Package 'CDSS'

January 24, 2023

Type Package

Title Course-Dependent Skill Structures

Version 0.1-0

Date 2023-01-23

Depends R (>= 4.2.0)

Imports readODS (>= 1.7.0), openxlsx (>= 4.2.0)

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NeedsCompilation no

Description Deriving skill structures from skill assignment data for courses (sets of learning objects).

Encoding UTF-8

RoxygenNote 7.2.3

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Repository CRAN

Date/Publication 2023-01-24 10:00:02 UTC

R topics documented:

CDSS *CDSS: Course dependent skill structures*

Description

The CDSS package provides functions for a complete workflow from skill assignment tables to surmise mappings on the sets of skills and learning objects, respectively.

Suggested workflow

1. Read the skill assignment using one of the read_skill_assignments_xxx() functions.
2. Check the compliance to the definition for skill assignments using cdss_sa_compliance().
3. Convert the skill assignment into a skill multi-assignment using cdss_sa2sma().
4. Close the skill multi-assignment under completion using cdss_sma2csma().
5. Compute the surmise function on skills using cdss_csma2sf().
6. Derive the basis of the skill space using cdss_sf2basis().
7. Continue with functions from the kstMatrix package.

Data files

The installation of this package includes several data files as examples in the extdata sub directory (see the Examples below for how to access the files there). There are three data sets, KST, KST-Intro, SkillAssignment, and ErroneousSkillAssignment. The SkillAssignment data set is available in three formats, ODS, XLSX, and CSV (in CSV format, there are two files each, <dataset>-R and <dataset>-T, for required and taught skills, respectively). The other two data sets are available in ODS format only.

SkillAssignment and ErroneousSkillAssignment are small example data sets where the latter fails for cdss_sa_compliancde(). KST contains a skill assignment for the course on knowledge space theory under https://moodle.qhelp.eu/. KST-Intro contains the reduction of KST to the first chapter of that course.

References

Hockemeyer, C. (2022). Building Course-Dependent Skill Structures - Applying Competence based Knowledge Space Theory to Itself. Manuscript in preparation.

Acknowledgements

The creation of this R package was financially supported by the Erasmus+ Programme of the European Commission through the QHELP project (https://qhelp.eu/).

Examples

```
library(readODS)
fpath <- system.file("extdata", "SkillAssignment.ods", package="CDSS")
sa <- read_skill_assignment_ods(fpath)
sa
efpath <- system.file("extdata", "ErroneousSkillAssignment.ods", package="CDSS")
esa <- read_skill_assignment_ods(efpath)
esa
sma <- cdss_sa2sma(sa)
sma
csma <- cdss_sma2csma(sma)
csma
sf <- cdss_csma2sf(csma)
sf
b <- cdss_sf2basis(sf)
b
```

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cdss_attribution_function_sa

Build an attribution function from CDSS skill assignment matrices.

Description

`cdss_attribution_function_sa` builds an attribution function from skill assignment matrices using the procedure described by Hockemeyer (2022).

Usage

```
cdss_attribution_function_sa(sa)
```

Arguments

`sa`	Skill assignment

Value

Data frame defining the attribution function derived from `sa`

cdss_attribution_function_sma

Build an attribution function from CDSS skill multi-assignment matrices.

Description

`cdss_attribution_function_sma` builds an attribution function from skill multi-assignment matrices using the procedure described by Hockemeyer (2022).

Usage

```
cdss_attribution_function_sma(sma)
```

Arguments

`sma`	Skill multi-assignment

Value

Data frame defining the attribution function derived from `sma`

cdss_circular_requirements

Vector of learning objects requiring and teaching the same skill

Description

`cdss_circular_requirements` expects skill assignment and returns a vector of learning objects which require a skill that they teach.

Usage

```
cdss_circular_requirements(sa)
```

Arguments

`sa`	Skill assignment

Value

Vector of learning objects

See Also

Other Functions testing validity of skill assignments: `cdss_missing_los()`, `cdss_sa_compliance()`

cdss_csma2sf *Derive a surmise function from a complete skill multi-assignment*

Description

cdss_csma2sf expects a complete skill multi-assignment object and returns the corresponding surmise function on the set of skills.

Usage

```
cdss_csma2sf(csma)
```

Arguments

csma	Skill multi-assignment to be completed

Value

Object of class cdss_csma.

cdss_missing_los *Vector of skills without teaching learning objects.*

Description

cdss_missing_los expects a skill assignment and returns a vector of skills which are not taught by any learning object.

Usage

```
cdss_missing_los(sa)
```

Arguments

sa	SKill assignment

Value

Vector of skills

See Also

Other Functions testing validity of skill assignments: cdss_circular_requirements(), cdss_sa_compliance()

cdss_sa2sma *Convert skill assignment matrices to skill multi-assignment*

Description

cdss_sa2sma expects a list of two matrices (taught and required) of a skill assignment. It returns a skill multi-assignment object.

Usage

```
cdss_sa2sma(sa)
```

Arguments

sa	Skill assignment object

Value

Object of class cdss_sma.

See Also

Other functions building skill (multi) assignment matrices: cdss_tables2sa()

cdss_sa_compliance *Check whether a skill assignment is compliant to the CDCS conditions.*

Description

cdss_sa_compliance expects a skill assignment and checks whether it is compliant to the conditions for CDCS.

