

Package ‘poset’

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Type Package

Title Analysis of Partially Ordered Data

Version 1.0.0

Description Win ratio approach to partially ordered data, such as multivariate ordinal responses under product (consensus) or prioritized order. Two-sample tests and multiplicative regression models are implemented (Mao, 2024, under revision).

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URL <https://sites.google.com/view/lmaowisc/>,
<https://lmaowisc.github.io/poset/>

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liver

A dataset from a non-alcoholic fatty liver disease study

Description

A total of 186 patients with non-alcoholic fatty liver disease were recruited at the University of Wisconsin Hospitals in 2017. The patients underwent computed tomography scan of the liver for the presence of non-alcoholic steato-hepatitis, the most severe form of non-alcoholic fatty liver disease. The image was subsequently assessed by two radiologists using a scale of 1 to 5, with higher values indicating greater likelihood of disease. This is a slightly altered dataset from the one used in Mao (2024).

Usage

```
liver
```

Format

A data frame with 186 rows (one per patient) and 7 variables:

R1NASH, R2NASH Rating scores (1-5) by two readers.

Sex M: male; F: female.

AF Advanced fibrosis (TRUE or FALSE).

Steatosis Percent of steatosis.

SSF2 Liver mean gray level intensity.

LSN Liver surface nodularity.

References

Mao, L. (2024). Win ratio for partially ordered data. *Statistica Sinica*, Under revision.

print.summary.wreg *Print method for summary.wreg objects*

Description

Print summary results for win ratio regression.

Usage

```
## S3 method for class 'summary.wreg'  
print(x, ...)
```

Arguments

x An object returned by [summary.wreg](#).
... Further arguments passed to or from other methods

Value

No return value, called for side effects.

print.wreg *Print concise model results from wreg*

Description

Print concise results for win ratio regression.

Usage

```
## S3 method for class 'wreg'  
print(x, ...)
```

Arguments

x An object returned by [wreg](#).
... Further arguments passed to or from other methods

Value

No return value, called for side effects.

See Also

[wreg](#).

print.wrtest *Print results from wrtest*

Description

Print the results for two-sample win ratio (net benefit) analysis, including point estimates, 95% confidence intervals, and p-values.

Usage

```
## S3 method for class 'wrtest'  
print(x, ...)
```

Arguments

x An object returned by [wrtest](#).
... Further arguments passed to or from other methods

Value

No return value, called for side effects.

See Also

[wrtest](#).

summary.wreg *Summarize model results from wreg*

Description

Summarize the inferential results for win ratio regression.

Usage

```
## S3 method for class 'wreg'  
summary(object, ...)
```

Arguments

object An object returned by [wreg](#).
... Additional arguments affecting the summary produced.

Value

An object of class `summary.wreg` with components:

`coefficients` A matrix of coefficients, standard errors, z-values and p-values.
`exp_coef` A matrix of win ratios ($\exp(\text{coef})$) and 95% confidence intervals.
`wald, wald_pval` Overall wald test statistic on all covariates and p-value.

See Also

[wreg](#).

Examples

#See examples for `wreg()`.

wprod

The product-order win function for multivariate ordinal data

Description

A common rule of comparison for the `fun` argument in [wrtest](#) and [wreg](#). A winner has all its components greater than or equal to those of the loser, and strictly so for at least one component.

Usage

```
wprod(y1, y0)
```

Arguments

`y1` A K -dimensional vector y_1 .
`y0` A K -dimensional vector y_0 .

Value

An integer in $1, 0, -1$:

`1` If $y_1 \geq y_0$ component-wise, with strict inequality for at least one component.
`-1` If $y_0 \geq y_1$ component-wise, with strict inequality for at least one component.
`0` Otherwise.

See Also

[wrtest](#), [wreg](#).

wreg

*Win ratio regression analysis***Description**

Fit a multiplicative win-ratio regression model to partially ordered response against covariates.

Usage

```
wreg(Y, Z, fun = NULL, sfun = NULL, ep = 1e-06)
```

Arguments

Y	An $n \times K$ matrix for K -variate response data on n subjects. The entries must be numeric. For pseudo-efficient estimation (without specifying <code>sfun</code>), the average score across components (row means) should be compatible with the partial order (i.e., preserve the same order for any two comparable and ordered elements).
Z	An $n \times p$ design matrix for covariates.
fun	User-specified win function for pairwise comparison. It takes two arguments y_1 and y_0 (both K -vectors) and returns 1 if y_1 wins, -1 if y_0 wins, and 0 if tied. The default is wprod for the product order of multivariate ordinal data.
sfun	The scoring function used in pseudo-efficient estimation. The default is to take the row means of Y.
ep	Convergence criterion in Newton-Raphson algorithm. The default is 1e-6.

Value

An object of class `wreg` with the following components:

beta	A vector of estimated regression coefficients.
var	Estimated covariance matrix for beta
l	Number of Newton-Raphson iterations.
beta_nv	Naive (non-pseudo-efficient) estimates of beta.
se_nv	Estimated standard errors for beta_nv.
n	Sample size n of input data with non-missing values.
Nw1	Number of comparable pairs (those with a win and loss) out of the $n(n-1)/2$ possible ones.

References

Mao, L. (2024). Win ratio for partially ordered data. *Statistica Sinica*, Under revision.

See Also

[wprod](#), [print.wreg](#), [summary.wreg](#).

Examples

```

head(liver)
# regress bivariate ratings against covariates
Y <- 5 - liver[, c("R1NASH", "R2NASH")] # lower score is better
Z <- cbind("Female" = liver$Sex == "F",
           liver[, c("AF", "Steatosis", "SSF2", "LSN")]) # covariates
obj <- wreg(Y, Z) # fit model
obj
summary(obj)

```

wrtest

*Two-sample win ratio (net benefit) analysis***Description**

Estimate and make inference on win ratio (net benefit) comparing a treatment to a control group.

Usage

```
wrtest(Y1, Y0, fun = wprod)
```

Arguments

Y1	K -variate response data on n_1 subjects in treatment ($n_1 \times K$ matrix).
Y0	K -variate response data on n_0 subjects in control ($n_0 \times K$ matrix).
fun	User-specified win function for pairwise comparison. It takes two arguments y_1 and y_0 (both K -vectors) and returns 1 if y_1 wins, -1 if y_0 wins, and 0 if tied. The default is wprod for the product order of multivariate ordinal data.

Value

An object of class `wrtest` with the following components:

theta	A bivariate vector of win/loss fractions.
lgwr, lgwr_se, lgwr_pval	Log-win ratio estimate ($\log(\text{theta}[1]/\text{theta}[2])$), standard error, and p-value.
nb, nb_se, nb_pval	Net benefit estimate ($\text{theta}[1] - \text{theta}[2]$), standard error, and p-value.

References

Mao, L. (2024). Win ratio for partially ordered data. *Statistica Sinica*, Under revision.

Buyse, M. (2010). Generalized pairwise comparisons of prioritized outcomes in the two-sample problem. *Statistics in Medicine*, 29, 3245-3257.

See Also

[wprod](#), [print.wrtest](#).

Examples

```
head(liver)
## compare bivariate ratings by fibrosis stage
## lower score is better
Y1 <- liver[liver$AF, c("R1NASH", "R2NASH")] # advanced
Y0 <- liver[!liver$AF, c("R1NASH", "R2NASH")] # not advanced
obj <- wrtest(Y1, Y0)
obj
```


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