

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")
```

pay attention to the order. If parentheses are *part of* the sentence, the sentence should read well even without the parentheses. fit_continuous

Arguments

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

Value

of
The returned value is a list ~~with~~ components.
trajectories of binary loss values over iterations.
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*.

``a series of '' allows non-ordered list.

Examples

I intentionally use ``a series of sign tensors vs. ``a sequence of sign tensors." in our paper — think about why

```
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

given a sign tensor

```
# 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)
```

Revise the code to allow r >= d_min.
Current random initialization seems require r <= min d.
in the final documentation, use r=3 and start = "linear".

Signal tensor estimation

fit_continuous ~~Estimating a signal tensor~~ from a noisy and incomplete data tensor based on CP low rank tensor method.

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

object

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)
```

Signal tensor estimation

SignT

~~Estimation of a signal tensor~~ from a noisy and incomplete data tensor based on nonparametric tensor method via sign series.

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 **object**

The returned **value** is a list with components.

fitted A series of optimizers that minimize the weighted classification loss at **each** ~~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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