Package 'asus'

October 25, 2017

Title Adaptive SURE Thresholding Using Side Information

Version 1.0.0

Description Provides the ASUS procedure for estimating a high dimensional sparse parameter in the presence of auxiliary data that encode side information on sparsity.
It is a robust data combination procedure in the sense that even when pooling non-informative auxiliary data ASUS would be at least as efficient as competing soft thresholding based methods that do not use auxiliary data.
For more information, please see the website <http://www-bcf.usc.edu/~wenguans/Papers/ASUS.htm> and the accompanying paper.

Depends R (>= 3.4.2)

License GPL (>= 2)

Encoding UTF-8

LazyData true

URL https://github.com/trambakbanerjee/asus#asus

Imports rwt, wavethresh, stats, utils

RoxygenNote 6.0.1

Suggests knitr, rmarkdown

VignetteBuilder knitr

NeedsCompilation no

Author Trambak Banerjee [aut, cre],
Gourab Mukherjee [aut],
Wenguang Sun [aut]

Maintainer Trambak Banerjee <trambakb@usc.edu>

Repository CRAN

Date/Publication 2017-10-25 08:45:32 UTC

R topics documented:

`asus` *Adaptive SURE thresholding with side information (asus)*

Description

ASUS procedure for shrinkage estimation of a high dimensional sparse parameter.

Usage

```
asus(d, v.d, s, k = 2, m = 50)
```

Arguments

`d`	an n vector of primary observations
`v.d`	an n vector of variances for each component of d
`s`	an n vector of side information
`k`	number of groups. Default is k=2
`m`	partitions the support of $\|s\|$ into m equidistant points. Default is $m = 50$

Details

Estimates a sparse high dimensional vector using the ASUS procedure described in Banerjee et al. (2017). If k = 1 then ASUS is the SureShrink estimator. The current implementation of ASUS estimates the grouping thresholds based on the magnitude of $|s|$. See the reference for more details.

Value

1. est - an n vector holding the estimates
2. mse - estimate of risk
3. tau - k-1 vector of grouping parameters if k>=2
4. t - k vector of thresholding parameters
5. size - k vector of group sizes

References

Banerjee. T, Mukherjee. G and Sun. W (2017). Adaptive Sparse Estimation with Side Information.

See Also

`sureshrink`,`ejs`,`sureshrink.mse`

Examples

```
library(asus)
set.seed(42)
d<-rnorm(10,2,1)
v.d<- rep(1,10)
set.seed(42)
s<-rnorm(10,3,0.1)
asus.out<-asus(d,v.d,s)
```

`asus.cuts` *Risk of asus with pre-defined grouping thresholds*

Description

Estimates the risk of asus when there are k(>2) groups with pre-defined grouping thresholds

Usage

```
asus.cuts(d, v.d, s, cutpoints)
```

Arguments

`d`	an n vector of primary observations
`v.d`	an n vector of variances for each component of d
`s`	an n vector of side information
`cutpoints`	k-1 pre-defined grouping thresholds for k groups. k must be bigger than 2.

Details

Estimates the risk of asus when there are k(>2) groups with k pre-defined grouping thresholds. This function is called when `asus` executes.

Value

mse - estimate of risk

References

Banerjee. T, Mukherjee. G and Sun. W (2017). Adaptive Sparse Estimation with Side Information.

See Also

`asus`,`sureshrink`,`ejs`,`sureshrink.mse`

Examples

```
library(asus)
set.seed(42)
d<-rnorm(10)
v.d<- rep(1,10)
set.seed(42)
s<-rnorm(10)
out<-asus.cuts(d,v.d,s,c(0.1,0.5,1))
```

`ejs` *Extended James-Stein (ejs) estimator*

Description

Extended James-Stein estimator of a high dimensional sparse parameter.

Usage

```
ejs(d, v.d)
```

Arguments

`d`	an n vector of observations
`v.d`	an n vector of variances for each component of d

Details

Extended James-Stein estimator of mean from Brown (2008) and equation (7.3) in Xie et al. (2012)

Value

est - an n vector holding the estimates

References

1. Brown, L.D. (2008). In-Season Prediction of Batting Averages: A Field Test of Empirical Bayes and Bayes Methodologies. The Annals of Applied Statistics, 2, 113-152
2. Xie, X. C., Kou, S. C., and Brown, L. D. (2012). SURE Estimates for a Heteroscedastic Hierarchical Model. Journal of the American Statistical Association, 107, 1465-1479.

See Also

sureshrink,asus

Examples

```
library(asus)
set.seed(42)
d<-rnorm(10,2,1)
v.d<- rep(1,10)
theta.hat<-ejs(d,v.d)
```

`sureshrink` *SureShrink estimator*

Description

SureShrink estimator of a high dimensional sparse parameter from Donoho and Johnstone (1995)

Usage

```
sureshrink(d, v.d)
```

Arguments

`d`	an n vector of observations
`v.d`	an n vector of variances for each component of d

Details

Estimates a threshold t by minimizing the SURE function and then soft thresholds d using t.

Value

1. est - an n vector holding the estimates
2. t - estimated threshold

References

David L Donoho and Iain M Johnstone. Adapting to unknown smoothness via wavelet shrinkage. Journal of the american statistical association, 90(432):1200-1224, 1995

See Also

`sureshrink.mse`

Examples

```
library(asus)
set.seed(42)
d<-rnorm(10,2,1)
v.d<- rep(1,10)
theta.hat<-sureshrink(d,v.d)
```

`sureshrink.mse` *SURE estimate of risk*

Description

Stein's Unbiased Risk Estimate for the sureshrink estimator

Usage

```
sureshrink.mse(d, v.d, type = 1, t = 0)
```

Arguments

`d`	an n vector of observations
`v.d`	an n vector of variances for each component of d
`type`	set type=1 if you want the thresholding parameter t to be estimated. Otherwise set type = 0 in which case you must provide t. Default is type = 1
`t`	soft thresholding parameter. If type = 1, then t is estimated whereas if type = 0 then you must provide t. Default is t = 0 (and type = 1)

Details

Estimates the risk of the surehsrink estimator of Donoho and Johnstone (1995).

Value

1. sure.est - SURE estimate of risk
2. t - estimated threshold (meaningless if type = 0)

References

1. Charles M Stein. Estimation of the mean of a multivariate normal distribution. The annals of Statistics, pages 1135-1151, 1981
2. David L Donoho and Iain M Johnstone. Adapting to unknown smoothness via wavelet shrinkage. Journal of the american statistical association, 90(432):1200-1224, 1995

See Also

`sureshrink`,`asus`

Examples

```
library(asus)
set.seed(42)
d<-rnorm(10,2,1)
v.d<- rep(1,10)
mse<-sureshrink.mse(d,v.d)
```

Index