Package ‘AOfamilies’

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Description This package implements AO transformations for binary response variables in Generalized Linear Models (GLMs) and bounded response variables in Quantile Regression (QR) models. The Maximum Likelihood Estimate (MLE) of the transformation parameter is obtained using the profile log likelihood method
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R topics documented:

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Description

This package implements both the AO symmetric and asymmetric transformations for binary response variables in GLM and for bounded response variables in QR models. The MLE of the transformation parameter is obtained using the profile log-likelihood method.

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Author(s)

Hakim-Moulay Dehbi (with contributions from Mario Cortina-Borja and Marco Geraci)

Maintainer: Dehbi, Hakim-Moulay <hakim-moulay.dehbi12@imperial.ac.uk>
References


For the datasets used in this manual, see:


---

**AIC.ao.glm**

*Akaike Information Criterion for an "ao.glm" object*

**Description**

Calculating the AIC of a fitted "ao.glm" model

**Usage**

```r
## S3 method for class 'ao.glm'
AIC(object, ...)
```

**Arguments**

- `object` An object of class "ao.glm"
- `...` Not used

**Examples**

```r
## beetle dataset
dose <- c(1.6907,1.7242,1.7552,1.7842,1.8113,1.8369,1.8610,1.8839)
totals <- c(59,60,62,56,63,59,62,60)
dead <- c(6,13,18,28,52,53,61,60)
prop_dead <- dead / totals

## fit the model using ao.glm() with an asymmetric transformation
fit.ao <- ao.glm(prop_dead ~ dose, weights = totals, link = ao.asym)

## extract the AIC
AIC.ao.glm(fit.ao)
```
ao.asym

AO asymmetric transformation

Description

Function to define the AO asymmetric transformation

Usage

ao.asym(phi, verbose = FALSE)

Arguments

phi Transformation parameter
verbose TRUE or FALSE. Default is FALSE

Author(s)

Hakim-Moulay Dehbi

ao.dose.p

Estimating lethal dose(s) for binomial assay model fitted with an AO transformation as link function

Description

Function to calibrate binomial assays, generalizing the calculation of LD50

Usage

ao.dose.p (object, cf = 1:2, p = 0.5, ...)

Arguments

object An object of class "ao.glm"

cf The terms in the coefficient vector giving the intercept and coefficient of (log-) dose

p Probabilities at which to calculate the lethal dose

... Not used

Value

A list containing the predictions at each probability level, the associated standard errors and the confidence intervals
References


See Also

Function dose.p() of package MASS

Examples

```r
## beetle dataset
dose <- c(1.6907, 1.7242, 1.7552, 1.7842, 1.8113, 1.8369, 1.8610, 1.8839)
totals <- c(59, 60, 62, 56, 63, 59, 62, 60)
dead <- c(6, 13, 18, 28, 52, 53, 61, 60)
prop.dead <- dead / totals

## fit the model using ao.glm() with an asymmetric transformation
fit.ao <- ao.glm(prop.dead ~ dose, weights = totals, link = ao.asym)

## estimate the lethal dose at p=0.25, p=0.5 and p=0.75
lethal.doses <- ao.dose.p (fit.ao, p = c(0.25, 0.5, 0.75))
```

ao.glm

Generic function

Description

Generic function of ao.glm()

Usage

```r
ao.glm(x, ...)
```

Arguments

- `x` For the UseMethod function
- `...` Not used

Author(s)

Hakim-Moulay Dehbi
Examples

```r
## beetle dataset
dose <- c(1.6907, 1.7242, 1.7552, 1.7842, 1.8113, 1.8369, 1.8610, 1.8839)
totals <- c(59, 60, 62, 63, 59, 62, 60)
dead <- c(6, 13, 18, 28, 52, 53, 61, 60)
prop_dead <- dead / totals

## fit the model using ao.glm() with an asymmetric transformation
fit.ao <- ao.glm(prop_dead ~ dose, weights = totals, link = ao.asym)
```

