Package 'redistmetrics'

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Title Redistricting Metrics

Version 1.0.2

Date 2022-04-11

Description Reliable and flexible tools for scoring redistricting plans using common measures and metrics. These functions provide key direct access to tools useful for non-simulation analyses of redistricting plans, such as for measuring compactness or partisan fairness. Tools are designed to work with the 'redist' package seamlessly.

Depends R (>= 2.10)

Imports sf, Rcpp, cli, foreach, doParallel, magrittr, dplyr, rlang, geos, wk

Suggests rmarkdown, knitr, testthat (>= 3.0.0), ggplot2

LinkingTo Rcpp, RcppArmadillo

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Encoding UTF-8

LazyData true

SystemRequirements C++11

RoxygenNote 7.1.2

URL https://alarm-redist.github.io/redistmetrics/, https::/github.com/alarm-redist/redistmetrics/

BugReports https://github.com/alarm-redist/redistmetrics/issues

VignetteBuilder knitr

Config/testthat/edition 3

NeedsCompilation yes

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Repository CRAN

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R topics documented:

`by_plan` *Shorten District by Plan vector*

Description

If `x` is repeated for each district, it returns a plan level value. Otherwise it returns `x`.

Usage

```
by_plan(x, ndists)
```

Arguments

`x`	summary statistic at the district level
`ndists`	numeric. Number of districts. Estimated as the gcd of the unique run length encodings if missing.

Value

x or plan level subset of x

Examples

```
by_plan(letters)
by_plan(rep(letters, each = 2))
```

`compet_talisman` *Compute Talismanic Redistricting Competitiveness Metric*

Description

Compute Talismanic Redistricting Competitiveness Metric

Usage

```
compet_talisman(plans, shp, rvote, dvote, alpha = 1, beta = 1)
```

Arguments

`plans`	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
`shp`	redist_map object, tibble, or data frame containing other columns
`rvote`	unqouted name of column in shp with group population
`dvote`	unqouted name of column in shp with total population
`alpha`	Numeric scaling value
`beta`	Numeric scaling value

Value

numeric vector

References

Wendy K. Tam Cho and Yan Y. Liu Toward a Talismanic Redistricting Tool. Election Law Journal. 15, 4. Pp. 351-366.

Examples

```
data(nh)
data(nh_m)
# For a single plan:
compet_talisman(plans = nh$r_2020, shp = nh, rvote = nrv, dvote = ndv)

# Or many plans:
compet_talisman(plans = nh_m[, 3:5], shp = nh, rvote = nrv, dvote = ndv)
```

---

comp_bc *Calculate Boyce Clark Ratio*

Description

Calculate Boyce Clark Ratio

Usage

```
comp_bc(plans, shp, epsg = 3857, ncores = 1)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
shp	redist_map object or tibble with sf geometry column
epsg	numeric EPSG code to planarize to. Default is 3857.
ncores	numeric. Number of cores to use. Default is 1.

Value

numeric vector

References

Boyce, R., & Clark, W. 1964. The Concept of Shape in Geography. Geographical Review, 54(4), 561-572.

Examples

```
data(nh)
data(nh_m)
# For a single plan:
comp_bc(plans = nh$r_2020, shp = nh)

# Or many plans:

# slower, beware!
comp_bc(plans = nh_m[, 3:5], shp = nh)
```

---

comp_box_reock *Calculate Box Reock Compactness*

Description

Box reock is the ratio of the area of the district by the area of the minimum bounding box (of any rotation). Scores are bounded between 0 and 1, where 1 is most compact.

Usage

```
comp_box_reock(plans, shp, epsg = 3857, ncores = 1)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
shp	redist_map object or tibble with sf geometry column
epsg	numeric EPSG code to planarize to. Default is 3857.
ncores	numeric. Number of cores to use. Default is 1.

Value

numeric vector

Examples

```
#' data(nh)
data(nh_m)
# For a single plan:
comp_box_reock(plans = nh$r_2020, shp = nh)

# Or many plans:

# slower, beware!
comp_box_reock(plans = nh_m[, 3:5], shp = nh)
```

comp_ch *Calculate Convex Hull Compactness*

Description

Calculate Convex Hull Compactness

Usage

```
comp_ch(plans, shp, epsg = 3857, ncores = 1)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
shp	redist_map object or tibble with sf geometry column
epsg	numeric EPSG code to planarize to. Default is 3857.
ncores	numeric. Number of cores to use. Default is 1.

Value

numeric vector

Examples

```
data(nh)
data(nh_m)
# For a single plan:
comp_ch(plans = nh$r_2020, shp = nh)

# Or many plans:
comp_ch(plans = nh_m[, 3:5], shp = nh)
```

comp_edges_rem *Calculate Edges Removed Compactness*

Description

Calculate Edges Removed Compactness

Usage

```
comp_edges_rem(plans, shp, adj)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
shp	redist_map object or tibble with sf geometry column
adj	zero-indexed adjacency list. Not required if redist_map supplied to shp.

