predict(input)`
(list) -> named list
Predict on new data in input, possibly using the stored `$state`. Input and output are specified by `$input` and `$output` in the same way as for `$train()`, except that the `predict` column is used for type checking. The workhorse function for predicting in each using each `PipeOp` is `.predict(input)`
(named list) -> list
Abstract function that must be implemented by concrete subclasses. `private$.predict()` is called by `$predict()` after typechecking and works analogously to `private$.train()`. Unlike `private$.train()`, `private$.predict()` should not modify the `PipeOp` in any way. Just as `private$.train()`, `private$.predict()` should not be called by a user; instead, the `$predict()` method should be used.
- `print()`
() -> NULL
Prints the `PipeOps` most salient information: `$id`, `$is_trained`, `$param_set$values`, `$input` and `$output`.
- `help(help_type)`
(character(1)) -> help file
Displays the help file of the concrete `PipeOp` instance. `help_type` is one of "text", "html", "pdf" and behaves as the `help_type` argument of R's `help()`.

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other mlr3pipelines backend related: `Graph`, `PipeOpTargetTrafo`, `PipeOpTaskPreprocSimple`, `PipeOpTaskPreproc`, `mlr_graphs`, `mlr_pipeops_updatetarget`, `mlr_pipeops`

Other PipeOps: `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreprocSimple`, `PipeOpTaskPreproc`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_encodelmer`, `mlr_pipeops_encode`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputeconstant`, `mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_mutate`, `mlr_pipeops_nmf`, `mlr_pipeops_nop`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunit`, `mlr_pipeops_pca`, `mlr_pipeops_proxy`, `mlr_pipeops_quantilebin`, `mlr_pipeops_randomprojection`, `mlr_pipeops_randomresponse`, `mlr_pipeops_regravg`, `mlr_pipeops_removeconstant`, `mlr_pipeops_renamecolumns`, `mlr_pipeops_replicate`, `mlr_pipeops_scalexmaxabs`, `mlr_pipeops_scalerange`, `mlr_pipeops_scale`, `mlr_pipeops_select`, `mlr_pipeops_smote`, `mlr_pipeops_spatialsign`, `mlr_pipeops_subsample`, `mlr_pipeops_targetinvert`, `mlr_pipeops_targetmutate`, `mlr_pipeops_targettrafoscale`, `mlr_pipeops_textvectorizer`, `mlr_pipeops_threshold`, `mlr_pipeops_tunethreshold`, `mlr_pipeops_unbranch`, `mlr_pipeops_updatetarget`, `mlr_pipeops_vtreat`, `mlr_pipeops_yeojohnson`, `mlr_pipeops`

Examples

```
# example (bogus) PipeOp that returns the sum of two numbers during $train()
# as well as a letter of the alphabet corresponding to that sum during $predict().
```

```
PipeOpSumLetter = R6::R6Class("sumletter",
  inherit = PipeOp, # inherit from PipeOp
  public = list(
    initialize = function(id = "posum", param_vals = list()) {
      super$initialize(id, param_vals = param_vals,
        # declare "input" and "output" during construction here
        # training takes two 'numeric' and returns a 'numeric';
        # prediction takes 'NULL' and returns a 'character'.
        input = data.table::data.table(name = c("input1", "input2"),
          train = "numeric", predict = "NULL"),
        output = data.table::data.table(name = "output",
          train = "numeric", predict = "character")
      )
    },
    private = list(
      # PipeOp deriving classes must implement .train and
      # .predict; each taking an input list and returning
      # a list as output.
      .train = function(input) {
        sum = input[[1]] + input[[2]]
        self$state = sum
        list(sum)
      },
      .predict = function(input) {
        list(letters[self$state])
      }
    )
  )
)
```

```

    }
  )
)
posum = PipeOpSumLetter$new()

print(posum)

posum$train(list(1, 2))
# note the name 'output' is the name of the output channel specified
# in the $output data.table.

posum$predict(list(NULL, NULL))

```

PipeOpEnsemble

Ensembling Base Class

Description

Parent class for [PipeOps](#) that aggregate predictions. Implements the `private$.train()` and `private$.predict()` methods necessary for a [PipeOp](#) and requires deriving classes to create the `private$weighted_avg_predictions()` function.

Format

Abstract [R6Class](#) inheriting from [PipeOp](#).

Construction

Note: This object is typically constructed via a derived class, e.g. [PipeOpClassifAvg](#) or [PipeOpRegrAvg](#).

```
PipeOpEnsemble$new(innum = 0, collect_multiplicity = FALSE, id, param_set = ParamSet$new(), param_vals
```

- `innum :: numeric(1)`
Determines the number of input channels. If `innum` is 0 (default), a vararg input channel is created that can take an arbitrary number of inputs.
- `collect_multiplicity :: logical(1)`
If TRUE, the input is a [Multiplicity](#) collecting channel. This means, a [Multiplicity](#) input, instead of multiple normal inputs, is accepted and the members are aggregated. This requires `innum` to be 0. Default is FALSE.
- `id :: character(1)`
Identifier of the resulting object.
- `param_set :: ParamSet`
("Hyper"-)Parameters in form of a [ParamSet](#) for the resulting [PipeOp](#).
- `param_vals :: named list`
List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

- `packages` :: character
Set of packages required for this PipeOp. These packages are loaded during `$train()` and `$predict()`, but not attached. Default character(`0`).
- `prediction_type` :: character(1)
The `predict` entry of the `$input` and `$output` type specifications. Should be "Prediction" (default) or one of its subclasses, e.g. "PredictionClassif", and correspond to the type accepted by `private$.train()` and `private$.predict()`.

Input and Output Channels

`PipeOpEnsemble` has multiple input channels depending on the `innum` construction argument, named "input1", "input2", ... if `innum` is nonzero; if `innum` is 0, there is only one *vararg* input channel named "...". All input channels take only NULL during training and take a `Prediction` during prediction.

`PipeOpEnsemble` has one output channel named "output", producing NULL during training and a `Prediction` during prediction.

The output during prediction is in some way a weighted averaged representation of the input.

State

The `$state` is left empty (`list()`).

Parameters

- `weights` :: numeric
Relative weights of input predictions. If this has length 1, it is ignored and weighs all inputs equally. Otherwise it must have length equal to the number of connected inputs. Initialized to 1 (equal weights).

Internals

The commonality of ensemble methods using `PipeOpEnsemble` is that they take a NULL-input during training and save an empty `$state`. They can be used following a set of `PipeOpLearner` `PipeOps` to perform (possibly weighted) prediction averaging. See e.g. `PipeOpClassifAvg` and `PipeOpRegrAvg` which both inherit from this class.

Should it be necessary to use the output of preceding `Learners` during the "training" phase, then `PipeOpEnsemble` should not be used. In fact, if training time behaviour of a `Learner` is important, then one should use a `PipeOpLearnerCV` instead of a `PipeOpLearner`, and the ensemble can be created with a `Learner` encapsulated by a `PipeOpLearner`. See `LearnerClassifAvg` and `LearnerRegrAvg` for examples.

Fields

Only fields inherited from `PipeOp`.