---

**ao.glm.default**

*Default method*

Description

Default method of ao.glm()

Usage

```r
## Default S3 method:
ao.glm(x, y, link, phi, weights, ...)
```

Arguments

- **x**: Design matrix
- **y**: Response variable
- **link**: Link function: ao.sym or ao.asym
- **phi**: An optional vector specifying the value(s) of the transformation parameter to
- **weights**: An optional vector of weights to be used in the fitting process
- **...**: Further arguments passed to or from other methods

Author(s)

Hakim-Moulay Dehbi
**ao.glm.fit**  
*Central fitting function*

**Description**
Central fitting function of ao.glm()

**Usage**
```r
## S3 method for class 'fit'
ao.glm(x, y, link, phi, weights, maxit = 500, ...)
```

**Arguments**
- `x`: Design matrix
- `y`: Response variable
- `link`: Link function: ao.sym or ao.asym
- `phi`: An optional vector specifying the value(s) of the transformation parameter to
- `weights`: An optional vector of weights to be used in the fitting process
- `maxit`: Maximum number of iterations
- `...`: Further arguments passed to or from other methods

**Author(s)**
Hakim-Moulay Dehbi

---

**ao.glm.formula**  
*Formula method*

**Description**
Formula method of ao.glm()

**Usage**
```r
## S3 method for class 'formula'
ao.glm(formula, data = list(), link, phi = seq(-2, 2, 0.01), weights, plotit = "TRUE", plot.spline = "TRUE", ...)
```
Arguments

- **formula**: A symbolic description of the model to fit. See Details section for further information.
- **data**: An optional data frame containing the variables in the model.
- **link**: Link function: `ao.sym` or `ao.asym`.
- **phi**: An optional vector specifying the value(s) of the transformation parameter to.
- **weights**: An optional vector of weights to be used in the fitting process.
- **plotit**: If "TRUE" (default), the plot of the profile log-likelihood is produced when calling the summary method, otherwise not.
- **plot.spline**: If "TRUE" (default), it fits a cubic smoothing spline to the profile log-likelihood data.
- **...**: Further arguments passed to or from other methods.

Details

Regarding the argument formula: a typical predictor has the form response ~ terms where response is the (numeric) response vector and terms is a series of terms which specifies a linear predictor for response. The response should consist of proportions of successes for each binomial trial of the dataset.

Value

An object of class "ao.glm" is a list containing at least the following components:

- **MLE**: The MLE of the transformation parameter.
- **fit.MLE**: A list containing all the outputs from the fitted model. The components of the list are the ones of the function glm() in package base.
- **fit.MLE.coef**: The vector of estimated coefficients.
- **loglik**: The log-likelihood of the model using the MLE of the transformation parameter.
- **valid.lambda**: A vector containing the values of the transformation parameters for which convergence was reached by the IWLS algorithm.
- **valid.logLik**: A vector containing the log-likelihood associated with the valid values of the transformation parameter.
- **fitted.values**: The fitted mean values, obtained by transforming the linear predictors by the inverse of the link function.

Note

To obtain special case transformations, use: a/for the logit: transfo = "ao.sym" and phi = 0, b/for the cloglog: transfo = "ao.asym" and phi = 0, c/for the probit: transfo = "ao.sym" and phi = 0.3955, d/for the arcsine: transfo = "ao.sym" and phi = 0.6755.

Available methods for an object of class "ao.glm": `summary.ao.glm`, `fitted.ao.glm`, `predict.ao.glm`, `plot.ao.glm` and `ao.dose.p`
Author(s)
Hakim-Moulay Dehbi

References

See Also
summary.ao.glm, fitted.ao.glm, predict.ao.glm, plot.ao.glm and ao.dose.p

---

### Description

Generic function of ao.qr()