Value

numeric vector

References

Matthew P. Dube and Jesse Tyler Clark. 2016. Beyond the circle: Measuring district compactness using graph theory. In Annual Meeting of the Northeastern Political Science Association

Examples

```
data(nh)
data(nh_m)
# For a single plan:
comp_edges_rem(plans = nh$r_2020, shp = nh, nh$adj)

# Or many plans:
comp_edges_rem(plans = nh_m[, 3:5], shp = nh, nh$adj)
```

---

comp_fh *Calculate Fryer Holden Compactness*

Description

Calculate Fryer Holden Compactness

Usage

```
comp_fh(plans, shp, total_pop, epsg = 3857, ncores = 1)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
shp	redist_map object or tibble with sf geometry column
total_pop	A numeric vector with the population for every observation.
epsg	numeric EPSG code to planarize to. Default is 3857.
ncores	TRUE

Value

numeric vector

References

Fryer R, Holden R. 2011. Measuring the Compactness of Political Districting Plans. Journal of Law and Economics.

Examples

```
data(nh)
data(nh_m)
# For a single plan:
comp_fh(plans = nh$r_2020, shp = nh, total_pop = pop)

# Or many plans:
comp_fh(plans = nh_m[, 3:5], shp = nh, pop)
```

---

comp_frac_kept *Calculate Fraction Kept Compactness*

Description

Calculate Fraction Kept Compactness

Usage

```
comp_frac_kept(plans, shp, adj)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
shp	redist_map object or tibble with sf geometry column
adj	zero-indexed adjacency list. Not required if redist_map supplied to shp.

Value

numeric vector

References

Matthew P. Dube and Jesse Tyler Clark. 2016. Beyond the circle: Measuring district compactness using graph theory. In Annual Meeting of the Northeastern Political Science Association

Examples

```
data(nh)
data(nh_m)
# For a single plan:
comp_frac_kept(plans = nh$r_2020, shp = nh, nh$adj)

# Or many plans:
comp_frac_kept(plans = nh_m[, 3:5], shp = nh, nh$adj)
```

`comp_log_st` *Calculate Log Spanning Tree Compactness*

Description

Calculate Log Spanning Tree Compactness

Usage

```
comp_log_st(plans, shp, counties = NULL, adj)
```

Arguments

`plans`	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
`shp`	redist_map object or tibble with sf geometry column
`counties`	column name in shp containing counties
`adj`	zero-indexed adjacency list. Not required if `redist_map` supplied to `shp`.

Value

numeric vector

References

Cory McCartan and Kosuke Imai. 2020. Sequential Monte Carlo for Sampling Balanced and Compact Redistricting Plans.

Examples

```
data(nh)
data(nh_m)
# For a single plan:
comp_log_st(plans = nh$r_2020, shp = nh, counties = county, adj = nh$adj)

# Or many plans:
comp_log_st(plans = nh_m[, 3:5], shp = nh, counties = county, adj = nh$adj)
```

comp_lw *Calculate Length Width Compactness*

Description

Calculate Length Width Compactness

Usage

```
comp_lw(plans, shp, epsg = 3857, ncores = 1)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
shp	redist_map object or tibble with sf geometry column
epsg	numeric EPSG code to planarize to. Default is 3857.
ncores	numeric. Number of cores to use. Default is 1.

Value

numeric vector

References

Harris, Curtis C. 1964. “A scientific method of districting”. Behavioral Science 3(9), 219–225.

Examples

```
data(nh)
data(nh_m)
# For a single plan:
comp_lw(plans = nh$r_2020, shp = nh)

# Or many plans:

# slower, beware!
comp_lw(plans = nh_m[, 3:5], shp = nh)
```

`comp_polsby` *Calculate Polsby Popper Compactness*

Description

Calculate Polsby Popper Compactness

Usage

```
comp_polsby(
  plans,
  shp,
  use_Rcpp,
  perim_path,
  perim_df,
  epsg = 3857,
  ncores = 1
)
```

Arguments

`plans`	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
`shp`	redist_map object or tibble with sf geometry column
`use_Rcpp`	If `TRUE` (the default for more than 8 plans), precompute boundaries shared by each pair of units and use them to quickly compute the compactness score.
`perim_path`	path to perimeter tibble saved by `prep_perims()`
`perim_df`	tibble of perimeters from `prep_perims()`
`epsg`	numeric EPSG code to planarize to. Default is 3857.
`ncores`	numeric. Number of cores to use. Default is 1.

Value

numeric vector

References

Cox, E. 1927. A Method of Assigning Numerical and Percentage Values to the Degree of Roundness of Sand Grains. Journal of Paleontology, 1(3), 179-183.

Polsby, Daniel D., and Robert D. Popper. 1991. "The Third Criterion: Compactness as a procedural safeguard against partisan gerrymandering." Yale Law & Policy Review 9 (2): 301–353.

Examples

```
data(nh)
data(nh_m)
# For a single plan:
comp_polsby(plans = nh$r_2020, shp = nh)

# Or many plans:
comp_polsby(plans = nh_m[, 3:5], shp = nh)
```

`comp_reock` *Calculate Reock Compactness*

Description

Calculate Reock Compactness

Usage

```
comp_reock(plans, shp, epsg = 3857, ncores = 1)
```

Arguments

`plans`	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
`shp`	redist_map object or tibble with sf geometry column
`epsg`	numeric EPSG code to planarize to. Default is 3857.
`ncores`	numeric. Number of cores to use. Default is 1.

Value

numeric vector

References

Reock, E. 1961. A Note: Measuring Compactness as a Requirement of Legislative Apportionment. Midwest Journal of Political Science, 5(1), 70-74.

Examples

