

Package ‘tensorsign’

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Type Package

Title Nonparametric Tensor Completion Via Sign Series

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Imports rTensor,
Matrix,
pracma

Description Efficient algorithm for nonparametric tensor completion method via sign series. The algorithm employs the alternating optimization approach to solve the weighted classification problem. The detailed algorithm description can be found in Lee and Wang (2021) <arXiv:2102.00384>.

URL <https://arxiv.org/abs/2102.00384>

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Encoding UTF-8

LazyData true

RoxygenNote 7.1.1

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Alt	<i>Alternating optimization of the weighted classification loss</i>
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Description

Optimize the weighted classification loss given a weight tensor, an observed data tensor, and a large margin loss.

Usage

```
Alt(Ybar,W,r,type = c("logistic","hinge"),start = "random")
```

Arguments

Ybar	A given data tensor (possibly noisy and incomplete).
W	A weight tensor of the weighted classification loss.
r	A rank to be fitted.
type	A large margin loss to be used. Logistic or hinge loss is available.
start	Choice of initialization method. Use random initialization if start = "random", the initialization based on low rank approximation if start = "linear".

Value

The returned value is a list with components.

binary_obj	A series of binary loss values at each iteration.
obj	A series of the weighted classification loss values at each iteration.
iter	The number of iterations.
error	A series of errors at each iteration.
fitted	A tensor that optimizes the weighted classification loss.

References

Lee, C., & Wang, M. (2021). Beyond the Signs: Nonparametric Tensor Completion via Sign Series. *arXiv preprint arXiv:2102.00384*.

Examples

```
library(rTensor)
indices = c(2,3,4)
noise = rand_tensor(indices)@data
Theta = array(runif(prod(indices),min=-3,max = 3),indices)

# The signal plus noise model
Y = Theta + noise

# Optimize the weighted classification for a given sign tensor sign(Y) and a weight tensor abs(Y)
result = Alt(sign(Y),abs(Y),r = 2,type = "logistic",start = "random")
signTheta = sign(result$fitted)
```

fit_continuous	<i>Estimating a signal tensor from a noisy and incomplete data tensor based on CP low rank tensor method.</i>
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Description

Estimate a signal tensor from a noisy and incomplete data tensor using CP low rank tensor method.

Usage

```
fit_continuous(data,r)
```

Arguments

`data` A given data tensor (possibly noisy and incomplete).
`r` A rank of the signal tensor.

Value

The returned value is a list with components.

`est` An estimated signal tensor based on CP low rank tensor method.

`U` A list of factor matrices.

`lambda` A vector of tensor singular values.

Examples

```
library(rTensor)
indices = c(2,3,4)
noise = rand_tensor(indices)@data
Theta = array(runif(prod(indices),min=-3,max = 3),indices)

# The signal plus noise model
Y = Theta + noise

# Estimate Theta from CP low rank tensor method
hatTheta = fit_continuous(Y,3)
print(hatTheta$est)
```

SignT	<i>Estimation of a signal tensor from a noisy and incomplete data tensor based on nonparametric tensor method via sign series.</i>
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Description

Estimate a signal tensor from a noisy and incomplete data tensor using nonparametric tensor method via sign series.

Usage

```
SignT(Y,truer,H,Lmin,Lmax,option = 1)
```

Arguments

`Y` A given data tensor (possibly noisy and incomplete).
`truer` A sign rank of the signal tensor.
`H` A resolution parameter.
`Lmin` A minimum value of the signal tensor (or a minimum value of the tensor `Y`).
`Lmax` A maximum value of the signal tensor (or a maximum value of the tensor `Y`).
`option` A large margin loss to be used. Use logistic loss if `option = 1`, hinge loss if `option = 2`.

Value

The returned value is a list with components.

`fitted` A series of optimizers that minimize the weighted classification loss at a given level π .

`est` An estimated signal tensor based on nonparametric tensor method via sign series.

References

Lee, C., & Wang, M. (2021). Beyond the Signs: Nonparametric Tensor Completion via Sign Series. *arXiv preprint arXiv:2102.00384*.

Examples

```
library(rTensor)
indices = c(2,3,4)
noise = rand_tensor(indices)@data
Theta = array(runif(prod(indices),min=-3,max = 3),indices)

# The signal plus noise model
Y = Theta + noise

# Estimate Theta from nonparametric completion method via sign series
hatTheta = SignT(Y,truer = 3,H = 5,Lmin = -3,Lmax = 3, option =1)
print(hatTheta$est)
```

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