Package 'PVomega'

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Title Omega Shrinkage Measure for Drug-Drug Interaction Signal Detection

Version 1.0.0

Description Implements the Omega interaction disproportionality measure of Noren et al. (2008) <doi:10.1002/sim.3247> for drug-drug interaction signal detection in databases of adverse event reports.

License Apache License (>= 2)

URL https://uppsala-monitoring-centre.github.io/PVomega/, https://github.com/Uppsala-Monitoring-Centre/PVomega

Depends R (>= 4.1)

Imports data.table, stats, utils

Suggests devtools, knitr, styler, testthat (>= 3.0.0)

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`omega_from_counts` *Compute Omega from report counts*

Description

Computes the Omega shrinkage observed-to-expected ratio for a drug-drug-event triplet (Noren et al. 2008), together with its credibility interval and all intermediate quantities. The function is vectorised: every count argument can be a vector, and one row is returned per element.

Usage

```
omega_from_counts(
  n111,
  n11.,
  n1.1,
  n.11,
  n1..,
  n.1.,
  n..1,
  n...,
  alpha1 = 0.5,
  alpha2 = 0.5,
  cred_level = 0.95
)
```

Arguments

`n111`	Reports listing D1, D2 and the event.
`n11.`	Reports listing D1 and D2.
`n1.1`	Reports listing D1 and the event.
`n.11`	Reports listing D2 and the event.
`n1..`	Reports listing D1.
`n.1.`	Reports listing D2.
`n..1`	Reports listing the event.
`n...`	Total number of reports.
`alpha1`	Shrinkage added to the observed count: the shape of the Gamma prior (default 0.5, as in the paper). Must be > 0.
`alpha2`	Shrinkage added to the expected count: the rate of the Gamma prior (default 0.5, as in the paper). Must be > 0.
`cred_level`	Level of the two-sided credibility interval (default 0.95, giving Omega025 and Omega975).

Details

The expected relative reporting rate under the additive-risk baseline model is (eq. 16 of Noren et al. 2008)

$$g_{11} = 1 - \frac{1}{\max(o_{00}, o_{10}) + \max(o_{00}, o_{01}) - o_{00} + 1}$$

where $o_{ij} = f_{ij}/(1 - f_{ij})$ and f_{ij} is the relative reporting rate of the event in the stratum exposed to D1 (`i`) and D2 (`j`). The expected count is $E_{111} = g_{11} n_{11\cdot}$ and

$$\Omega = \log_2 \frac{n_{111} + \alpha_1}{E_{111} + \alpha_2}$$

Following the paper, the interval limits are log2 quantiles of the posterior Gamma(shape = $n_{111}+\alpha_1$, rate = $E_{111} + \alpha_2$) distribution (eq. 20). The paper uses $\alpha_1 = \alpha_2 = 0.5$, a prior with mean 1 that shrinks Omega towards 0. When $\alpha_1 \neq \alpha_2$, the prior mean is α_1/α_2 and Omega is shrunk towards $\log_2(\alpha_1/\alpha_2)$ instead of 0, which changes the meaning of the `omega_lower > 0` signal criterion.

Omega can only be computed when all four D1/D2 strata contain reports ($n_{11\cdot}$, $n_{10\cdot}$, $n_{01\cdot}$, $n_{00\cdot}$ > 0), so that the reporting rates are defined, and when f_{00}, f_{10} and f_{01} are below 1, so that the odds in eq. 16 are finite. $f_{11} = 1$ is valid. Rows that violate these conditions return `NA` for `g11`, `E111` and the Omega columns, and a single warning lists the affected rows and the reason. Counts that cannot come from one set of reports (e.g. a negative cell) raise an error.

Value

A `data.table` with one row per element of the inputs and columns:

- the input marginal counts `n1.1`, `n.11`, `n1..`, `n.1.`, `n..1`, `n...`;
- the eight cells of the 2x2x2 contingency table, named by presence (1) or absence (0) of D1, D2 and the event: `n111`, `n110`, `n101`, `n100`, `n011`, `n010`, `n001`, `n000` (they sum to `n...`);
- the four exposure strata totals `n11.`, `n10.`, `n01.`, `n00.`;
- `f00`, `f10`, `f01`, `f11`, `g11`, the expected count `E111`, `omega`, `omega_lower`, `omega_upper`. Each `f` is `NA` when its stratum is empty; `g11`, `E111` and the Omega columns are `NA` for rows where Omega cannot be computed (see Details).

References

Noren GN, Sundberg R, Bate A, Edwards IR. A statistical methodology for drug-drug interaction surveillance. Stat Med. 2008;27(16):3057-70. doi: 10.1002/sim.3247

Examples

```
# Itraconazole + oral contraceptives, delayed bleeding
# (Table II of Noren et al. 2008)
omega_from_counts(
  n111 = 10, n11. = 23, n1.1 = 10, n.11 = 19,
  n1.. = 39, n.1. = 1489, n..1 = 39, n... = 5503
)
```

omega_from_table *Compute Omega from a table of report counts*

Description

Convenience wrapper around omega_from_counts() for tabular input. The input must contain one column for each of the eight report counts required by omega_from_counts(). Computation is vectorised, so one output row is returned for each input row.

Usage

```
omega_from_table(x, alpha1 = 0.5, alpha2 = 0.5, cred_level = 0.95)
```

Arguments

x	A data frame, data.table, or other object coercible to a data.frame, containing the required count columns.
alpha1	Shrinkage tuning parameter for the observed count. Passed to omega_from_counts().
alpha2	Shrinkage tuning parameter for the expected count. Passed to omega_from_counts().
cred_level	Level of the two-sided credibility interval. Passed to omega_from_counts().

Value

A data.table containing the input columns followed by the results from omega_from_counts().

See Also

omega_from_counts()

Examples

```
counts <- data.frame(
  drug1 = "itraconazole",
  drug2 = "oral contraceptives",
  event = "delayed bleeding",
  n111 = 10,
  `n11.` = 23,
  `n1.1` = 10,
  `n.11` = 19,
  `n1..` = 39,
  `n.1.` = 1489,
  `n..1` = 39,
  `n...` = 5503,
  check.names = FALSE
)

omega_from_table(counts)
```

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