```
data(nh)
data(nh_m)
# For a single plan:
comp_reock(plans = nh$r_2020, shp = nh)

# Or many plans:
comp_reock(plans = nh_m[, 3:5], shp = nh)
```

comp_schwartz *Calculate Schwartzberg Compactness*

Description

Calculate Schwartzberg Compactness

Usage

```
comp_schwartz(
  plans,
  shp,
  use_Rcpp,
  perim_path,
  perim_df,
  epsg = 3857,
  ncores = 1
)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
shp	redist_map object or tibble with sf geometry column
use_Rcpp	Logical. Use Rcpp?
perim_path	path to perimeter tibble saved by prep_perims()
perim_df	tibble of perimeters from prep_perims()
epsg	numeric EPSG code to planarize to. Default is 3857.
ncores	numeric. Number of cores to use. Default is 1.

Value

numeric vector

References

Schwartzberg, Joseph E. 1966. Reapportionment, Gerrymanders, and the Notion of Compactness. Minnesota Law Review. 1701.

Examples

```
data(nh)
data(nh_m)
# For a single plan:
comp_schwartz(plans = nh$r_2020, shp = nh)
```

```
# Or many plans:
comp_schwartz(plans = nh_m[, 3:5], shp = nh)
```

`comp_skew` *Calculate Skew Compactness*

Description

Skew is defined as the ratio of the radii of the largest inscribed circle with the smallest bounding circle. Scores are bounded between 0 and 1, where 1 is most compact.

Usage

```
comp_skew(plans, shp, epsg = 3857, ncores = 1)
```

Arguments

`plans`	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
`shp`	redist_map object or tibble with sf geometry column
`epsg`	numeric EPSG code to planarize to. Default is 3857.
`ncores`	numeric. Number of cores to use. Default is 1.

Value

numeric vector

References

S.N. Schumm. 1963. Sinuosity of alluvial rivers on the Great Plains. Bulletin of the Geological Society of America, 74. 1089-1100.

Examples

```
data(nh)
data(nh_m)
# For a single plan:
comp_skew(plans = nh$r_2020, shp = nh)

# Or many plans:

# slower, beware!
comp_skew(plans = nh_m[, 3:5], shp = nh)
```

comp_x_sym *Calculate X Symmetry Compactness*

Description

X symmetry is the overlapping area of a shape and its projection over the x-axis.

Usage

```
comp_x_sym(plans, shp, epsg = 3857, ncores = 1)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
shp	redist_map object or tibble with sf geometry column
epsg	numeric EPSG code to planarize to. Default is 3857.
ncores	numeric. Number of cores to use. Default is 1.

Value

numeric vector

References

Aaron Kaufman, Gary King, and Mayya Komisarchik. 2021. How to Measure Legislative District Compactness If You Only Know it When You See It. American Journal of Political Science. 65, 3. Pp. 533-550.

Examples

```
#' data(nh)
data(nh_m)
# For a single plan:
comp_x_sym(plans = nh$r_2020, shp = nh)

# Or many plans:

# slower, beware!
comp_x_sym(plans = nh_m[, 3:5], shp = nh)
```

comp_y_sym *Calculate Y Symmetry Compactness*

Description

Y symmetry is the overlapping area of a shape and its projection over the y-axis.

Usage

```
comp_y_sym(plans, shp, epsg = 3857, ncores = 1)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
shp	redist_map object or tibble with sf geometry column
epsg	numeric EPSG code to planarize to. Default is 3857.
ncores	numeric. Number of cores to use. Default is 1.

Value

numeric vector

References

Aaron Kaufman, Gary King, and Mayya Komisarchik. 2021. How to Measure Legislative District Compactness If You Only Know it When You See It. American Journal of Political Science. 65, 3. Pp. 533-550.

Examples

```
#' data(nh)
data(nh_m)
# For a single plan:
comp_y_sym(plans = nh$r_2020, shp = nh)

# Or many plans:

# slower, beware!
comp_y_sym(plans = nh_m[, 3:5], shp = nh)
```

dist_euc *Calculate Euclidean Distances*

Description

Calculate Euclidean Distances

Usage

```
dist_euc(plans, ncores = 1)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
ncores	numeric. Number of cores to use. Default is 1.

Value

matrix of plan distances

Examples

```
data(nh)
data(nh_m)
# For a single plan (distance is trivial, 0):
dist_euc(plans = nh$r_2020)

# Or many plans:
dist_euc(plans = nh_m[, 3:5])
```

dist_ham *Calculate Hamming Distances*

Description

Calculate Hamming Distances

Usage

```
dist_ham(plans, ncores = 1)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
ncores	numeric. Number of cores to use. Default is 1.