Methods

Methods inherited from `PipeOp` as well as:

- `weighted_avg_prediction(inputs, weights, row_ids, truth)`
(list of `Prediction`, numeric, integer | character, list) -> NULL
Create `Predictions` that correspond to the weighted average of incoming `Predictions`. This is called by `private$.predict()` with cleaned and sanity-checked values: inputs are guaranteed to fit together, `row_ids` and `truth` are guaranteed to be the same as each one in inputs, and `weights` is guaranteed to have the same length as inputs.
This method is abstract, it must be implemented by deriving classes.

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreprocSimple`, `PipeOpTaskPreproc`, `PipeOp`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_encodelmer`, `mlr_pipeops_encode`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputeconstant`, `mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_mutate`, `mlr_pipeops_nmf`, `mlr_pipeops_nop`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunite`, `mlr_pipeops_pca`, `mlr_pipeops_proxy`, `mlr_pipeops_quantilebin`, `mlr_pipeops_randomprojection`, `mlr_pipeops_randomresponse`, `mlr_pipeops_regravg`, `mlr_pipeops_removeconstant`, `mlr_pipeops_renamecolumns`, `mlr_pipeops_replicate`, `mlr_pipeops_scalemaxabs`, `mlr_pipeops_scalerange`, `mlr_pipeops_scale`, `mlr_pipeops_select`, `mlr_pipeops_smote`, `mlr_pipeops_spatialsign`, `mlr_pipeops_subsample`, `mlr_pipeops_targetinvert`, `mlr_pipeops_targetmutate`, `mlr_pipeops_targettrafoscale`, `mlr_pipeops_textvectorizer`, `mlr_pipeops_threshold`, `mlr_pipeops_tunethreshold`, `mlr_pipeops_unbranch`, `mlr_pipeops_updatetarget`, `mlr_pipeops_vtreat`, `mlr_pipeops_yeojohnson`, `mlr_pipeops`

Other Multiplicity PipeOps: `Multiplicity()`, `mlr_pipeops_classifavg`, `mlr_pipeops_featureunion`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunite`, `mlr_pipeops_regravg`, `mlr_pipeops_replicate`

Other Ensembles: `mlr_learners_avg`, `mlr_pipeops_classifavg`, `mlr_pipeops_ovrunite`, `mlr_pipeops_regravg`

PipeOpImpute

Imputation Base Class

Description

Abstract base class for feature imputation.

Format

Abstract `R6Class` object inheriting from `PipeOp`.

Construction

`PipeOpImpute$new(id, param_set = ParamSet$new(), param_vals = list(), whole_task_dependent = FALSE, pa`

- `id` :: `character(1)`
Identifier of resulting object. See `$id` slot of [PipeOp](#).
- `param_set` :: [ParamSet](#)
Parameter space description. This should be created by the subclass and given to `super$initialize()`.
- `param_vals` :: `named list`
List of hyperparameter settings, overwriting the hyperparameter settings given in `param_set`. The subclass should have its own `param_vals` parameter and pass it on to `super$initialize()`. Default `list()`.
- `whole_task_dependent` :: `logical(1)`
Whether the `context_columns` parameter should be added which lets the user limit the columns that are used for imputation inference. This should generally be `FALSE` if imputation depends only on individual features (e.g. mode imputation), and `TRUE` if imputation depends on other features as well (e.g. kNN-imputation).
- `packages` :: `character`
Set of all required packages for the [PipeOp](#)'s `private$.train` and `private$.predict` methods. See `$packages` slot. Default is `character(0)`.
- `task_type` :: `character(1)`
The class of [Task](#) that should be accepted as input and will be returned as output. This should generally be a `character(1)` identifying a type of [Task](#), e.g. `"Task"`, `"TaskClassif"` or `"TaskRegr"` (or another subclass introduced by other packages). Default is `"Task"`.
- `feature_types` :: `character`
Feature types affected by the [PipeOp](#). See `private$.select_cols()` for more information.

Input and Output Channels

[PipeOpImpute](#) has one input channel named `"input"`, taking a [Task](#), or a subclass of [Task](#) if the `task_type` construction argument is given as such; both during training and prediction.

[PipeOpImpute](#) has one output channel named `"output"`, producing a [Task](#), or a subclass; the [Task](#) type is the same as for input; both during training and prediction.

The output [Task](#) is the modified input [Task](#) with features imputed according to the `private$.impute()` function.

State

The `$state` is a `named list`; besides members added by inheriting classes, the members are:

- `affected_cols` :: `character`
Names of features being selected by the `affect_columns` parameter.
- `context_cols` :: `character`
Names of features being selected by the `context_columns` parameter.
- `intasklayout` :: [data.table](#)
Copy of the training [Task](#)'s `$feature_types` slot. This is used during prediction to ensure that the prediction [Task](#) has the same features, feature layout, and feature types as during training.

- `outtasklayout` :: `data.table`
Copy of the trained `Task`'s `$feature_types` slot. This is used during prediction to ensure that the `Task` resulting from the prediction operation has the same features, feature layout, and feature types as after training.
- `model` :: named list
Model used for imputation. This is a list named by `Task` features, containing the result of the `private$.train_imputer()` or `private$.train_nullmodel()` function for each one.

Parameters

- `affect_columns` :: `function | Selector | NULL`
What columns the `PipeOpImpute` should operate on. The parameter must be a `Selector` function, which takes a `Task` as argument and returns a character of features to use. See `Selector` for example functions. Defaults to `NULL`, which selects all features.
- `context_columns` :: `function | Selector | NULL`
What columns the `PipeOpImpute` imputation may depend on. This parameter is only present if the constructor is called with the `whole_task_dependent` argument set to `TRUE`. The parameter must be a `Selector` function, which takes a `Task` as argument and returns a character of features to use. See `Selector` for example functions. Defaults to `NULL`, which selects all features.

Internals

`PipeOpImpute` is an abstract class inheriting from `PipeOp` that makes implementing imputer `PipeOps` simple.

Fields

Fields inherited from `PipeOp`.

Methods

Methods inherited from `PipeOp`, as well as:

- `.select_cols(task)`
(`Task`) -> character
Selects which columns the `PipeOp` operates on. In contrast to the `affect_columns` parameter, `private$.select_cols()` is for the *inheriting class* to determine which columns the operator should function on, e.g. based on feature type, while `affect_columns` is a way for the *user* to limit the columns that a `PipeOpTaskPreproc` should operate on. This method can optionally be overloaded when inheriting `PipeOpImpute`; If this method is not overloaded, it defaults to selecting the columns of type indicated by the `feature_types` construction argument.
- `.train_imputer(feature, type, context)`
(atomic, character(1), `data.table`) -> any
Abstract function that must be overloaded when inheriting. Called once for each feature selected by `affect_columns` to create the model entry to be used for `private$.impute()`. This function is only called for features with at least one non-missing value.

- `.train_nullmodel(feature, type, context)`
(atomic, character(1), [data.table](#)) -> any
Like `.train_imputer()`, but only called for each feature that only contains missing values. This is not an abstract function and, if not overloaded, gives a default response of 0 (integer, numeric), `c(TRUE, FALSE)` (logical), all available levels (factor/ordered), or the empty string (character).
- `.impute(feature, type, model, context)`
(atomic, character(1), any, [data.table](#)) -> atomic
Imputes the features. `model` is the model created by `private$.train_imputer()` Default behaviour is to assume `model` is an atomic vector from which values are sampled to impute missing values of `feature`. `model` may have an attribute `probabilities` for non-uniform sampling.

