Package 'meta.shrinkage'

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Type Package

Title Meta-Analyses for Simultaneously Estimating Individual Means

Version 0.1.3

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Description Implement meta-analyses for simultaneously estimating individual means with shrinkage, isotonic regression and pretests. Include our original implementation of the isotonic regression via the pool-adjacent-violators algorithm (PAVA) algorithm.
This methodology is published in Taketomi et al.(2021) <doi:10.3390/axioms10040267>.

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R topics documented:

`gpt` *The General Pretest(GPT) Estimator for Sparse Means*

Description

This function is used to calculate the general pretest(GPT) estimator for individual means under sparse means. As an option, confidence intervals corresponding to pretest estimators can be computed. The methodology is described in detail in Section 3.3 of Taketomi et al. (2021). An example shows the application of this method to the gastric cancer data of GASTRIC group (2013) .

Usage

```
gpt(y,s,alpha1=0.05,alpha2=0.10,level=0.05,q=0.5,conf.int=FALSE,conf.type="pivot")
```

Arguments

y	a vector for estimates
s	a vector for standard errors of y
alpha1	significance level for pretest (0<alpha1<1)
alpha2	significance level for pretest (0<alpha2<1)
level	a constant such that 1-level is confidence level
q	degrees of shrinkage(0<q<1)
conf.int	an indicator whether confidence intervals for pretest estimators are in the output
conf.type	an indicator that implies which type of confidence intervals for pretest estimators is in the output. Default is "pivot".The other type is "wald".

Value

PT	pretest(PT) estimator for y
GPT	general pretest(GPT) estimator for y
lower.pt.pivot	Lower limits for pivoting type.
upper.pt.pivot	Upper limits for pivoting type.
lower.pt.wald	Lower limits for Wald type.
upper.pt.wald	Upper limits for Wald type.

Author(s)

Nanami Taketomi, Takeshi Emura

References

Taketomi N, Konno Y, Chang YT and Emura T (2021). A meta-analysis for simultaneously estimating individual means with shrinkage, isotonic regression and pretests. Axioms. 10. 267. 10.3390/axioms10040267.

GASTRIC group (2013). Role of chemotherapy for advanced/recurrent gastric cancer: An individual-patient-data meta-analysis, European Journal of Cancer 49 (7): 1565-1577. doi:10.1016/j.ejca.2012.12.016.

Taketomi N, Michimae H, Chang YT and Emura T (2022). meta.shrinkage: An R Package for Meta-Analyses for Simultaneously Estimating Individual Means. Algorithms. 15. 26.

Examples

```
#Estimates from the gastric cancer studies(Taketomi et al.(2021); GASTRIC group (2013))
y<-c(-0.18312,-0.72266,-0.48507,-0.23961,-0.13226,-0.27228,-0.5867,-0.13969,
-0.1004,-0.31143,-0.04949,-0.11685,-0.13044,0.04391)

#Standard errors(Taketomi et al.(2021))
```

```
s<-c(0.15372,0.28686,0.33192,0.21558,0.14691,0.14416,0.24885,
0.14542,0.16404,0.17038,0.19818,0.16476,0.19268,0.17632)

#Pretest(PT) estimator and general pretest(GPT) estimator
gpt(y,s)

#If conf.int=TRUE, confidence intervals fot PT are in the output.
#Default is 95% confidence interval in pivot type.
gpt(y,s,conf.int=TRUE)
```

`js` *James-Stein(JS) Estimator and Positive-Part JS Estimator for Means*

Description

This function computes the James-Stein(JS) shirinkage estimators for means. The detail of this estimation is described in Section 3.1 of Taketomi et al.(2021). An example shows the application of this method to the gastric cancer data of GASTRIC group (2013).

Usage

```
js(y,s)
```

Arguments

`y`	a vector for estimates
`s`	a vector for standard errors of y

Value

`JS`	James-Stein(JS) estimator for y
`JS_plus`	positive-part JS estimator for y

Author(s)

Nanami Taketomi, Takeshi Emura

References

Taketomi N, Konno Y, Chang YT , Emura T (2021). A meta-analysis for simultaneously estimating individual means with shrinkage, isotonic regression and pretests. Axioms. 10. 267. 10.3390/axioms10040267.

GASTRIC group (2013). Role of chemotherapy for advanced/recurrent gastric cancer: An individual-patient-data meta-analysis, European Journal of Cancer 49 (7): 1565-1577. doi:10.1016/j.ejca.2012.12.016.

Examples

```
#Estimates from the gastric cancer studies(Taketomi et al.(2021); GASTRIC group (2013))
y<-c(-0.18312,-0.72266,-0.48507,-0.23961,-0.13226,-0.27228,-0.5867,-0.13969,
-0.1004,-0.31143,-0.04949,-0.11685,-0.13044,0.04391)

#Standard errors(Taketomi et al.(2021))
s<-c(0.15372,0.28686,0.33192,0.21558,0.14691,0.14416,0.24885,
0.14542,0.16404,0.17038,0.19818,0.16476,0.19268,0.17632)

#JS estimator and JS-plus estimator
js(y,s)
```

`rjs` *Restricted James-Stein(JS) Estimator Under Ordered Means*

Description

This function is used to calculate the James-Stein(JS) shrinkage estimator under ordered means. The calculation of this estimator includes pooled-adjacent-violators algorithm(PAVA). Technical details is described in Taketomi et al.(2021). An example shows the application to the COVID-19 data from Pranata et al.(2020). This appliction is also described in Section 5.2 of Taketomi et al.(2021).