Value

matrix of plan distances

Examples

```
data(nh)
data(nh_m)
# For a single plan (distance is trivial, 0):
dist_ham(plans = nh$r_2020)

# Or many plans:
dist_ham(plans = nh_m[, 3:5])
```

---

dist_info *Calculate Variation of Information Distances*

Description

Calculate Variation of Information Distances

Usage

```
dist_info(plans, shp, total_pop, ncores = 1)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
shp	redist_map object, tibble, or data frame containing other columns
total_pop	unqouted name of column in shp with total population
ncores	numeric. Number of cores to use. Default is 1.

Value

matrix of plan distances

Examples

```
data(nh)
data(nh_m)
# For a single plan (distance is trivial, 0):
dist_info(plans = nh$r_2020, shp = nh, total_pop = pop)

# Or many plans:
dist_info(plans = nh_m[, 3:5], shp = nh, total_pop = pop)
```

dist_man *Calculate Manhattan Distances*

Description

Calculate Manhattan Distances

Usage

```
dist_man(plans, ncores = 1)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
ncores	numeric. Number of cores to use. Default is 1.

Value

matrix of plan distances

Examples

```
data(nh)
data(nh_m)
# For a single plan (distance is trivial, 0):
dist_man(plans = nh$r_2020)

# Or many plans:
dist_man(plans = nh_m[, 3:5])
```

inc_pairs *Count Incumbent Pairings*

Description

Count the number of incumbents paired with at least one other incumbent.

Usage

```
inc_pairs(plans, shp, inc)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
shp	redist_map object, tibble, or data frame containing other columns
inc	unqouted name of logical column in shp indicating where incumbents live

Value

vector of number of incumbents paired

Examples

```
data(nh)
data(nh_m)
# Use incumbent data:
fake_inc <- rep(FALSE, nrow(nh))
fake_inc[3:4] <- TRUE

# For a single plan:
inc_pairs(plans = nh$r_2020, shp = nh, inc = fake_inc)

# Or many plans:
inc_pairs(plans = nh_m[, 3:5], shp = nh, inc = fake_inc)
```

---

list_fn *Return Functions Matching a Prefix*

Description

This package uses prefixes for each function that correspond to the type of measure. This function returns the functions

Usage

```
list_fn(prefix)
```

Arguments

prefix	character prefix of functions to return

Value

character vector of functions

Examples

```
list_fn('part_')
```

nh *New Hampshire Election and Demographic Data*

Description

This data set contains demographic, election, and geographic information for the 326 voting tabulation districts in New Hampshire in 2020.

Usage

```
data("nh")
```

Format

A tibble with 326 rows and 45 columns

- GEOID20: 2020 VTD GEOID
- state: state name
- county: county name
- vtd: VTD portion of GEOID
- pop: total population
- pop_hisp: Hispanic population
- pop_white: White, not Hispanic population
- pop_black: Black, not Hispanic population
- pop_aian: American Indian and Alaska Native, not Hispanic population
- pop_asian: Asian, not Hispanic population
- pop_nhpi: Native Hawaiian and Pacific Islander, not Hispanic population
- pop_other: other race, not Hispanic population
- pop_two: multi-race, not Hispanic population
- vap: total voting-age population
- vap_hisp: Hispanic voting-age population
- vap_white: White, not Hispanic voting-age population
- vap_black: Black, not Hispanic voting-age population
- vap_aian: American Indian and Alaska Native, not Hispanic voting-age population
- vap_asian: Asian, not Hispanic voting-age population
- vap_nhpi: Native Hawaiian and Pacific Islander, not Hispanic voting-age population
- vap_other: other race, not Hispanic voting-age population
- vap_two: multi-race, not Hispanic voting-age population
- pre_16_rep_tru: Votes for Republican president 2016
- pre_16_dem_cli: Votes for Democratic president 2016

- uss_16_rep_ayo: Votes for Republican senate 2016
- uss_16_dem_has: Votes for Democratic senate 2016
- gov_16_rep_sun: Votes for Republican governor 2016
- gov_16_dem_van: Votes for Democratic governor 2016
- gov_18_rep_sun: Votes for Republican governor 2018
- gov_18_dem_kel: Votes for Democratic governor 2018
- pre_20_dem_bid: Votes for Democratic president 2020
- pre_20_rep_tru: Votes for Republican president 2020
- uss_20_dem_sha: Votes for Democratic senate 2020
- uss_20_rep_mes: Votes for Republican senate 2020
- gov_20_dem_fel: Votes for Democratic governor 2020
- gov_20_rep_sun: Votes for Republican governor 2020
- arv_16: Average Republican vote 2016
- adv_16: Average Democratic vote 2016
- arv_18: Average Republican vote 2018
- adv_18: Average Democratic vote 2018
- arv_20: Average Republican vote 2020
- adv_20: Average Democratic vote 2020
- nrv: Normal Republican vote
- ndv: Normal Democratic vote
- geometry: sf geometry, simplified for size using rmapshaper
- r_2020: Republican proposed plan for 2020 Congressional districts
- d_2020: Democratic proposed plan for 2020 Congressional districts
- adj: zero-indexed adjacency graph

References

Voting and Election Science Team, 2020, "2020 Precinct-Level Election Results", https://doi.org/10.7910/DVN/K7760H, Harvard Dataverse, V23

Voting and Election Science Team, 2018, "2016 Precinct-Level Election Results", https://doi.org/10.7910/DVN/NH5S2I, Harvard Dataverse, V71

Voting and Election Science Team, 2019, "2018 Precinct-Level Election Results", https://doi.org/10.7910/DVN/UBKYRU, Harvard Dataverse, V48

Kenny & McCartan (2021, Aug. 10). ALARM Project: 2020 Redistricting Data Files. Retrieved from https://github.com/alarm-redist/census-2020/

Examples

