Package ‘robustmeta’

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Type Package

Title Robust Inference for Meta-Analysis with Influential Outlying Studies

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Description
Robust inference methods for fixed-effect and random-effects models of meta-analysis are implementable. The robust methods are developed using the density power divergence that is a robust estimating criterion developed in machine learning theory, and can effectively circumvent biases and misleading results caused by influential outliers. The density power divergence is originally introduced by Basu et al. (1998) <doi:10.1093/biomet/85.3.549>, and the meta-analysis methods are developed by Noma et al. (2022) <forthcoming>.

Depends R (>= 3.5.0)

Imports stats, metafor

License GPL-3

Encoding UTF-8

LazyData true

RoxygenNote 7.1.1

NeedsCompilation no

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R topics documented:

`robustmeta-package` *The 'robustmeta' package.*

Description

A R package for implementing the robust inference methods for meta-analysis involving influential outlying studies.

References

Noma, H., Sugasawa, S. and Furukawa, T. A. (2022). Robust inference methods for meta-analysis involving influential outlying studies. In Preparation.

`clbp` *Rubinstein et al. (2019)'s chronic low back pain data*

Description

- `ID`: Study ID
- `Souce`: First author name and year of publication
- `m1`: Estimated mean in experimental group
- `s1`: Standard deviation in experimental group
- `n1`: Number of observations in experimental group
- `m2`: Estimated mean in control group
- `s2`: Standard deviation in control group
- `n2`: Number of observations in control group

Usage

```
data(clbp)
```

Format

A data frame with 23 rows and 8 variables

References

Rubinstein, S. M,, de Zoete, A., van Middelkoop, M., Assendelft, W. J. J., de Boer, M. R., van Tulder, M. W. (2019). Benefits and harms of spinal manipulative therapy for the treatment of chronic low back pain: systematic review and meta-analysis of randomised controlled trials. *BMJ.* **364**: l689.

rmeta — *Robust estimation for meta-analysis with influential outlying studies*

Description

Implementing the robust inference for meta-analysis involving influential outlying studies based on the density power divergence.

Usage

```
rmeta(y, v, model="RE", gamma=0.01)
```

Arguments

`y`	A vector of the outcome measure estimates (e.g., MD, SMD, log OR, log RR, log HR, RD)
`v`	A vector of the variance estimate of `y`
`model`	Type of the pooling model; `"FE"`: Fixed-effect model or `"RE"`: Random-effects model; Default is `"RE"`
`gamma`	Unit of grid search to explore the optimal value of tuning parameter `alpha` on (0,1); Default is 0.01

Value

Results of the robust inference for meta-analysis.

- `mu`: Estimate of the common effect (for the fixed-effect model) or the grand mean (for the random-effects model).
- `se`: Standard error estimate of `mu`.
- `CI`: 95 percent confidence interval of `mu`.
- `P`: P-value of the hypothesis test of `mu=0`.
- `alpha`: Selected `alpha` by the Hyvarinen score.
- `W`: Contribution rates of individual studies (`ui`: contribution rates of the conventional methods, `wi`: contribution rates of the robust methods).

References

Noma, H., Sugasawa, S. and Furukawa, T. A. (2022). Robust inference methods for meta-analysis involving influential outlying studies. In Preparation.

Basu, A., Harris, I. R., Hjort, N. L., Jones, M. C. (1998). Robust and efficient estimation by minimizing a density power divergence. *Biometrika.* **85**: 549-559.

Sugasawa, S. and Yonekura, S. (2021). On selection criteria for the tuning parameter in robust divergence. *Entropy.* **23**: 1147.

Examples

```
require(metafor)
data(clbp)
edat1 <- escalc(measure="SMD",m1i=m1,m2i=m2,sd1i=s1,sd2i=s2,n1i=n1,n2i=n2,data=clbp)
DL1 <- rma(yi, vi, data=edat1, method="DL")
print(DL1)         # ordinary DerSimonian-Laird method
plot(DL1)   # plots of influential statistics, etc.

###

y <- as.numeric(edat1$yi) # definition of summary statistics
v <- edat1$vi

rmeta(y,v)                 # robust inference based on the random-effects model
rmeta(y,v,model="FE")      # robust inference based on the fixed-effect model
```

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