

# Package ‘tensorsign’

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**Type** Package

**Title** Nonparametric Tensor Completion Via Sign Series

**Version** 0.1.0

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**Imports** rTensor,  
Matrix

## Description

Efficient algorithm for nonparametric tensor completion 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>

**License** GPL(>=2)

**Encoding** UTF-8

**LazyData** true

**RoxygenNote** 7.1.1

## R topics documented:

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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 = "linear")
```

**Arguments**

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

**Value**

The returned object is a list of components.

`binary_obj` - Trajectory of binary loss values over iterations.

`obj` - Trajectory of weighted classification loss values over iterations.

`iter` - The number of iterations.

`error` - Trajectory of errors over iterations.

`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 given a sign tensor sign(Y) and a weight tensor abs(Y)
result = Alt(sign(Y),abs(Y),r = 3,type = "logistic",start = "linear")
signTheta = sign(result$fitted)
```

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<code>fit_continuous</code>	<i>Signal tensor estimation 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 (possibly noisy and incomplete) data tensor.
r	Rank of the signal tensor.

**Value**

The returned object is a list of 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)
```

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SignT	<i>Signal tensor estimation 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 (possibly noisy and incomplete) data tensor.
truer	Sign rank of the signal tensor.
H	Resolution parameter.
Lmin	Minimum value of the signal tensor (or minimum value of the tensor Y).
Lmax	Maximum value of the signal tensor (or 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. Logistic loss is default.

**Value**

The returned object is a list of components.

fitted - A series of optimizers that minimize the weighted classification loss at each  $\pi$ .

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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