```
data(nh)
```

nh_m *Redistricting Plans for New Hampshire as* matrix

Description

This data set contains two reference plans (d_2020 and r_2020) and 50 simulated plans for New Hampshire, based on 2020 demographics, simulated at a population tolerance of 0.05%.

Usage

```
data("nh_m")
```

Format

A matrix with 52 columns and 326 rows where each column is a plan

Examples

```
data(nh_m)
```

nh_map *New Hampshire Election and Demographic Data as a* redist_map

Description

This data set contains demographic, election, and geographic information for the 326 voting tabulation districts in New Hampshire in 2020.

Usage

```
data("nh_map")
```

Format

A redist_map with 326 rows and 45 columns

- GEOID20: 2020 VTD GEOID
- state: state name
- county: county name
- vtd: VTD portion of GEOID
- pop: total population
- pop_hisp: Hispanic population
- pop_white: White, not Hispanic population
- pop_black: Black, not Hispanic population

- pop_aian: American Indian and Alaska Native, not Hispanic population
- pop_asian: Asian, not Hispanic population
- pop_nhpi: Native Hawaiian and Pacific Islander, not Hispanic population
- pop_other: other race, not Hispanic population
- pop_two: multi-race, not Hispanic population
- vap: total voting-age population
- vap_hisp: Hispanic voting-age population
- vap_white: White, not Hispanic voting-age population
- vap_black: Black, not Hispanic voting-age population
- vap_aian: American Indian and Alaska Native, not Hispanic voting-age population
- vap_asian: Asian, not Hispanic voting-age population
- vap_nhpi: Native Hawaiian and Pacific Islander, not Hispanic voting-age population
- vap_other: other race, not Hispanic voting-age population
- vap_two: multi-race, not Hispanic voting-age population
- pre_16_rep_tru: Votes for Republican president 2016
- pre_16_dem_cli: Votes for Democratic president 2016
- uss_16_rep_ayo: Votes for Republican senate 2016
- uss_16_dem_has: Votes for Democratic senate 2016
- gov_16_rep_sun: Votes for Republican governor 2016
- gov_16_dem_van: Votes for Democratic governor 2016
- gov_18_rep_sun: Votes for Republican governor 2018
- gov_18_dem_kel: Votes for Democratic governor 2018
- pre_20_dem_bid: Votes for Democratic president 2020
- pre_20_rep_tru: Votes for Republican president 2020
- uss_20_dem_sha: Votes for Democratic senate 2020
- uss_20_rep_mes: Votes for Republican senate 2020
- gov_20_dem_fel: Votes for Democratic governor 2020
- gov_20_rep_sun: Votes for Republican governor 2020
- arv_16: Average Republican vote 2016
- adv_16: Average Democratic vote 2016
- arv_18: Average Republican vote 2018
- adv_18: Average Democratic vote 2018
- arv_20: Average Republican vote 2020
- adv_20: Average Democratic vote 2020
- nrv: Normal Republican vote
- ndv: Normal Democratic vote
- r_2020: Republican proposed plan for 2020 Congressional districts
- d_2020: Democratic proposed plan for 2020 Congressional districts
- adj: zero-indexed adjacency graph
- geometry: sf geometry, simplified for size using rmapshaper

References

Voting and Election Science Team, 2020, "2020 Precinct-Level Election Results", https://doi.org/10.7910/DVN/K7760H, Harvard Dataverse, V23

Voting and Election Science Team, 2018, "2016 Precinct-Level Election Results", https://doi.org/10.7910/DVN/NH5S2I, Harvard Dataverse, V71

Voting and Election Science Team, 2019, "2018 Precinct-Level Election Results", https://doi.org/10.7910/DVN/UBKYRU, Harvard Dataverse, V48

Kenny & McCartan (2021, Aug. 10). ALARM Project: 2020 Redistricting Data Files. Retrieved from https://github.com/alarm-redist/census-2020/

Examples

```
data(nh_map)
```

---

nh_plans *Redistricting Plans for New Hampshire as* redist_plans

---

Description

This data set contains two reference plans (`d_2020` and `r_2020`) and 50 simulated plans for New Hampshire, based on 2020 demographics, simulated at a population tolerance of 0.05%.

Usage

```
data("nh_plans")
```

Format

A redist_plans with 104 rows and 3 columns

- draw: factor identifying the reference plans (`d_2020` and `r_2020`) and 50 simulted plans
- district: district number (1 or 2)
- total_pop: total population in the district

Examples

```
data(nh_plans)
```

part_bias *Calculate Partisan Bias*

Description

Calculate Partisan Bias

Usage

```
part_bias(plans, shp, dvote, rvote, v = 0.5)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
shp	redist_map object, tibble, or data frame containing other columns
dvote	unqouted name of column in shp with total population
rvote	unqouted name of column in shp with group population
v	vote share to calculate bias at. Numeric. Default is 0.5.