### Usage

```r
ao.qr(x, ...)  
```

### Arguments

- `x` For the UseMethod function
- `...` Not used

### Author(s)

Hakim-Moulay Dehbi

### Examples

```r
## labor dataset
data(labor)
data <- labor

## fit the model using ao.qr() with a symmetric transformation
## for the quantile 0.5 with the method "linprog"
fit.ao.qr <- ao.qr(pain ~ treatment*time, data = data,  
kappa = 0.5, estimation = "linprog",  
method = "fn", phi = seq(-1,1,0.1),  
transfo = "ao.sym")
```
ao.qr.default  

Default method

Description

Default method of ao.qr

Usage

```r
## Default S3 method:
ao.qr(x, y, weights, method, kappa, phi, estimation, epsilon, transfo, se, R, ...)
```

Arguments

- **x**: Design matrix
- **y**: Response variable
- **weights**: An optional vector of weights to be used in the fitting process
- **method**: The algorithmic method used to compute the fit if linprog is chosen as estimation process (see below).
- **kappa**: Quantile to be estimated. Default value is 0.5
- **phi**: Transformation parameter. The default value is a sequence from 0 to 1.6 by step of 0.05
- **estimation**: 2 possibilities: "laplace" (default) or "linprog". Choosing "laplace" means fitting with the package **lqmm** while "linprog" implies **quantreg**
- **epsilon**: Tolerance parameter. The default value is 0.001
- **transfo**: 2 possibilities: "ao.sym" or "ao.asym" ("ao.sym" for the symmetric transformation and "ao.asym" for the asymmetric one)
- **se**: Method used to compute standard error if estimation is performed with "linprog". Options are "boot" (default), "iid", "nid" and "ker". See package **quantreg**
- **R**: Number of bootstrap replications
- **...**: Further arguments passed to or from other methods

Author(s)

Hakim-Moulay Dehbi
Central fitting function of `ao.qr`

Usage

```r
## S3 method for class 'fit'
ao.qr(x, y, weights, kappa, phi, se, estimation, method, epsilon, transfo, R, ...)
```

Arguments

- **x**: Design matrix
- **y**: Response variable
- **weights**: An optional vector of weights to be used in the fitting process
- **kappa**: Quantile to be estimated. Default value is 0.5
- **phi**: Transformation parameter. The default value is a sequence from 0 to 1.6 by step of 0.05
- **se**: Method used to compute standard error if estimation is performed with "linprog". Options are "boot" (default), "iid", "nid" and "ker". See package `quantreg`
- **estimation**: 2 possibilities: "laplace" (default) or "linprog". Choosing "laplace" means fitting with the package `lqmm` while "linprog" implies `quantreg`
- **method**: The algorithmic method used to compute the fit if linprog is chosen as estimation process (see below).
- **epsilon**: Tolerance parameter. The default value is 0.001
- **transfo**: 2 possibilities: "ao.sym" or "ao.asym" ("ao.sym" for the symmetric transformation and "ao.asym" for the asymmetric one)
- **R**: Number of bootstrap replications
- **...**: Further arguments passed to or from other methods

Author(s)

Hakim-Moulay Dehbi
ao.qr.formula

**Formula method**

**Description**

Formula method of ao.qr()

**Usage**

```r
## S3 method for class 'formula'
ao.qr(formula, data = list(),
weights = rep(1, length(y)), kappa = 0.5,
phi = seq(0, 1.5, 0.005), estimation = "laplace",
epsilon = 0.001, transfo = "ao.sym",
plotit = "TRUE", method = "br", se = "boot", R = 100, ...)
```

**Arguments**

- `formula` A symbolic description of the model to fit. See Details section for further information
- `data` An optional data frame containing the variables in the model
- `weights` An optional vector of weights to be used in the fitting process
- `kappa` Quantile to be estimated. Default value is 0.5
- `phi` Transformation parameter. The default value is a sequence from 0 to 1.5 by step of 0.005
- `estimation` 2 possibilities: "laplace" (default) or "linprog". Choosing "laplace" means fitting with the package `lqmm` while "linprog" implies `quantreg`
- `epsilon` Tolerance parameter. The default value is 0.001
- `transfo` 2 possibilities: "ao.sym" or "ao.asym" ("ao.sym" for the symmetric transformation and "ao.asym" for the asymmetric one)
- `plotit` If "TRUE" (default), the plot of the profile log-likelihood is produced when calling the summary method, otherwise not
- `method` The algorithmic method used to compute the fit if linprog is chosen as estimation process (see below).
- `se` Method used to compute standard error if estimation is performed with "linprog". Options are "boot" (default), "iid", "nid" and "ker". See package `quantreg`
- `R` Number of bootstrap replications
- `...` Further arguments passed to or from other methods