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: [PipeOpEnsemble](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_encodelmer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputeconstant](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconstant](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalemaxabs](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#), [mlr_pipeops_select](#), [mlr_pipeops_smote](#), [mlr_pipeops_spatialsign](#), [mlr_pipeops_subsample](#), [mlr_pipeops_targetinvert](#), [mlr_pipeops_targetmutate](#), [mlr_pipeops_targettrafoscale](#), [mlr_pipeops_textvectorizer](#), [mlr_pipeops_threshold](#), [mlr_pipeops_tunethreshold](#), [mlr_pipeops_unbranch](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops_vtreat](#), [mlr_pipeops_yeojohnson](#), [mlr_pipeops](#)

Other Imputation PipeOps: [mlr_pipeops_imputeconstant](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#)

PipeOpTargetTrafo

Target Transformation Base Class

Description

Base class for handling target transformation operations. Target transformations are different from feature transformation because they have to be "inverted" after prediction. The target is transformed during the training phase and information to invert this transformation is sent along to

[PipeOpTargetInvert](#) which then inverts this transformation during the prediction phase. This inversion may need info about both the training and the prediction data.

Users can overload up to four private\$-functions: `.get_state()` (optional), `.transform()` (mandatory), `.train_invert()` (optional), and `.invert()` (mandatory).

Format

Abstract [R6Class](#) inheriting from [PipeOp](#).

Construction

```
PipeOpTargetTrafo$new(id, param_set = ParamSet$new(), param_vals = list() packages = character(0), task_type_in = "Task", task_type_out = "Task")
```

- `id` :: character(1)
Identifier of resulting object. See `$id` slot of [PipeOp](#).
- `param_set` :: [ParamSet](#)
Parameter space description. This should be created by the subclass and given to `super$initialize()`.
- `param_vals` :: named list
List of hyperparameter settings, overwriting the hyperparameter settings given in `param_set`. The subclass should have its own `param_vals` parameter and pass it on to `super$initialize()`. Default `list()`.
- `task_type_in` :: character(1)
The class of [Task](#) that should be accepted as input. This should generally be a character(1) identifying a type of [Task](#), e.g. "Task", "TaskClassif" or "TaskRegr" (or another subclass introduced by other packages). Default is "Task".
- `task_type_out` :: character(1)
The class of [Task](#) that is produced as output. This should generally be a character(1) identifying a type of [Task](#), e.g. "Task", "TaskClassif" or "TaskRegr" (or another subclass introduced by other packages). Default is the value of `task_type_in`.
- `packages` :: character
Set of all required packages for the [PipeOp](#)'s methods. See `$packages` slot. Default is `character(0)`.
- `tags` :: character | NULL
Tags of the resulting [PipeOp](#). This is added to the tag "target transform". Default NULL.

Input and Output Channels

[PipeOpTargetTrafo](#) has one input channels named "input" taking a [Task](#) (or whatever class was specified by the `task_type` during construction) both during training and prediction.

[PipeOpTargetTrafo](#) has two output channels named "fun" and "output". During training, "fun" returns NULL and during prediction, "fun" returns a function that can later be used to invert the transformation done during training according to the overloaded `.train_invert()` and `.invert()` functions. "output" returns the modified input [Task](#) (or `task_type`) according to the overloaded `transform()` function both during training and prediction.

State

The `$state` is a named list and should be returned explicitly by the user in the overloaded `.get_state()` function.

Internals

`PipeOpTargetTrafo` is an abstract class inheriting from `PipeOp`. It implements the `private$.train()` and `private$.predict()` functions. These functions perform checks and go on to call `.get_state()`, `.transform()`, `.train_invert()`. `.invert()` is packaged and sent along the "fun" output to be applied to a `Prediction` by `PipeOpTargetInvert`. A subclass of `PipeOpTargetTrafo` should implement these functions and be used in combination with `PipeOpTargetInvert`.

Fields

Fields inherited from `PipeOp`.

Methods

Methods inherited from `PipeOp`, as well as:

- `.get_state(task)`
`(Task) -> list`
 Called by `PipeOpTargetTrafo`'s implementation of `private$.train()`. Takes a single `Task` as input and returns a list to set the `$state`. `.get_state()` will be called a single time during *training* right before `.transform()` is called. The return value (i.e. the `$state`) should contain info needed in `.transform()` as well as in `.invert()`.
 The base implementation returns `list()` and should be overloaded if setting the state is desired.
- `.transform(task, phase)`
`(Task, character(1)) -> Task`
 Called by `PipeOpTargetTrafo`'s implementation of `private$.train()` and `private$.predict()`. Takes a single `Task` as input and modifies it. This should typically consist of calculating a new target and modifying the `Task` by using the `convert_task` function. `.transform()` will be called during training and prediction because the target (and if needed also type) of the input `Task` must be transformed both times. Note that unlike `$.train()`, the argument is *not* a list but a singular `Task`, and the return object is also *not* a list but a singular `Task`. The phase argument is "train" during training phase and "predict" during prediction phase and can be used to enable different behaviour during training and prediction. When phase is "train", the `$state` slot (as previously set by `.get_state()`) may also be modified, alternatively or in addition to overloading `.get_state()`.
 The input should *not* be cloned and if possible should be changed in-place.
 This function is abstract and should be overloaded by inheriting classes.
- `.train_invert(task)`
`(Task) -> any`
 Called by `PipeOpTargetTrafo`'s implementation of `private$.predict()`. Takes a single `Task` as input and returns an arbitrary value that will be given as `predict_phase_state` to `.invert()`. This should not modify the input `Task`.
 The base implementation returns a list with a single element, the `$truth` column of the `Task`, and should be overloaded if a more training-phase-dependent state is desired.

- `.invert(prediction, predict_phase_state)`
([Prediction](#), any) -> [Prediction](#)
Takes a [Prediction](#) and a `predict_phase_state` object as input and inverts the prediction. This function is sent as "fun" to [PipeOpTargetInvert](#). This function is abstract and should be overloaded by inheriting classes. Care should be taken that the `predict_type` of the [Prediction](#) being inverted is handled well.
- `.invert_help(predict_phase_state)`
(`predict_phase_state` object) -> function
Helper function that packages `.invert()` that can later be used for the inversion.