Value

numeric vector

References

Jonathan N. Katz, Gary King, and Elizabeth Rosenblatt. 2020. Theoretical Foundations and Empirical Evaluations of Partisan Fairness in District-Based Democracies. American Political Science Review, 114, 1, Pp. 164-178.

Examples

```
data(nh)
data(nh_m)
# For a single plan:
part_bias(plans = nh$r_2020, shp = nh, rvote = nrv, dvote = ndv)

# Or many plans:
part_bias(plans = nh_m[, 3:5], shp = nh, rvote = nrv, dvote = ndv)
```

part_decl *Calculate Declination*

Description

Calculate Declination

Usage

```
part_decl(plans, shp, dvote, rvote, normalize = TRUE, adjust = TRUE)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
shp	redist_map object, tibble, or data frame containing other columns
dvote	unqouted name of column in shp with total population
rvote	unqouted name of column in shp with group population
normalize	Default is TRUE Translate score to an angle?
adjust	Default is TRUE. Applies a correction to increase cross-size comparison.

Value

numeric vector

References

Gregory S. Warrington. 2018. "Quantifying Gerrymandering Using the Vote Distribution." Election Law Journal: Rules, Politics, and Policy. Pp. 39-57.http://doi.org/10.1089/elj.2017.0447

Examples

```
data(nh)
data(nh_m)
# For a single plan:
part_decl(plans = nh$r_2020, shp = nh, rvote = nrv, dvote = ndv)

# Or many plans:
part_decl(plans = nh_m[, 3:5], shp = nh, rvote = nrv, dvote = ndv)
```

`part_decl_simple` *Calculate Simplified Declination*

Description

Calculate Simplified Declination

Usage

```
part_decl_simple(plans, shp, dvote, rvote)
```

Arguments

`plans`	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
`shp`	redist_map object, tibble, or data frame containing other columns
`dvote`	unqouted name of column in shp with total population
`rvote`	unqouted name of column in shp with group population

Value

numeric vector

References

Jonathan N. Katz, Gary King, and Elizabeth Rosenblatt. 2020. Theoretical Foundations and Empirical Evaluations of Partisan Fairness in District-Based Democracies. American Political Science Review, 114, 1, Pp. 164-178.

Examples

```
data(nh)
data(nh_m)
# For a single plan:
part_decl_simple(plans = nh$r_2020, shp = nh, rvote = nrv, dvote = ndv)

# Or many plans:
part_decl_simple(plans = nh_m[, 3:5], shp = nh, rvote = nrv, dvote = ndv)
```

part_dseats *Calculate Democratic Seats*

Description

Calculate Democratic Seats

Usage

```
part_dseats(plans, shp, dvote, rvote)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
shp	redist_map object, tibble, or data frame containing other columns
dvote	unqouted name of column in shp with total population
rvote	unqouted name of column in shp with group population

Value

numeric vector

Examples

```
data(nh)
data(nh_m)
# For a single plan:
part_dseats(plans = nh$r_2020, shp = nh, rvote = nrv, dvote = ndv)

# Or many plans:
part_dseats(plans = nh_m[, 3:5], shp = nh, rvote = nrv, dvote = ndv)
```

part_dvs *Calculate Democratic Vote Share*

Description

Calculate Democratic Vote Share

Usage

```
part_dvs(plans, shp, dvote, rvote)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
shp	redist_map object, tibble, or data frame containing other columns
dvote	unqouted name of column in shp with total population
rvote	unqouted name of column in shp with group population

Value

numeric vector

Examples

```
data(nh)
data(nh_m)
# For a single plan:
part_dvs(plans = nh$r_2020, shp = nh, rvote = nrv, dvote = ndv)

# Or many plans:
part_dvs(plans = nh_m[, 3:5], shp = nh, rvote = nrv, dvote = ndv)
```

---

part_egap *Calculate Efficiency Gap*

Description

Calculate Efficiency Gap

Usage

```
part_egap(plans, shp, dvote, rvote)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
shp	redist_map object, tibble, or data frame containing other columns
dvote	unqouted name of column in shp with total population
rvote	unqouted name of column in shp with group population

Value

numeric vector

References

Nicholas O. Stephanopoulos. 2015. Partisan Gerrymandering and the Efficiency Gap. The University of Chicago Law Review, 82, Pp. 831-900.

Examples

```
data(nh)
data(nh_m)
# For a single plan:
part_egap(plans = nh$r_2020, shp = nh, rvote = nrv, dvote = ndv)

# Or many plans:
part_egap(plans = nh_m[, 3:5], shp = nh, rvote = nrv, dvote = ndv)
```

---

part_egap_ep *Calculate Efficiency Gap (Equal Population Assumption)*

Description

Calculate Efficiency Gap (Equal Population Assumption)

Usage

```
part_egap_ep(plans, shp, dvote, rvote)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
shp	redist_map object, tibble, or data frame containing other columns
dvote	unqouted name of column in shp with total population
rvote	unqouted name of column in shp with group population

Value

numeric vector

References

Nicholas O. Stephanopoulos. 2015. Partisan Gerrymandering and the Efficiency Gap. The University of Chicago Law Review, 82, Pp. 831-900.

Examples

```
data(nh)
data(nh_m)
# For a single plan:
part_egap_ep(plans = nh$r_2020, shp = nh, rvote = nrv, dvote = ndv)

# Or many plans:
part_egap_ep(plans = nh_m[, 3:5], shp = nh, rvote = nrv, dvote = ndv)
```

---

part_lop_wins *Calculate Lopsided Wins*

Description

Calculate Lopsided Wins

Usage

```
part_lop_wins(plans, shp, dvote, rvote)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
shp	redist_map object, tibble, or data frame containing other columns
dvote	unqouted name of column in shp with total population
rvote	unqouted name of column in shp with group population

Value

numeric vector

References

Samuel S.-H. Wang. 2016. "Three Tests for Practical Evaluation of Partisan Gerrymandering." Stanford Law Review, 68, Pp. 1263 - 1321.