**Details**

Regarding the argument formula: a typical predictor has the form `response ~ terms` where `response` is the (numeric) response vector and `terms` is a series of terms which specifies a linear predictor for `response`. 
Value

An object of class "ao.qr" is a list containing at least the following components:

- **MLE**
  The MLE of the transformation parameter

- **logLik.MLE**
  The log-likelihood of the model using the MLE of the transformation parameter

- **ao**
  A vector of AO-transformed values based on the initial bounded response variable using the MLE of the transformation parameter

- **fit.coef.table**
  A table containing the coefficients of the QR model, the standard errors, the t value and the test statistic. If the method "laplace" is used, the confidence bounds of the coefficients are included

- **fit.coef**
  The vector of coefficients of the QR model

- **predict.all**
  A matrix containing the fitted values and the confidence intervals on the transformed scale

- **fit**
  A list containing all the outputs from the fitted QR model. The components are the ones of the functions rq() or lqm() in packages quantreg and lqmm respectively

Note

To obtain special case transformations, use:
- a/ for the logit: transfo = "ao.sym" and phi = 0,
- b/ for the cloglog: transfo = "ao.asym" and phi = 0,
- c/ for the probit: transfo = "ao.sym" and phi = 0.3955,
- d/ for the arcsine: transfo = "ao.sym" and phi = 0.6755

Available methods for an object of class "ao.qr": summary.aq, fitted.aq and predict.aq

Author(s)

Hakim-Moulay Dehbi

---

**ao.sym**

*AO symmetric transformation*

**Description**

Function to define the AO symmetric transformation

**Usage**

`ao.sym(phi, verbose = FALSE)`

**Arguments**

- **phi**
  Transformation parameter
- **verbose**
  TRUE or FALSE. Default is FALSE

**Author(s)**

Hakim-Moulay Dehbi
fitted.ao.glm  
Extracting fitted values of an "ao.glm" object

Description
Function to extract the fitted values of a model fitted using ao.glm

Usage

## S3 method for class 'ao.glm'
fitted(object, ...)

Arguments

object  An object of class "ao.glm"
...
Not used

Value
A list containing the vector of fitted values

Examples

## beetle dataset
dose <- c(1.6907,1.7242,1.7552,1.7842,1.8113,1.8369,1.8610,1.8839)
totals <- c(59,60,62,56,63,59,62,60)
dead <- c(6,13,18,28,52,53,61,60)
prop_dead <- dead / totals

## fit the model using ao.glm() with an asymmetric transformation
fit.ao <- ao.glm(prop_dead ~ dose, weights = totals, link = ao.asym)

## extract the fitted values
fitted.values <- fitted.ao.glm(fit.ao)

fitted.ao.qr  
Extracting fitted values of an "ao.qr" object

Description
Function to extract the fitted values of a QR model fitted using ao.qr
Usage

```r
## S3 method for class 'ao.qr'
fitted(object, ...)
```

Arguments

- `object`: An object of class "ao.qr"
- `...`: Not used

Value

A list containing a dataframe with 3 columns: the fitted values on the untransformed scale, the lower bound and the higher bound of the estimates

