

Package ‘qcapower’

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Type Package

Title Estimate Power and Required Sample Size in QCA

Version 0.2.0

Imports ggplot2, ggforce, stats

Depends R (>= 2.10)

Description Researchers working with Qualitative Comparative Analysis (QCA) can use the package to estimate power of a sufficient term using permutation tests. A term can be anything: A condition, conjunction or disjunction of any combination of these. The package further allows users to plot the estimation results and to estimate the number of cases required to achieve a certain level of power, given a prespecified null and alternative hypothesis. Reference for the article introducing power estimation for QCA is: Rohlfing, Ingo (2018) <[doi:10.1017/pan.2017.30](https://doi.org/10.1017/pan.2017.30)> (ungated version: <[doi:10.17605/OSF.IO/PC4DF](https://doi.org/10.17605/OSF.IO/PC4DF)>).

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Encoding UTF-8

LazyData true

Suggests knitr, rmarkdown

VignetteBuilder knitr

URL <https://github.com/ingorohlfing/qcapower>

BugReports <https://github.com/ingorohlfing/qcapower/issues>

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qcapower	<i>Estimate power for a term in Qualitative Comparative Analysis (QCA). qcapower returns a power estimate with regard to the consistency of a term, given information about the required parameters</i>
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Description

qcapower allows you to estimate power for a term. Probability is the probability of rejecting the null hypothesis that no set relation is in place when it is in place, in fact. A term can be a single condition, a conjunction, or a disjunction of any combination of the two.

Usage

```
qcapower(
  cases,
  null_hypo,
  alt_hypo,
  sims = 1000,
  perms = 10000,
  alpha = 0.05,
  cons_threshold = 0.01,
  set_seed = 135
)
```

Arguments

cases	Number of cases. In fuzzy-set QCA, equal to total number of cases in the analysis
null_hypo	Null hypothesis (H_0). Consistency value separating consistent from inconsistent terms. It is the highest possible consistency value that would let you conclude that no set relation is given.
alt_hypo	Alternative hypothesis (H_1). Expected, actual consistency value of term.
sims	Number of simulations for calculating power
perms	Number of permutations of hypothetical dataset per simulation run
alpha	Level of alpha at which statistical significance of H_0 is tested

cons_threshold Degree of tolerance in generating hypothetical data with consistency equaling alt_hypo (see vignette)

set_seed Parameter for achieving reproducibility of estimate

Value

A dataframe with rows equaling the number of sims. power is the power estimate and is identical for each rows. powercum is the running power estimate up to this row. quant is the 5%-quantile of the permuted distributions. See the vignette for more information.

See Also

[qp_quant_plot](#) and [qp_run_plot](#)

Examples

```
power_data <- qcapower(cases = 20, null_hypo = 0.8, alt_hypo = 0.95, sims = 10, perms = 1000)
head(power_data)
```

qp_cases	<i>Calculate the number of cases for a particular case target based on simulated data</i>
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Description

qp_cases calculates the number of cases needed for a particular power level. It is based on the presimulated data using qcapower. See the vignette for more details.

Usage

```
qp_cases(power_target, null_hypo, alt_hypo)
```

Arguments

power_target Desired level of power

null_hypo Null hypothesis (H_0). Consistency value separating consistent from inconsistent terms.

alt_hypo Alternative hypothesis (H_1). Expected, actual consistency value of term.

Value

An integer showing how many cases are needed to achieve the target level of power.

See Also

[qp_cases_brute](#)

Examples

```
qp_cases(0.1, null_hypo = 0.8, alt_hypo = 1)
```

qp_cases_brute	<i>Calculate the number of cases for a particular case target with iterative simulations (brute force)</i>
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Description

qp_cases_brute calculates the number of cases needed for a particular power level. The function starts with the number of cases given by start_value and iteratively simulates power and adjusts the number of cases until the power_target is met or the max_value has been reached. Running the function can take a lot of time. Use [qp_cases](#) to

Usage

```
qp_cases_brute(
  power_target,
  start_value = 2,
  max_value = 100,
  progress = TRUE,
  ...
)
```

Arguments

power_target	Power level target
start_value	Default number of cases for initial search
max_value	Default maximum number of cases for search
progress	Show progress of calculation (default TRUE)
...	qcapower parameters – see qcapower

Value

An integer showing how many cases are needed to achieve the target level of power.

See Also

[qp_cases_brute](#)

Examples

```
## Not run:
qp_cases_brute(power_target = 0.9, null_hypo = 0.80, alt_hypo = 1)

qp_cases_brute(power_target = 0.9, null_hypo = 0.80, alt_hypo = 1, start_value = 20,
               max_value = 50, perms = 500)

## End(Not run)
```

qp_quant_plot

Sina plot of 5 distributions

Description

Depending on the number of cases, the permuted distributions of consistency values can differ narrowly or widely in terms of their location on the spectrum and their shape.

Usage

```
qp_quant_plot(power_est, title = FALSE)
```

Arguments

power_est	Dataframe containing simulation results (see qcapower)
title	Option for adding title to plot (default FALSE)

Details

Creates a sina plot with ggforce

Value

A sina plot using the cases to visualize the density distribution ('gg' object).

Examples

```
sim_data <- qp_sina_data
qp_quant_plot(sim_data)
```

`qp_run_plot`*Plot of power estimate against the number of simulations*

Description

`qp_run_plot` allows you to plot the running power estimate to determine whether `sims` is sufficiently large to derive a reliable estimate

Usage

```
qp_run_plot(power_est, title = FALSE)
```

Arguments

`power_est` Dataframe containing the simulation results (see [qcapower](#))
`title` Option for adding title to plot (default FALSE)

Details

Creates a plot with `ggplot2`

Value

A line plot ('gg' object).

Examples

```
power_data <- qcapower(cases = 20, null_hypo = 0.8, alt_hypo = 0.95, sims = 10, perms = 1000)
qp_run_plot(power_data)

# Using data with 10000 estimates
data(qp_sina_data)
qp_run_plot(qp_sina_data)
```

`qp_sim_power`*Data simulated power estimates*

Description

A dataset containing power simulations for different number of cases and different values for null- and alternative hypothesis

Usage

```
qp_sim_power
```

Format

A dataframe with simulation parameters and calculated power

Details

cases number of cases
null_hypo null hypothesis (H0)
alt_hypo alternative hypothesis
sims number of simulations
perms number of permutations
perms calculate power

qp_sina_data

Data simulated power estimates for plotting of 5%-quantiles

Description

A dataset containing the estimated 5%-quantiles from a power simulation with 1000 simulations each with 10000 permutations. The value for the alternative hypothesis was set to 1.

Usage

qp_sina_data

Format

A dataframe with 1000 rows and 6 variables:

Details

power power estimate over 1000 simulations
powercum running power estimate for ith simulation
null_hypo null hypothesis (H0), set to 0.8 (irrelevant here)
alt_hypo alternative hypothesis (H1), set to 1
cases number of cases, set to 10
quant estimated 5%-quantiles per simulations

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