Examples

```
data(nh)
data(nh_m)
# For a single plan:
part_lop_wins(plans = nh$r_2020, shp = nh, rvote = nrv, dvote = ndv)

# Or many plans:
part_lop_wins(plans = nh_m[, 3:5], shp = nh, rvote = nrv, dvote = ndv)
```

part_mean_median *Calculate Mean Median Score*

Description

Calculate Mean Median Score

Usage

```
part_mean_median(plans, shp, dvote, rvote)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
shp	redist_map object, tibble, or data frame containing other columns
dvote	unqouted name of column in shp with total population
rvote	unqouted name of column in shp with group population

Value

numeric vector

References

Michael D. McDonald and Robin E. Best. 2015. Unfair Partisan Gerrymanders in Politics and Law: A Diagnostic Applied to Six Cases. Election Law Journal: Rules, Politics, and Policy. 14. 4. Pp. 312-330.

Examples

```
data(nh)
data(nh_m)
# zero for the two district case:
# For a single plan:
part_mean_median(plans = nh$r_2020, shp = nh, rvote = nrv, dvote = ndv)

# Or many plans:
part_mean_median(plans = nh_m[, 3:5], shp = nh, rvote = nrv, dvote = ndv)
```

part_resp *Calculate Responsiveness*

Description

Calculate Responsiveness

Usage

```
part_resp(plans, shp, dvote, rvote, v = 0.5, bandwidth = 0.01)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
shp	redist_map object, tibble, or data frame containing other columns
dvote	unqouted name of column in shp with total population
rvote	unqouted name of column in shp with group population
v	vote share to calculate bias at. Numeric. Default is 0.5.
bandwidth	Defaults to 0.01. A value between 0 and 1 for the step size to estimate the slope.

Value

numeric vector

References

Jonathan N. Katz, Gary King, and Elizabeth Rosenblatt. 2020. Theoretical Foundations and Empirical Evaluations of Partisan Fairness in District-Based Democracies. American Political Science Review, 114, 1, Pp. 164-178.

Examples

```
data(nh)
data(nh_m)
# For a single plan:
part_resp(plans = nh$r_2020, shp = nh, rvote = nrv, dvote = ndv)

# Or many plans:
part_resp(plans = nh_m[, 3:5], shp = nh, rvote = nrv, dvote = ndv)
```

part_rmd *Calculate Ranked Marginal Deviation*

Description

Calculate Ranked Marginal Deviation

Usage

```
part_rmd(plans, shp, dvote, rvote)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
shp	redist_map object, tibble, or data frame containing other columns
dvote	unqouted name of column in shp with total population
rvote	unqouted name of column in shp with group population

Value

numeric vector

References

Gregory Herschlag, Han Sung Kang, Justin Luo, Christy Vaughn Graves, Sachet Bangia, Robert Ravier & Jonathan C. Mattingly (2020) Quantifying Gerrymandering in North Carolina, Statistics and Public Policy, 7:1, 30-38, DOI: 10.1080/2330443X.2020.1796400

Examples

```
data(nh)
data(nh_m)
# For a single plan:
part_rmd(plans = nh$r_2020, shp = nh, rvote = nrv, dvote = ndv)

# Or many plans:
part_rmd(plans = nh_m[, 3:5], shp = nh, rvote = nrv, dvote = ndv)
```

part_sscd *Calculate Smoothed Seat Count Deviation*

Description

Calculate Smoothed Seat Count Deviation

Usage

```
part_sscd(plans, shp, dvote, rvote)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
shp	redist_map object, tibble, or data frame containing other columns
dvote	unqouted name of column in shp with total population
rvote	unqouted name of column in shp with group population

Value

numeric vector

References

Gregory Herschlag, Han Sung Kang, Justin Luo, Christy Vaughn Graves, Sachet Bangia, Robert Ravier & Jonathan C. Mattingly (2020) Quantifying Gerrymandering in North Carolina, Statistics and Public Policy, 7:1, 30-38, DOI: 10.1080/2330443X.2020.1796400