---

**logLik.ao.glm**

Log-likelihood for an "ao.glm" object

**Description**

Extracting the log-likelihood of a fitted "ao.glm" model

Usage

```r
## S3 method for class 'ao.glm'
logLik(object, ...)
```

Arguments

- `object`: An object of class "ao.glm"
- `...`: Not used

Examples

```r
## beetle dataset

dose <- c(1.6907, 1.7242, 1.7552, 1.7842, 1.8113, 1.8369, 1.8610, 1.8839)

totals <- c(59, 60, 62, 56, 63, 59, 62, 60)

dead <- c(6, 13, 18, 28, 52, 53, 61, 60)

prop_dead <- dead / totals

## fit the model using ao.glm() with an asymmetric transformation

fit.ao <- ao.glm(prop_dead ~ dose, weights = totals, link = ao.asym)

## extract the log-likelihood

logLik.ao.glm(fit.ao)
```
plot.ao.glm

Ploting diagnostics for an "ao.glm" object

Description

This function corresponds to the function plot.lm() of package stats. Six plots (selectable by which) are currently available: a plot of residuals against fitted values, a Scale-Location plot of sqrt(|residuals|) against fitted values, a Normal Q-Q plot, a plot of Cook’s distances versus row labels, a plot of residuals against leverages, and a plot of Cook’s distances against leverage/(1-leverage).

Usage

```r
## S3 method for class 'ao.glm'
plot(x, which = 1:4, ...)  
```

Arguments

- `x`: An object of class "ao.glm"
- `which`: The first four plots are provided by default. If a subset of the plots is required, specify a subset of the numbers 1:6
- `...`: Further arguments passed to or from other methods

See Also

- `ao.glm`

Examples

```r
## beetle dataset
dose <- c (1.6907,1.7242,1.7552,1.7842,1.8113,1.8369,1.8610,1.8839)

totals <- c (59,60,62,56,63,59,62,60)

dead <- c (6,13,18,28,52,53,61,60)

prop_dead <- dead / totals

## fit the model using ao.glm() with an asymmetric transformation
fit.ao <- ao.glm (prop_dead ~ dose, weights = totals, link = ao.asym)

## plot the first two diagnostics
plot.ao.glm (fit.ao, which = 1:2)
```
predict.aoglm

Predicting values based on an "ao.glm" object

Description
Function to predict values based on a model fitted using ao.glm

Usage
## S3 method for class 'ao.glm'
predict(object, newdata = NULL, ...)

Arguments
object  An object of class "ao.glm"
newdata An optional data frame in which to look for variables with which to predict. If omitted, the fitted values are used
...     Not used

Value
A list containing the vector of predictions

Examples
## beetle dataset
dose <- c(1.6907, 1.7242, 1.7552, 1.7842, 1.8113, 1.8369, 1.8610, 1.8839)
totals <- c(59, 60, 62, 56, 63, 59, 62, 60)
dead <- c(6, 13, 18, 28, 52, 53, 61, 60)
prop.dead <- dead / totals

## fit the model using ao.glm() with an asymmetric transformation
fit.ao <- ao.glm(prop.dead ~ dose, weights = totals, link = ao.asym)

## predictions
range.dose <- seq(min(dose), max(dose), length=50)
pred.dose.ao <- predict.aoglm(fit.ao, newdata = data.frame(dose = range.dose))
plot(range.dose, pred.dose.ao[[1]], type='l')
predict.aqqr  

Predicting values based on an "ao.qr" object

Description

Function to predict values based on a QR model fitted using ao.qr

Usage

## S3 method for class 'ao.qr'
predict(object, newdata = NULL, ...)

Arguments

- **object**: An object of class "ao.qr"
- **newdata**: An optional data frame in which to look for variables with which to predict. If omitted, the fitted values are used
- **...**: Not used

Value

A list containing a dataframe with 3 columns: the point estimates on the untransformed scale, the lower bound and the higher bound of the estimates

Examples

## labor dataset
data(labor)
data <- labor
data.subset <- subset (data, time == 90)

## fit the model using ao.qr() with a symmetric transformation
## for the quantile 0.25 with the method "linprog"
fit.aqqr <- ao.qqr(pain ~ treatment, data = data.subset,
   kappa = 0.25, estimation = "linprog",
   transfo = "ao.sym")