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other mlr3pipelines backend related: [Graph](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_graphs](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops](#)

Other PipeOps: [PipeOpEnsemble](#), [PipeOpImpute](#), [PipeOpTaskPreprocSimple](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_pipeops_boxcox](#), [mlr_pipeops_branch](#), [mlr_pipeops_chunk](#), [mlr_pipeops_classbalancing](#), [mlr_pipeops_classifavg](#), [mlr_pipeops_classweights](#), [mlr_pipeops_colapply](#), [mlr_pipeops_collapsefactors](#), [mlr_pipeops_colroles](#), [mlr_pipeops_copy](#), [mlr_pipeops_datefeatures](#), [mlr_pipeops_encodeimpact](#), [mlr_pipeops_encodelmer](#), [mlr_pipeops_encode](#), [mlr_pipeops_featureunion](#), [mlr_pipeops_filter](#), [mlr_pipeops_fixfactors](#), [mlr_pipeops_histbin](#), [mlr_pipeops_ica](#), [mlr_pipeops_imputeconstant](#), [mlr_pipeops_imputehist](#), [mlr_pipeops_imputelearner](#), [mlr_pipeops_imputemean](#), [mlr_pipeops_imputemedian](#), [mlr_pipeops_imputemode](#), [mlr_pipeops_imputeoor](#), [mlr_pipeops_imputesample](#), [mlr_pipeops_kernelpca](#), [mlr_pipeops_learner](#), [mlr_pipeops_missind](#), [mlr_pipeops_modelmatrix](#), [mlr_pipeops_multiplicityexply](#), [mlr_pipeops_multiplicityimply](#), [mlr_pipeops_mutate](#), [mlr_pipeops_nmf](#), [mlr_pipeops_nop](#), [mlr_pipeops_ovrsplit](#), [mlr_pipeops_ovrunite](#), [mlr_pipeops_pca](#), [mlr_pipeops_proxy](#), [mlr_pipeops_quantilebin](#), [mlr_pipeops_randomprojection](#), [mlr_pipeops_randomresponse](#), [mlr_pipeops_regravg](#), [mlr_pipeops_removeconstant](#), [mlr_pipeops_renamecolumns](#), [mlr_pipeops_replicate](#), [mlr_pipeops_scalemaxabs](#), [mlr_pipeops_scalerange](#), [mlr_pipeops_scale](#), [mlr_pipeops_select](#), [mlr_pipeops_smote](#), [mlr_pipeops_spatialsign](#), [mlr_pipeops_subsample](#), [mlr_pipeops_targetinvert](#), [mlr_pipeops_targetmutate](#), [mlr_pipeops_targettrafoscale](#), [mlr_pipeops_textvectorizer](#), [mlr_pipeops_threshold](#), [mlr_pipeops_tunethreshold](#), [mlr_pipeops_unbranch](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops_vtreat](#), [mlr_pipeops_yeojohnson](#), [mlr_pipeops](#)

PipeOpTaskPreproc

Task Preprocessing Base Class

Description

Base class for handling most "preprocessing" operations. These are operations that have exactly one [Task](#) input and one [Task](#) output, and expect the column layout of these [Tasks](#) during input and output to be the same.

Prediction-behavior of preprocessing operations should always be independent for each row in the input-[Task](#). This means that the prediction-operation of preprocessing-[PipeOps](#) should commute with `rbind()`: Running prediction on an n-row [Task](#) should result in the same result as `rbind()`-ing the prediction-result from n 1-row [Tasks](#) with the same content. In the large majority of cases, the number and order of rows should also not be changed during prediction.

Users must implement `private$.train_task()` and `private$.predict_task()`, which have a `Task` input and should return that `Task`. The `Task` should, if possible, be manipulated in-place, and should not be cloned.

Alternatively, the `private$.train_dt()` and `private$.predict_dt()` functions can be implemented, which operate on `data.table` objects instead. This should generally only be done if all data is in some way altered (e.g. PCA changing all columns to principal components) and not if only a few columns are added or removed (e.g. feature selection) because this should be done at the `Task`-level with `private$.train_task()`. The `private$.select_cols()` function can be overloaded for `private$.train_dt()` and `private$.predict_dt()` to operate only on subsets of the `Task`'s data, e.g. only on numerical columns.

If the `can_subset_cols` argument of the constructor is `TRUE` (the default), then the hyperparameter `affect_columns` is added, which can limit the columns of the `Task` that is modified by the `PipeOpTaskPreproc` using a `Selector` function. Note this functionality is entirely independent of the `private$.select_cols()` functionality.

`PipeOpTaskPreproc` is useful for operations that behave differently during training and prediction. For operations that perform essentially the same operation and only need to perform extra work to build a `$state` during training, the `PipeOpTaskPreprocSimple` class can be used instead.

Format

Abstract `R6Class` inheriting from `PipeOp`.

Construction

```
PipeOpTaskPreproc$new(id, param_set = ParamSet$new(), param_vals = list(), can_subset_cols = TRUE,
  packages = character(0), task_type = "Task", tags = NULL, feature_types = mlr_reflections$task_features)
```

- `id` :: `character(1)`
Identifier of resulting object. See `$id` slot of `PipeOp`.
- `param_set` :: `ParamSet`
Parameter space description. This should be created by the subclass and given to `super$initialize()`.
- `param_vals` :: `named list`
List of hyperparameter settings, overwriting the hyperparameter settings given in `param_set`. The subclass should have its own `param_vals` parameter and pass it on to `super$initialize()`. Default `list()`.
- `can_subset_cols` :: `logical(1)`
Whether the `affect_columns` parameter should be added which lets the user limit the columns that are modified by the `PipeOpTaskPreproc`. This should generally be `FALSE` if the operation adds or removes rows from the `Task`, and `TRUE` otherwise. Default is `TRUE`.
- `packages` :: `character`
Set of all required packages for the `PipeOp`'s `private$.train()` and `private$.predict()` methods. See `$packages` slot. Default is `character(0)`.
- `task_type` :: `character(1)`
The class of `Task` that should be accepted as input and will be returned as output. This should generally be a `character(1)` identifying a type of `Task`, e.g. `"Task"`, `"TaskClassif"` or `"TaskRegr"` (or another subclass introduced by other packages). Default is `"Task"`.

- `tags` :: character | NULL
Tags of the resulting PipeOp. This is added to the tag "data transform". Default NULL.
- `feature_types` :: character
Feature types affected by the PipeOp. See `private$.select_cols()` for more information. Defaults to all available feature types.

Input and Output Channels

`PipeOpTaskPreproc` has one input channel named "input", taking a `Task`, or a subclass of `Task` if the `task_type` construction argument is given as such; both during training and prediction.

`PipeOpTaskPreproc` has one output channel named "output", producing a `Task`, or a subclass; the `Task` type is the same as for input; both during training and prediction.

The output `Task` is the modified input `Task` according to the overloaded `private$.train_task()/private$.predict_tasks` or `private$.train_dt()/private$.predict_dt()` functions.

State

The `$state` is a named list; besides members added by inheriting classes, the members are:

- `affect_cols` :: character
Names of features being selected by the `affect_columns` parameter, if present; names of *all* present features otherwise.
- `intasklayout` :: `data.table`
Copy of the training `Task`'s `$feature_types` slot. This is used during prediction to ensure that the prediction `Task` has the same features, feature layout, and feature types as during training.
- `outtasklayout` :: `data.table`
Copy of the trained `Task`'s `$feature_types` slot. This is used during prediction to ensure that the `Task` resulting from the prediction operation has the same features, feature layout, and feature types as after training.
- `dt_columns` :: character
Names of features selected by the `private$.select_cols()` call during training. This is only present if the `private$.train_dt()` functionality is used, and not present if the `private$.train_task()` function is overloaded instead.
- `feature_types` :: character
Feature types affected by the PipeOp. See `private$.select_cols()` for more information.