Usage

```
cdss_sa_compliance(sa, warnings = FALSE)
```

Arguments

sa	Skill assignment
warnings	Toggles whether warnings should be printed

Value

Boolean

See Also

Other Functions testing validity of skill assignments: cdss_circular_requirements(), cdss_missing_los()

cdss_sf2basis *Derive a basis from a surmise function*

Description

cdss_sf2basis expects a surmise function object and returns the corresponding basis.

Usage

```
cdss_sf2basis(sf)
```

Arguments

sf	Surmise function

Value

Matrix representing the basis.

cdss_sma2csma *Complete a skill multi-assignment*

Description

cdss_sma2csma expects a skill multi-assignment object and returns its closure under completeness.

Usage

```
cdss_sma2csma(sma)
```

Arguments

sma	Skill multi-assignment to be completed

Value

Object of class cdss_csma.

`cdss_tables2sa` *Build matrices of taught and required, respectively, skills for learning objects from respective tables.*

Description

`cdss_tables2sa` expects two data frames with two columns each. The first column contains the IDs of learning objects and the second row the IDs of single skills required or taught, respectively, by this learning object. It returns a list of two binary matrices, "taught" and "required". Each matrix has one row per learning object and one column per skill. The cells contain a "1" if the skill is taught or required, respectively, by the learning object and a "0" otherwise.

Usage

```
cdss_tables2sa(taught, required)
```

Arguments

`taught`	Data table containing the assignment of taught skills to learning objects
`required`	Data table containing the assignment of required skills to learning objects

Value

List of two binary matrices, "taught" and "required".

See Also

Other functions building skill (multi) assignment matrices: `cdss_sa2sma()`

`read_skill_assignment_csv` *Read an assignment of taught and required skills for a set of learning objects from CSV-files.*

Description

`read_skill_assignment` expects two CSV-files with two columns each. The first column contains the IDs of learning objects and the second row the IDs of single skills required or taught, respectively, by this learning object. It returns a list of two binary matrices, "taught" and "required". Each matrix has one row per learning object and one column per skill. The cells contain a "1" if the skill is taught or required, respectively, by the learning object and a "0" otherwise,

Usage

```
read_skill_assignment_csv(
  taught,
  required,
  header = TRUE,
  sep = ",",
  dec = ".",
  warnonly = FALSE,
  verbose = TRUE
)
```

Arguments

taught	CSV-file with assignments of taught competencies to learning objects
required	CSV-file with assignments of required competencies to learning objects
header	Boolean specifying whether the CSV-files contain a header line (default = TRUE)
sep	Column separator (default ",")
dec	Decimal point character (default ".")
warnonly	Are non-compliant SAs allowed? (default = FALSE)
verbose	Verbosity of compliance test (default = TRUE)

Value

List of two binary matrices, "taught" and "required".

See Also

Other functions reading skill assignments: read_skill_assignment_ods(), read_skill_assignment_xlsx()

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read_skill_assignment_ods

Read an assignment of taught and required skills for a set of learning objects from an ODS-file.

Description

read_skill_assignment_ods expects an ODS-file with two sheets assigning taught and required, respectively, skills to learning objects with two columns each. The first column contains the IDs of learning objects and the second row the IDs of single skills required or taught, respectively, by this learning object. It returns a list of two binary matrices, "taught" and "required". Each matrix has one row per learning object and one column per skill. The cells contain a "1" if the skill is taught or required, respectively, by the learning object and a "0" otherwise,

Usage

```
read_skill_assignment_ods(
  filename,
  taughtname = "Taught",
  requiredname = "Required",
  warnonly = FALSE,
  verbose = TRUE
)
```

Arguments

filename	Name of the ODS-file
taughtname	Name of the sheet with required assignment (default = "Taught")
requiredname	Name of the sheet with required assignment (default = "Required")
warnonly	Are non-compliant SAs allowed? (default = FALSE)
verbose	Verbosity of compliance test (default = TRUE)

Value

List of two binary matrices, "taught" and "required".

See Also

Other functions reading skill assignments: read_skill_assignment_csv(), read_skill_assignment_xlsx()

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read_skill_assignment_xlsx

Read an assignment of taught and required skills for a set of learning objects from an XLSX-file.

Description

read_skill_assignment_xlsx expects an XLSX-file with two sheets assigning taught and required, respectively, skills to learning objects with two columns each. The first column contains the IDs of learning objects and the second row the IDs of single skills required or taught, respectively, by this learning object. It returns a list of two binary matrices, "taught" and "required". Each matrix has one row per learning object and one column per skill. The cells contain a "1" if the skill is taught or required, respectively, by the learning object and a "0" otherwise,

Usage

```
read_skill_assignment_xlsx(
  filename,
  taughtname = "Taught",
  requiredname = "Required",
  warnonly = FALSE,
  verbose = TRUE
)
```

Arguments

filename	Name of the XLSX-file
taughtname	Name of the sheet with required assignment (default = "Taught")
requiredname	Name of the sheet with required assignment (default = "Required")
warnonly	Are non-compliant SAs allowed? (default = FALSE)
verbose	Verbosity of compliance test (default = TRUE)

Value

List of two binary matrices, "taught" and "required".

See Also

Other functions reading skill assignments: read_skill_assignment_csv(), read_skill_assignment_ods()

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