## perform the prediction for a new data point
predicted.values <- predict.aqqr (fit.aqqr, newdata = data.frame (treatment = 0))
print.ao.glm

Printing the MLE, its associated log-likelihood and the coefficients of an "ao.glm" object

Description

Print method of the function ao.glm

Usage

## S3 method for class 'ao.glm'
print(x, ...)

Arguments

x
An object of class "ao.glm"

... Not used

Details

Printing the MLE of the transformation parameter, its associated log-likelihood and the coefficients of the regression

Examples

## beetle dataset
dose <- c (1.6907,1.7242,1.7552,1.7842,1.8113,1.8369,1.8610,1.8839)
totals <- c (59,60,62,56,63,59,62,60)
dead <- c (6,13,18,28,52,53,61,60)
prop_dead <- dead / totals

## fit the model using ao.glm() with an asymmetric transformation and print the results
fit.ao <- ao.glm (prop_dead ~ dose, weights = totals, link = ao.asym)
fit.ao
print.aoglm.dose

Printing the lethal dose(s) estimated with an "ao.glm" object

Description

Print method of the function ao.dose.p

Usage

## S3 method for class 'ao.glm.dose'
print(x, ...)

Arguments

x               An object of class "ao.glm"
...             Not used

Details

Printing a dataframe giving the prediction at each probability level with standard errors and confidence intervals

Examples

## beetle dataset
dose <- c(1.6907, 1.7242, 1.7552, 1.7842, 1.8113, 1.8369, 1.8610, 1.8839)
totals <- c(59, 60, 62, 56, 63, 59, 62, 60)
dead <- c(6, 13, 18, 28, 52, 53, 61, 60)
prop_dead <- dead / totals

## fit the model using ao.glm() with an asymmetric transformation
fit.ao <- ao.glm (prop_dead ~ dose, weights = totals, link = ao.asym)

## estimate and print the lethal doses at p=0.25, p=0.5 and p=0.75
lethal.doses <- ao.dose.p (fit.ao, p = c(0.25, 0.5, 0.75))
lethal.doses
**print.ao.qr**

**Description**

Print method of the function `ao.qr`

**Usage**

```r
## S3 method for class 'ao.qr'
print(x, ...)
```

**Arguments**

- `x`: An object of class "ao.qr"
- `...`: Not used

**Details**

Printing the MLE of the transformation parameter, its associated log-likelihood and the coefficients of the regression.

---

**print.fitted.ao glm**

**Description**

Print method of the function `fitted.ao glm`

**Usage**

```r
## S3 method for class 'fitted.ao glm'
print(x, ...)
```

**Arguments**

- `x`: An object of class "ao glm"
- `...`: Not used
Examples

```r
death <- c(1.6907, 1.7242, 1.7552, 1.7842, 1.8113, 1.8369, 1.8610, 1.8839)
dose <- c(1, 0.6, 0.5, 0.4, 0.3, 0.2, 0.1, 0.0)
totals <- c(59, 60, 62, 63, 59, 62, 60, 60)
death <- (6, 13, 18, 28, 52, 53, 61, 60)
prop.death <- death / totals

# fit the model using ao.glm() with an asymmetric transformation
fit.ao <- ao.glm(prop.death ~ dose, weights = totals, link = ao.asym)

# extract and print the fitted values
fitted.values <- fitted.ao.glm(fit.ao)
fitted.values
```

print.fitted.ao.qr  \hspace{1cm} Printing the fitted values of a model fitted using \texttt{ao.qr}

Description

Print method of the function \texttt{fitted.ao.qr}

Usage

```r
## S3 method for class 'fitted.ao.qr'
print(x, ...)
```

Arguments

- \texttt{x} \hspace{1cm} An object of class "ao.qr"
- \texttt{...} \hspace{1cm} Not used

print.predict.ao glm  \hspace{1cm} Printing predicted values based on an "ao glm" object

Description

Print method of the function \texttt{predict.ao.glm}

Usage

```r
## S3 method for class 'predict.ao glm'
print(x, ...)
```
Arguments

x An object of class "ao.glm"