Parameters

- `affect_columns` :: function | `Selector` | NULL
What columns the `PipeOpTaskPreproc` should operate on. This parameter is only present if the constructor is called with the `can_subset_cols` argument set to TRUE (the default). The parameter must be a `Selector` function, which takes a `Task` as argument and returns a character of features to use. See `Selector` for example functions. Defaults to NULL, which selects all features.

Internals

`PipeOpTaskPreproc` is an abstract class inheriting from `PipeOp`. It implements the `private$.train()` and `$.predict()` functions. These functions perform checks and go on to call `private$.train_task()` and `private$.predict_task()`. A subclass of `PipeOpTaskPreproc` may implement these functions, or implement `private$.train_dt()` and `private$.predict_dt()` instead. This works by having the default implementations of `private$.train_task()` and `private$.predict_task()` call `private$.train_dt()` and `private$.predict_dt()`, respectively.

The `affect_columns` functionality works by unsetting columns by removing their "col_role" before processing, and adding them afterwards by setting the `col_role` to "feature".

Fields

Fields inherited from `PipeOp`.

Methods

Methods inherited from `PipeOp`, as well as:

- `.train_task`
(`Task`) -> `Task`
Called by the `PipeOpTaskPreproc`'s implementation of `private$.train()`. Takes a single `Task` as input and modifies it (ideally in-place without cloning) while storing information in the `$state` slot. Note that unlike `$.train()`, the argument is *not* a list but a singular `Task`, and the return object is also *not* a list but a singular `Task`. Also, contrary to `private$.train()`, the `$state` being generated must be a list, which the `PipeOpTaskPreproc` will add additional slots to (see Section *State*). Care should be taken to avoid name collisions between `$state` elements added by `private$.train_task()` and `PipeOpTaskPreproc`.
By default this function calls the `private$.train_dt()` function, but it can be overloaded to perform operations on the `Task` directly.
- `.predict_task`
(`Task`) -> `Task`
Called by the `PipeOpTaskPreproc`'s implementation of `$.predict()`. Takes a single `Task` as input and modifies it (ideally in-place without cloning) while using information in the `$state` slot. Works analogously to `private$.train_task()`. If `private$.predict_task()` should only be overloaded if `private$.train_task()` is overloaded (i.e. `private$.train_dt()` is *not* used).
- `.train_dt(dt, levels, target)`
(`data.table`, named list, any) -> `data.table` | `data.frame` | `matrix`
Train `PipeOpTaskPreproc` on `dt`, transform it and store a state in `$state`. A transformed object must be returned that can be converted to a `data.table` using `as.data.table`. `dt` does not need to be copied deliberately, it is possible and encouraged to change it in-place.
The `levels` argument is a named list of factor levels for factorial or character features. If the input `Task` inherits from `TaskSupervised`, the `target` argument contains the `$truth()` information of the training `Task`; its type depends on the `Task` type being trained on.
This method can be overloaded when inheriting from `PipeOpTaskPreproc`, together with `private$.predict_dt()` and optionally `private$.select_cols()`; alternatively, `private$.train_task()` and `private$.predict_task()` can be overloaded.

- `.predict_dt(dt, levels)`
 (`data.table`, named list) -> `data.table` | `data.frame` | `matrix`
 Predict on new data in `dt`, possibly using the stored `$state`. A transformed object must be returned that can be converted to a `data.table` using `as.data.table`. `dt` does not need to be copied deliberately, it is possible and encouraged to change it in-place.
 The `levels` argument is a named list of factor levels for factorial or character features.
 This method can be overloaded when inheriting `PipeOpTaskPreproc`, together with `private$.train_dt()` and optionally `private$.select_cols()`; alternatively, `private$.train_task()` and `private$.predict_task()` can be overloaded.
- `.select_cols(task)`
 (`Task`) -> `character`
 Selects which columns the `PipeOp` operates on, if `private$.train_dt()` and `private$.predict_dt()` are overloaded. This function is not called if `private$.train_task()` and `private$.predict_task()` are overloaded. In contrast to the `affect_columns` parameter, `private$.select_cols()` is for the *inheriting class* to determine which columns the operator should function on, e.g. based on feature type, while `affect_columns` is a way for the *user* to limit the columns that a `PipeOpTaskPreproc` should operate on.
 This method can optionally be overloaded when inheriting `PipeOpTaskPreproc`, together with `private$.train_dt()` and `private$.predict_dt()`; alternatively, `private$.train_task()` and `private$.predict_task()` can be overloaded.
 If this method is not overloaded, it defaults to selecting of type indicated by the `feature_types` construction argument.

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other `mlr3` pipelines backend related: `Graph`, `PipeOpTargetTrafo`, `PipeOpTaskPreprocSimple`, `PipeOp`, `mlr_graphs`, `mlr_pipeops_updatetarget`, `mlr_pipeops`

Other `PipeOps`: `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreprocSimple`, `PipeOp`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_encodeimer`, `mlr_pipeops_encode`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputeconstant`, `mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_mutate`, `mlr_pipeops_nmf`, `mlr_pipeops_nop`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunite`, `mlr_pipeops_pca`, `mlr_pipeops_proxy`, `mlr_pipeops_quantilebin`, `mlr_pipeops_randomprojection`, `mlr_pipeops_randomresponse`, `mlr_pipeops_regravg`, `mlr_pipeops_removeconstant`, `mlr_pipeops_renamecolumns`, `mlr_pipeops_replicate`, `mlr_pipeops_scalemaxabs`, `mlr_pipeops_scalerange`, `mlr_pipeops_scale`, `mlr_pipeops_select`, `mlr_pipeops_smote`, `mlr_pipeops_spatialsign`, `mlr_pipeops_subsample`, `mlr_pipeops_targetinvert`, `mlr_pipeops_targetmutate`, `mlr_pipeops_targettrafoscale`, `mlr_pipeops_textvectorizer`, `mlr_pipeops_threshold`, `mlr_pipeops_tunethreshold`, `mlr_pipeops_unbranch`, `mlr_pipeops_updatetarget`, `mlr_pipeops_vtreat`, `mlr_pipeops_yeojohnson`, `mlr_pipeops`

 PipeOpTaskPreprocSimple

Simple Task Preprocessing Base Class

Description

Base class for handling many "preprocessing" operations that perform essentially the same operation during training and prediction. Instead implementing a `private$.train_task()` and a `private$.predict_task()` operation, only a `private$.get_state()` and a `private$.transform()` operation needs to be defined, both of which take one argument: a [Task](#).

Alternatively, analogously to the [PipeOpTaskPreproc](#) approach of offering `private$.train_dt()/private$.predict_dt()` the `private$.get_state_dt()` and `private$.transform_dt()` functions may be implemented.

`private$.get_state` must not change its input value in-place and must return something that will be written into `$state` (which must not be NULL), `private$.transform()` should modify its argument in-place; it is called both during training and prediction.

This inherits from [PipeOpTaskPreproc](#) and behaves essentially the same.

Format

Abstract [R6Class](#) inheriting from [PipeOpTaskPreproc/PipeOp](#).