Examples

```
data(nh)
data(nh_m)
# For a single plan:
part_sscd(plans = nh$r_2020, shp = nh, rvote = nrv, dvote = ndv)

# Or many plans:
part_sscd(plans = nh_m[, 3:5], shp = nh, rvote = nrv, dvote = ndv)
```

part_tau_gap *Calculate Tau Gap*

Description

Calculate Tau Gap

Usage

```
part_tau_gap(plans, shp, dvote, rvote, tau = 1)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
shp	redist_map object, tibble, or data frame containing other columns
dvote	unqouted name of column in shp with total population
rvote	unqouted name of column in shp with group population
tau	A non-negative numeric for calculating Tau Gap. Defaults to 1.

Value

numeric vector

References

Gregory S. Warrington. 2018. "Quantifying Gerrymandering Using the Vote Distribution." Election Law Journal: Rules, Politics, and Policy. Pp. 39-57.http://doi.org/10.1089/elj.2017.0447

Examples

```
data(nh)
data(nh_m)
# For a single plan:
part_tau_gap(plans = nh$r_2020, shp = nh, rvote = nrv, dvote = ndv)

# Or many plans:
part_tau_gap(plans = nh_m[, 3:5], shp = nh, rvote = nrv, dvote = ndv)
```

prep_perims *Prep Polsby Popper Perimeter Tibble*

Description

Replaces `redist.prep.polsbypopper`

Usage

```
prep_perims(shp, epsg = 3857, perim_path, ncores = 1)
```

Arguments

shp	redist_map object or tibble with sf geometry column
epsg	numeric EPSG code to planarize to. Default is 3857.
perim_path	A path to save an rds
ncores	numeric. Number of cores to use. Default is 1.

Value

tibble of perimeters and lengths

Examples

```
data(nh)
prep_perims(nh)
```

seg_dissim *Compute Dissimilarity Index*

Description

Compute Dissimilarity Index

Usage

```
seg_dissim(plans, shp, group_pop, total_pop)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
shp	redist_map object, tibble, or data frame containing other columns
group_pop	unqouted name of column in shp with group population
total_pop	unqouted name of column in shp with total population

Value

numeric vector

References

Douglas Massey and Nancy Denton. 1987. The Dimensions of Social Segregation. Social Forces.

Examples

```
data(nh)
data(nh_m)
# For a single plan:
seg_dissim(plans = nh$r_2020, shp = nh, group_pop = vap_hisp, total_pop = vap)

# Or many plans:
seg_dissim(plans = nh_m[, 3:5], shp = nh, group_pop = vap_hisp, total_pop = vap)
```

---

splits_admin *Compute Number of Administrative Units Split*

Description

Compute Number of Administrative Units Split

Usage

```
splits_admin(plans, shp, admin)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
shp	redist_map object, tibble, or data frame containing other columns
admin	unqouted name of column in shp with numeric identifiers for administrative units

Value

numeric vector

Examples

```
data(nh)
data(nh_m)
# For a single plan:
splits_admin(plans = nh$r_2020, shp = nh, admin = county)

# Or many plans:
splits_admin(plans = nh_m[, 3:5], shp = nh, admin = county)
```

---

splits_count *Count the Number of Splits in Each Administrative Unit*

Description

Tallies the number of unique administrative unit-districts. An unsplit administrative unit will return an entry of 1, while each additional administrative unit-district adds 1.

Usage

```
splits_count(plans, shp, admin)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
shp	redist_map object, tibble, or data frame containing other columns
admin	unqouted name of column in shp with numeric identifiers for administrative units

Value

numeric matrix

Examples

```
data(nh)
data(nh_m)
# For a single plan:
splits_count(plans = nh$r_2020, shp = nh, admin = county)

# Or many plans:
splits_count(plans = nh_m[, 3:5], shp = nh, admin = county)
```

splits_multi *Compute Number of Administrative Units Split More than Once*

Description

Compute Number of Administrative Units Split More than Once

Usage

```
splits_multi(plans, shp, admin)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
shp	redist_map object, tibble, or data frame containing other columns
admin	unqouted name of column in shp with numeric identifiers for administrative units

Value

numeric vector

Examples

```
data(nh)
data(nh_m)
# For a single plan:
splits_multi(plans = nh$r_2020, shp = nh, admin = county)

# Or many plans:
splits_multi(plans = nh_m[, 3:5], shp = nh, admin = county)
```

splits_sub_admin *Compute Number of Sub-Administrative Units Split*

Description

Compute Number of Sub-Administrative Units Split

Usage

```
splits_sub_admin(plans, shp, sub_admin)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
shp	redist_map object, tibble, or data frame containing other columns
sub_admin	unqouted name of column in shp with numeric identifiers for subsidiary administrative units

Value

numeric vector

Examples

```
data(nh)
data(nh_m)
# For a single plan:
splits_sub_admin(plans = nh$r_2020, shp = nh, sub_admin = county)

# Or many plans:
splits_sub_admin(plans = nh_m[, 3:5], shp = nh, sub_admin = county)
```

---

splits_total *Count the Total Splits in Each Plan*

Description

Counts the total number of administrative splits.

Usage

```
splits_total(plans, shp, admin)
```

Arguments

plans	redist_plans object or plans_matrix where each row indicates a district assignment and each column is a plan
shp	redist_map object, tibble, or data frame containing other columns
admin	unqouted name of column in shp with numeric identifiers for administrative units

Value

numeric matrix

Examples

```
data(nh)
data(nh_m)
# For a single plan:
splits_total(plans = nh$r_2020, shp = nh, admin = county)

# Or many plans:
splits_total(plans = nh_m[, 3:5], shp = nh, admin = county)
```

Index