Examples

## beetle dataset
dose <- c(1.6907, 1.7242, 1.7552, 1.7842, 1.8113, 1.8369, 1.8610, 1.8839)
totals <- c(59, 60, 62, 56, 63, 59, 62, 60)
dead <- c(6, 13, 18, 28, 52, 53, 61, 60)
prop_dead <- dead / totals

## fit the model using ao.glm() with an asymmetric transformation
fit.ao <- ao.glm(prop_dead ~ dose, weights = totals, link = ao.asym)

## perform the prediction for a new data point and print the result
predicted.values <- predict.ao.glm(fit.ao, newdata = data.frame(dose = c(1.7)))
predicted.values

print.predict.ao.qr Printing predicted values based on an "ao.qr" object

Description

Print method of the function predict.ao.qr

Usage

## S3 method for class 'predict.ao.qr'
print(x, ...)

Arguments

x An object of class "ao.qr"

Examples

## labor dataset
data(labor)
data <- labor
data.subset <- subset(data, time == 90)

## fit the model using ao.qr() with a symmetric transformation (transformation parameter = 0.2)
## for the quantile 0.25 with the method "linprog"
fit.ao.qr <- ao.qr(pain ~ treatment, data = data.subset,  
      kappa = 0.25, estimation = "linprog",  
      transfo = "ao.sym")

## perform the prediction for a new data point and print the result  
predicted.values <- predict.ao.qr(fit.ao.qr, newdata = data.frame(treatment = 0))  
predicted.values

print.summary.ao.glm  
Printing the summary obtained from an "ao.glm" object

Description
Print method of the function summary.ao.glm

Usage
## S3 method for class 'summary.ao.glm'  
print(x, ...)

Arguments
x  
An object of class "ao.glm"  

...  
Not used

Details
This function prints the call of the function, the result of the asymmetry test as defined in Aranda-Ordaz (1981), the MLE and its associated log-likelihood. It also gives the 95 percent confidence interval for the MLE and the special case transformations included in it. It formats the coefficients, standard errors, etc. and additionally gives "significance stars"

Examples
## beetle dataset  
dose <- c(1.6907, 1.7242, 1.7552, 1.7842, 1.8113, 1.8369, 1.8610, 1.8839)

totals <- c(59, 60, 62, 56, 63, 59, 62, 60)

dead <- c(6, 13, 18, 28, 52, 53, 61, 60)

prop_dead <- dead / totals

## print the summary of the model  
summary(ao.glm(prop_dead ~ dose, weights = totals, link = ao.asym))
print.summary.ao.qr  Printing the summary obtained from an "ao.qr" object

Description

Print method of the function summary.ao.qr

Usage

## S3 method for class 'summary.ao.qr'
print(x, ...)

Arguments

x  An object of class "ao.qr"
...
Not used

Details

This function prints the call of the function, the quantile considered, the MLE and its associated log-likelihood. It formats the coefficients, standard errors, etc. and additionally gives "significance stars"

summary.ao.glm  Summarizing the results of an "ao.glm" object

Description

Summary method of the function ao.glm

Usage

## S3 method for class 'ao.glm'
summary(object, ...)

Arguments

object  An object of class "ao.glm"
...
Not used
Examples

```r
## beetle dataset
dose <- c(1.6907,1.7242,1.7552,1.7842,1.8113,1.8369,1.8610,1.8839)

totals <- c(59,60,62,63,59,62,60)

dead <- c(6,13,18,28,52,53,61,60)

prop_dead <- dead / totals

## summarize the model
summary.fit.ao <- summary.ao.glm (ao.glm (prop_dead ~ dose, weights = totals, link = ao.asym))
```

---

**summary.ao.qr**  
*Summarizing the results of an "ao.qr" object*

**Description**

Summary method of the function `ao.qr`

**Usage**

```r
## S3 method for class 'ao.qr'
summary(object, ...)
```

**Arguments**

- `object`  
  An object of class "ao.qr"

- `...`  
  Not used
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