Usage

```
rjs(y,s,x=1:length(y),id=1:length(y),decreasing=FALSE)
```

Arguments

`y`	a vector for estimates
`s`	a vector for standard errors of y
`x`	a numeric vector for covariates to define the order of studies. Default implies the serial number assigned to the dataset.
`id`	a vector for the names of studies. The elements of this vector are numeric or character.
`decreasing`	logical scalar - Whether to sort the dataset in decreasing order by x or not.

Value

`id`	the names of studies
`x`	a numeric vector for a covariate that is used to sort the dataset.
`RJS`	Restricted JS estimator
`RJS_plus`	positive-part restricted JS estimator

Author(s)

Nanami Taketomi, Takeshi Emura

References

Taketomi N, Konno Y, Chang YT , Emura T (2021). A meta-analysis for simultaneously estimating individual means with shrinkage, isotonic regression and pretests. Axioms. 10. 267. 10.3390/axioms10040267.

Pranata R, Lim MA, Huang I, Raharjo SB, Lukito AA (2020). Hypertension is associated with increased mortality and severity of disease in COVID-19 pneumonia: A systematic review, meta-analysis and meta-regression. Journal of the renin-angiotensin-aldosterone system. 21(2). 1470320320926899.

Examples

```
#Estimates from the COVID-19 data (Taketomi et al.(2021); Pranata et al.(2020))
y<-c(0.6881,0.5933,1.1756,0.5365,0.678,0.5878,0.4637,0.5247,1.2326,2.8904,1.1378)

#standard errors of estimates
s<-c(0.6732,0.2754,0.2821,0.2493,0.1713,0.3302,0.0956,0.3272,0.1489,1.4263,0.2097)

#The proportions of males of each study
x<-c(56.4,63.0,52.0,49.0,62.1,49.5,82.0,58.0,47.9,45.0,62.0)


#Note that in rjs function, y is sorted by x before calculating RML estimator.

#The names of studies
id<-c("Akbari 2020", "Bai 2000", "Cao 2020", "Chen 2020", "Chen T 2020", "Fu 2020",
         "Grasselli 2020", "Li 2020", "Luo 2020", "Yuan 2020", "Zhou 2020"
)

rjs(y,s,x,id,decreasing=TRUE)
```

`rml` *The Ordered Restricted Maximum Likelihood Estimator under Ordered Means*

Description

This function provides the restricted maximum likelihood(RML) estimator under ordered means using Pooled-Adjacent-Violators Algorithm(PAVA). The technical details and examples for this estimator are described in Section 3.2 of Taketomi et al.(2021). An example shows the application to the COVID-19 data from Pranata et al.(2020). This appliction is also described in Section 5.2 of Taketomi et al.(2021).

Usage

```
rml(y,x=1:length(y),id=1:length(y),decreasing=FALSE)
```

Arguments

y	a vector of estimates
x	a numeric vector for a covariate that is interested in the relationship between ordered means. Default implies the serial number assigned to the dataset.
id	a vector for the names of studies. The elements of this vector is numeric or character.
decreasing	logical scalar - Whether to sort the dataset in decreasing order by x or not. If decreasing=TRUE, RML in the output is estimators under the assumption that the y is monotonically decreasing with respect to x.

Value

id	the names of studies
x	a numeric vector for a covariate that is used to sort the dataset.
RML	the ordered restricted estimator for y using PAVA

Author(s)

Nanami Taketomi, Takeshi Emura

References

Taketomi N, Konno Y, Chang YT , Emura T (2021). A meta-analysis for simultaneously estimating individual means with shrinkage, isotonic regression and pretests. Axioms. 10. 267. 10.3390/axioms10040267.

Pranata R, Lim MA, Huang I, Raharjo SB, Lukito AA (2020). Hypertension is associated with increased mortality and severity of disease in COVID-19 pneumonia: A systematic review, meta-analysis and meta-regression. Journal of the renin-angiotensin-aldosterone system. 21(2). 1470320320926899.

Examples

```
#Estimates from the COVID-19 data (Taketomi et al.(2021); Pranata et al.(2020))
y<-c(0.6881,0.5933,1.1756,0.5365,0.678,0.5878,0.4637,0.5247,1.2326,2.8904,1.1378)

#Proportions of males of each study
x<-c(56.4,63.0,52.0,49.0,62.1,49.5,82.0,58.0,47.9,45.0,62.0)


#Under the assumption that y is monotonically decreasing with respect to x,
#input decreasing=TRUE(the dataset is sorted by in decreasing order by x).
rml(y,x,decreasing=TRUE)


#If x and decreasing are default, the dataset is sorted by
```

```
#in the serial numbers of studies
#and RML in the output is under the assumption
#that y is monotonically increasing with respect to serial numbers.
rml(y)



#If x is default and decreasing=TRUE, the dataset is sorted by
#in decreasing the serial numbers of studies
#and RML in the output is under the assumption
#that y is monotonically decreasing with respect to serial numbers.
rml(y,decreasing=TRUE)
```

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