Package ‘qcapower’

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Type    Package
Title   Estimate Power and Required Sample Size in QCA
Version 0.1.0
Imports ggplot2, ggforce, devtools, 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> (ungated version: <doi:10.17605/OSF.IO/PC4DF>).
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Author Ingo Rohlfing [aut, cre], Holger Doering [aut], Ayjeren Rozyjumayeva [aut]
Maintainer Ingo Rohlfing <i.rohlfing@uni-koeln.de>
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qcapower

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

```r
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 (H0). 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 (H1). 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 H0 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)

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 (H0). Consistency value separating consistent from inconsistent terms.
alt_hypo  Alternative hypothesis (H1). 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)

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

```r
## 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

```r
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

```r
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 sufficient large to derive a reliable estimate.

**Usage**

```r
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**

```r
data.power <- qcapower(cases = 20, null_hypo = 0.8, alt_hypo = 0.95, sims = 10, perms = 1000)
qp_run_plot(data.power)
```

# Using data with 10000 estimates
```r
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**

```r
qp_sim_power
```
qp_sina_data

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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