Construction

`PipeOpTaskPreprocSimple$new(id, param_set = ParamSet$new(), param_vals = list(), can_subset_cols = TRUE)`
 (Construction is identical to [PipeOpTaskPreproc](#).)

- `id` :: `character(1)`
 Identifier of resulting object. See `$id` slot of [PipeOp](#).
- `param_set` :: [ParamSet](#)
 Parameter space description. This should be created by the subclass and given to `super$initialize()`.
- `param_vals` :: `named list`
 List of hyperparameter settings, overwriting the hyperparameter settings given in `param_set`. The subclass should have its own `param_vals` parameter and pass it on to `super$initialize()`. Default `list()`.
- `can_subset_cols` :: `logical(1)`
 Whether the `affect_columns` parameter should be added which lets the user limit the columns that are modified by the [PipeOpTaskPreprocSimple](#). This should generally be `FALSE` if the operation adds or removes rows from the [Task](#), and `TRUE` otherwise. Default is `TRUE`.
- `packages` :: `character`
 Set of all required packages for the [PipeOp](#)'s `private$.train()` and `private$.predict()` methods. See `$packages` slot. Default is `character(0)`.
- `task_type` :: `character(1)`
 The class of [Task](#) that should be accepted as input and will be returned as output. This should generally be a `character(1)` identifying a type of [Task](#), e.g. `"Task"`, `"TaskClassif"` or `"TaskRegr"` (or another subclass introduced by other packages). Default is `"Task"`.

Input and Output Channels

Input and output channels are inherited from [PipeOpTaskPreproc](#).

The output during training and prediction is the [Task](#), modified by `private$.transform()` or `private$.transform_dt()`.

State

The `$state` is a named list with the `$state` elements inherited from [PipeOpTaskPreproc](#).

Parameters

The parameters are the parameters inherited from [PipeOpTaskPreproc](#).

Internals

[PipeOpTaskPreprocSimple](#) is an abstract class inheriting from [PipeOpTaskPreproc](#) and implementing the `private$.train_task()` and `private$.predict_task()` functions. A subclass of [PipeOpTaskPreprocSimple](#) may implement the functions `private$.get_state()` and `private$.transform()`, or alternatively the functions `private$.get_state_dt()` and `private$.transform_dt()` (as well as `private$.select_cols()`, in the latter case). This works by having the default implementations of `private$.get_state()` and `private$.transform()` call `private$.get_state_dt()` and `private$.transform_dt()`.

Fields

Fields inherited from [PipeOp](#).

Methods

Methods inherited from [PipeOpTaskPreproc](#), as well as:

- `.get_state(task)`
([Task](#)) -> named list
Store create something that will be stored in `$state` during training phase of [PipeOpTaskPreprocSimple](#). The state can then influence the `private$.transform()` function. Note that `private$.get_state()` must *return* the state, and should not store it in `$state`. It is not strictly necessary to implement either `private$.get_state()` or `private$.get_state_dt()`; if they are not implemented, the state will be stored as `list()`.
This method can optionally be overloaded when inheriting from [PipeOpTaskPreprocSimple](#), together with `private$.transform()`; alternatively, `private$.get_state_dt()` (optional) and `private$.transform_dt()` (and possibly `private$.select_cols()`, from [PipeOpTaskPreproc](#)) can be overloaded.
- `.transform(task)`
([Task](#)) -> [Task](#)
Predict on new data in `task`, possibly using the stored `$state`. `task` should not be cloned, instead it should be changed in-place. This method is called both during training and prediction phase, and should essentially behave the same independently of phase. (If this is incongruent with the functionality to be implemented, then it should inherit from [PipeOpTaskPreproc](#), not from [PipeOpTaskPreprocSimple](#).)

This method can be overloaded when inheriting from `PipeOpTaskPreprocSimple`, optionally with `private$.get_state()`; alternatively, `private$.get_state_dt()` (optional) and `private$.transform_dt()` (and possibly `private$.select_cols()`, from `PipeOpTaskPreproc`) can be overloaded.

- `.get_state_dt(dt)`
(`data.table`) -> named list
Create something that will be stored in `$state` during training phase of `PipeOpTaskPreprocSimple`. The state can then influence the `private$.transform_dt()` function. Note that `private$.get_state_dt()` must *return* the state, and should not store it in `$state`. If neither `private$.get_state()` nor `private$.get_state_dt()` are overloaded, the state will be stored as `list()`. This method can optionally be overloaded when inheriting from `PipeOpTaskPreprocSimple`, together with `private$.transform_dt()` (and optionally `private$.select_cols()`, from `PipeOpTaskPreproc`); Alternatively, `private$.get_state()` (optional) and `private$.transform()` can be overloaded.
- `.transform_dt(dt)`
(`data.table`) -> `data.table` | `data.frame` | `matrix`
Predict on new data in `dt`, possibly using the stored `$state`. A transformed object must be returned that can be converted to a `data.table` using `as.data.table`. `dt` does not need to be copied deliberately, it is possible and encouraged to change it in-place. This method is called both during training and prediction phase, and should essentially behave the same independently of phase. (If this is incongruent with the functionality to be implemented, then it should inherit from `PipeOpTaskPreproc`, not from `PipeOpTaskPreprocSimple`.) This method can optionally be overloaded when inheriting from `PipeOpTaskPreprocSimple`, together with `private$.transform_dt()` (and optionally `private$.select_cols()`, from `PipeOpTaskPreproc`); Alternatively, `private$.get_state()` (optional) and `private$.transform()` can be overloaded.

See Also

<https://mlr3book.mlr-org.com/list-pipeops.html>

Other PipeOps: `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreproc`, `PipeOp`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_ensemblemer`, `mlr_pipeops_encode`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputeconstant`, `mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_mutate`, `mlr_pipeops_nmf`, `mlr_pipeops_nop`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunite`, `mlr_pipeops_pca`, `mlr_pipeops_proxy`, `mlr_pipeops_quantilebin`, `mlr_pipeops_randomprojection`, `mlr_pipeops_randomresponse`, `mlr_pipeops_regravg`, `mlr_pipeops_removeconstant`, `mlr_pipeops_renamecolumns`, `mlr_pipeops_replicate`, `mlr_pipeops_scalemaxabs`, `mlr_pipeops_scalerange`, `mlr_pipeops_scale`, `mlr_pipeops_select`, `mlr_pipeops_smote`, `mlr_pipeops_spatialsign`, `mlr_pipeops_subsample`, `mlr_pipeops_targetinvert`, `mlr_pipeops_targetmutate`, `mlr_pipeops_targettrafoscale`, `mlr_pipeops_textvectorizer`, `mlr_pipeops_threshold`, `mlr_pipeops_tunethreshold`, `mlr_pipeops_unbranch`, `mlr_pipeops_updatetarget`, `mlr_pipeops_vtreat`, `mlr_pipeops_yeojohnson`, `mlr_pipeops`

Other mlr3pipelines backend related: [Graph](#), [PipeOpTargetTrafo](#), [PipeOpTaskPreproc](#), [PipeOp](#), [mlr_graphs](#), [mlr_pipeops_updatetarget](#), [mlr_pipeops](#)

po

Shorthand PipeOp Constructor

Description

Create

- a [PipeOp](#) from [mlr_pipeops](#) from given ID
- a [PipeOpLearner](#) from a [Learner](#) object
- a [PipeOpFilter](#) from a [Filter](#) object
- a [PipeOpSelect](#) from a [Selector](#) object
- a clone of a [PipeOp](#) from a given [PipeOp](#) (possibly with changed settings)

The object is initialized with given parameters and `param_vals`.

`po()` takes a single obj ([PipeOp](#) id, [Learner](#), ...) and converts it to a [PipeOp](#). `pos()` (with plural-s) takes either a character-vector, or a list of objects, and creates a list of [PipeOps](#).

Usage

```
po(.obj, ...)
```

```
pos(.objs, ...)
```

Arguments

<code>.obj</code>	[any] The object from which to construct a PipeOp . If this is a character(1), it is looked up in the mlr_pipeops dictionary. Otherwise, it is converted to a PipeOp .
<code>...</code>	any Additional parameters to give to constructed object. This may be an argument of the constructor of the PipeOp , in which case it is given to this constructor; or it may be a parameter value, in which case it is given to the <code>param_vals</code> argument of the constructor.
<code>.objs</code>	character list Either a character of PipeOps to look up in mlr_pipeops , or a list of other objects to be converted to a PipeOp . If this is a named list, then the names are used as <code>\$id</code> slot for the resulting PipeOps .

Value

A [PipeOp](#) (for `po()`), or a list of [PipeOps](#) (for `pos()`).

Examples

```
library("mlr3")

po("learner", lrn("classif.rpart"), cp = 0.3)

po(lrn("classif.rpart"), cp = 0.3)

# is equivalent with:
mlr_pipeops$get("learner", lrn("classif.rpart"),
  param_vals = list(cp = 0.3))

pos(c("pca", original = "nop"))
```

ppl

*Shorthand Graph Constructor***Description**

Creates a [Graph](#) from [mlr_graphs](#) from given ID

`ppl()` takes a `character(1)` and returns a [Graph](#). `ppls()` takes a character vector of any list and returns a list of possibly multiple [Graphs](#).

Usage

```
ppl(.key, ...)
```

```
ppls(.keys, ...)
```

Arguments

<code>.key</code>	[<code>character(1)</code>] The key of the Graph in mlr_graphs .
<code>...</code>	any Additional parameters to give to constructed object. This may be an argument of the constructor of the underlying function.
<code>.keys</code>	[<code>character</code>] The key of possibly multiple Graphs in mlr_graphs . If this is named, a named list is returned, but unlike <code>pos()</code> it will not set any <code>\$id</code> slots.

Value

[Graph](#) (for `ppl()`) or list of [Graphs](#) (for `ppls()`).

Examples

```
library("mlr3")

gr = ppl("bagging", graph = po(lrn("regr.rpart")),
  averager = po("regravg", collect_multiplicity = TRUE))
```

 register_autoconvert_function

Add Autoconvert Function to Conversion Register

Description

Add functions that perform conversion to a desired class.

Whenever a [Graph](#) or a [PipeOp](#) is called with an object that does not conform to its declared input type, the "autoconvert register" is queried for functions that may turn the object into a desired type.

Conversion functions should try to avoid cloning.

Usage

```
register_autoconvert_function(cls, fun, packages = character(0))
```

Arguments

cls	character(1) The class that fun converts to.
fun	function The conversion function. Must take one argument and return an object of class cls, or possibly a sub-class as recognized by <code>are_types_compatible()</code> .
packages	character The packages required to be loaded for fun to operate.

Value

NULL.

See Also

Other class hierarchy operations: [add_class_hierarchy_cache\(\)](#), [reset_autoconvert_register\(\)](#), [reset_class_hierarchy_cache\(\)](#)

Examples

```
# This lets mlr3pipelines automatically try to convert a string into
# a `PipeOp` by querying the [mlr_pipeops`] [Dictionary`][mlr3misc::Dictionary].
# This is an example and not necessary, because mlr3pipelines adds it by default.
register_autoconvert_function("PipeOp", function(x) as_pipeop(x), packages = "mlr3pipelines")
```

reset_autoconvert_register
Reset Autoconvert Register

Description

Reset autoconvert register to factory default, thereby undoing any calls to [register_autoconvert_function\(\)](#) by the user.

Usage

```
reset_autoconvert_register()
```

Value

NULL

See Also

Other class hierarchy operations: [add_class_hierarchy_cache\(\)](#), [register_autoconvert_function\(\)](#), [reset_class_hierarchy_cache\(\)](#)

reset_class_hierarchy_cache
Reset the Class Hierarchy Cache

Description

Reset the class hierarchy cache to factory default, thereby undoing any calls to [add_class_hierarchy_cache\(\)](#) by the user.

Usage

```
reset_class_hierarchy_cache()
```

Value

NULL

See Also

Other class hierarchy operations: [add_class_hierarchy_cache\(\)](#), [register_autoconvert_function\(\)](#), [reset_autoconvert_register\(\)](#)

 Selector

Selector Functions

Description

A [Selector](#) function is used by different [PipeOps](#), most prominently [PipeOpSelect](#) and many [PipeOps](#) inheriting from [PipeOpTaskPreproc](#), to determine a subset of [Tasks](#) to operate on.

Even though a [Selector](#) is a function that can be written itself, it is preferable to use the [Selector](#) constructors shown here. Each of these can be called with its arguments to create a [Selector](#), which can then be given to the [PipeOpSelect](#) selector parameter, or many [PipeOpTaskPreprocs](#)' `affect_columns` parameter. See there for examples of this usage.

Usage

```
selector_all()
```

```
selector_none()
```

```
selector_type(types)
```

```
selector_grep(pattern, ignore.case = FALSE, perl = FALSE, fixed = FALSE)
```

```
selector_name(feature_names, assert_present = FALSE)
```

```
selector_invert(selector)
```

```
selector_intersect(selector_x, selector_y)
```

```
selector_union(selector_x, selector_y)
```

```
selector_setdiff(selector_x, selector_y)
```

```
selector_missing()
```

```
selector_cardinality_greater_than(min_cardinality)
```

Arguments

<code>types</code>	(character) Type of feature to select
<code>pattern</code>	(character(1)) grep pattern
<code>ignore.case</code>	(logical(1)) ignore case
<code>perl</code>	(logical(1)) perl regex

fixed	(logical(1)) fixed pattern instead of regex
feature_names	(character) Select features by exact name match.
assert_present	(logical(1)) Throw an error if feature_names are not all present in the task being operated on.
selector	(Selector) Selector to invert.
selector_x	(Selector) First Selector to query.
selector_y	(Selector) Second Selector to query.
min_cardinality	(integer) Minimum number of levels required to be selected.

Value

function: A [Selector](#) function that takes a [Task](#) and returns the feature names to be processed.

Functions

- `selector_all`: `selector_all` selects all features.
- `selector_none`: `selector_none` selects none of the features.
- `selector_type`: `selector_type` selects features according to type. Legal types are listed in `mlr_reflections$task_feature_types`.
- `selector_grep`: `selector_grep` selects features with names matching the `grep()` pattern.
- `selector_name`: `selector_name` selects features with names matching exactly the names listed.
- `selector_invert`: `selector_invert` inverts a given [Selector](#): It always selects the features that would be *dropped* by the other [Selector](#), and drops the features that would be kept.
- `selector_intersect`: `selector_intersect` selects the intersection of two [Selectors](#): Only features selected by both [Selectors](#) are selected in the end.
- `selector_union`: `selector_union` selects the union of two [Selectors](#): Features selected by either [Selector](#) are selected in the end.
- `selector_setdiff`: `selector_setdiff` selects the setdiff of two [Selectors](#): Features selected by `selector_x` are selected, unless they are also selected by `selector_y`.
- `selector_missing`: `selector_missing` selects features with missing values.
- `selector_cardinality_greater_than`: `selector_cardinality_greater_than` selects categorical features with cardinality greater than a given threshold.

Details

A [Selector](#) is a function that has one input argument (commonly named `task`). The function is called with the [Task](#) that a [PipeOp](#) is operating on. The return value of the function must be a character vector that is a subset of the feature names present in the [Task](#).

For example, a [Selector](#) that selects all columns is

```
function(task) {
  task$feature_names
}
```

(this is the `selector_all()`-[Selector](#).) A [Selector](#) that selects all columns that have names shorter than four letters would be:

```
function(task) {
  task$feature_names[
    nchar(task$feature_names) < 4
  ]
}
```

A [Selector](#) that selects only the column "Sepal.Length" (as in the [iris task](#)), if present, is

```
function(task) {
  intersect(task$feature_names, "Sepal.Length")
}
```

It is preferable to use the [Selector](#) construction functions like `select_type`, `select_grep` etc. if possible, instead of writing custom [Selectors](#).

See Also

Other Selectors: [mlr_pipeops_select](#)

Examples

```
library("mlr3")

iris_task = tsk("iris")
bh_task = tsk("boston_housing")

sela = selector_all()
sela(iris_task)
sela(bh_task)

self = selector_type("factor")
self(iris_task)
self(bh_task)

selg = selector_grep("a.*i")
selg(iris_task)
```

```

selg(bh_task)

selgi = selector_invert(selg)
selgi(iris_task)
selgi(bh_task)

selgf = selector_union(selg, self)
selgf(iris_task)
selgf(bh_task)

```

%>>%

PipeOp Composition Operator

Description

These operators creates a connection that "pipes" data from the source `g1` into the sink `g2`. Both source and sink can either be a [Graph](#) or a [PipeOp](#) (or an object that can be automatically converted into a [Graph](#) or [PipeOp](#), see [as_graph\(\)](#) and [as_pipeop\(\)](#)).

`%>>%` and `%>>!` try to automatically match output channels of `g1` to input channels of `g2`; this is only possible if either

- the number of output channels of `g1` (as given by `g1$output`) is equal to the number of input channels of `g2` (as given by `g2$input`), or
- `g1` has only one output channel (i.e. `g1$output` has one line), or
- `g2` has only one input channel, which is a *vararg* channel (i.e. `g2$input` has one line, with name entry "...").

Connections between channels are created in the order in which they occur in `g1` and `g2`, respectively: `g1`'s output channel 1 is connected to `g2`'s input channel 1, channel 2 to 2 etc.

`%>>%` always creates deep copies of its input arguments, so they cannot be modified by reference afterwards. To access individual [PipeOps](#) after composition, use the resulting [Graph](#)'s `$pipeops` list. `%>>!`, on the other hand, tries to avoid cloning its first argument: If it is a [Graph](#), then this [Graph](#) will be modified in-place.

When `%>>!` fails, then it leaves `g1` in an incompletely modified state. It is therefore usually recommended to use `%>>%`, since the very marginal gain of performance from using `%>>!` often does not outweigh the risk of either modifying objects by-reference that should not be modified or getting graphs that are in an incompletely modified state. However, when creating long [Graphs](#), chaining with `%>>!` instead of `%>>%` can give noticeable performance benefits because `%>>%` makes a number of `clone()`-calls that is quadratic in chain length, `%>>!` only linear.

`concat_graphs(g1, g2, in_place = FALSE)` is equivalent to `g1 %>>% g2`. `concat_graphs(g1, g2, in_place = TRUE)` is equivalent to `g1 %>>! g2`.

Both arguments of `%>>%` are automatically converted to [Graphs](#) using [as_graph\(\)](#); this means that objects on either side may be objects that can be automatically converted to [PipeOps](#) (such as [Learners](#) or [Filters](#)), or that can be converted to [Graphs](#). This means, in particular, lists of [Graphs](#), [PipeOps](#) or objects convertible to that, because [as_graph\(\)](#) automatically applies [gunion\(\)](#) to lists. See examples. If the first argument of `%>>!` is not a [Graph](#), then it is cloned just as when `%>>%` is used; `%>>!` only avoids `clone()` if the first argument is a [Graph](#).

Note that if `g1` is `NULL`, `g2` converted to a `Graph` will be returned. Analogously, if `g2` is `NULL`, `g1` converted to a `Graph` will be returned.

Usage

```
g1 %>>% g2

concat_graphs(g1, g2, in_place = FALSE)

g1 %>>!% g2
```

Arguments

<code>g1</code>	(<code>Graph</code> <code>PipeOp</code> <code>Learner</code> <code>Filter</code> <code>list</code> ...) <code>Graph</code> / <code>PipeOp</code> / object-convertible-to- <code>PipeOp</code> to put in front of <code>g2</code> .
<code>g2</code>	(<code>Graph</code> <code>PipeOp</code> <code>Learner</code> <code>Filter</code> <code>list</code> ...) <code>Graph</code> / <code>PipeOp</code> / object-convertible-to- <code>PipeOp</code> to put after <code>g1</code> .
<code>in_place</code>	(<code>logical</code> (1)) Whether to try to avoid cloning <code>g1</code> . If <code>g1</code> is not a <code>Graph</code> , then it is cloned regardless.

Value

`Graph`: the constructed `Graph`.

See Also

Other `Graph` operators: `as_graph()`, `as_pipeop()`, `assert_graph()`, `assert_pipeop()`, `chain_graphs()`, `grepligate()`, `gunion()`, `mlr_graphs_grepligate`

Examples

```
o1 = PipeOpScale$new()
o2 = PipeOpPCA$new()
o3 = PipeOpFeatureUnion$new(2)

# The following two are equivalent:
pipe1 = o1 %>>% o2

pipe2 = Graph$new()$
  add_pipeop(o1)$
  add_pipeop(o2)$
  add_edge(o1$id, o2$id)

# Note automatical gunion() of lists.
# The following three are equivalent:
graph1 = list(o1, o2) %>>% o3

graph2 = gunion(list(o1, o2)) %>>% o3

graph3 = Graph$new()$
```

%>>%

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```
add_pipeop(o1)$
add_pipeop(o2)$
add_pipeop(o3)$
add_edge(o1$id, o3$id, dst_channel = 1)$
add_edge(o2$id, o3$id, dst_channel = 2)

pipe1 %>>!% o3 # modify pipe1 in-place

pipe1 # contains o1, o2, and o3 now.

o1 %>>!% o2

o1 # not changed, because not a Graph.
```

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