Package 'ham'

October 28, 2025

Title Healthcare Analysis Methods

Version 1.1.0

Description Conducts analyses for healthcare program evaluations or intervention studies. Calculates regression analyses for standard ordinary least squares (OLS or linear) or logistic models. Performs regression models used for causal modeling such as differences-in-differences (DID) and interrupted time series (ITS) models. Provides limited interpretations of model results and a ranking of variable importance in models. Performs propensity score models, top-coding of model outcome variables, and can return new data with the newly formed variables. Also performs Cronbach's alpha for various scale items (e.g., survey questions). See Github URL for examples in the README file. For more details on the statistical methods, see Allen & Yen (1979, ISBN:0-8185-0283-5), Angrist & Pischke (2009, ISBN:9780691120355), Harrell (2016, ISBN:978-3-319-19424-0), Kline (1999, ISBN:9780415211581), Linden (2015) <doi:10.1177/1536867X1501500208>, Merlo (2006) <doi:10.1136/jech.2004.029454> Muthen & Satorra (1995) <doi:10.2307/271070>, and Rabe-Hesketh & Skrondal (2008, ISBN:978-1-59718-040-5).

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Encoding UTF-8

RoxygenNote 7.3.2

Depends R (>= 3.5.0)

LazyData true

URL https://github.com/szuniga07/ham

BugReports https://github.com/szuniga07/ham/issues

Imports methods

Suggests knitr, rmarkdown, testthat (>= 3.0.0)

Config/testthat/edition 3

VignetteBuilder knitr

NeedsCompilation no

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Repository CRAN

Date/Publication 2025-10-28 21:20:06 UTC

Contents

`alpha` *Calculates Cronbach's alpha on scale items*

Description

Performs Cronbach's alpha of specified items from a data frame. Cronbach's Alpha is a formula for estimating the internal consistency reliability of a measurement instrument such as survey items (see Allen & Yang, 1979; Kline, 1999). Survey items can have 2 or more categories such as 5-point scales and contain 2 or more items.

Usage

```
alpha(items, data)
```

Arguments

`items`	Vector of item names that form a scale (e.g., 5-point Likert scales)
`data`	Data frame object.

Value

A list object with Cronbach's alpha summary statistics.

References

Allen, M. J., & Yen, W. M. (1979). Introduction to Measurement Theory. Brooks/Cole. ISBN: 0-8185-0283-5. Kline, Paul (1999). Handbook of Psychological Testing (2nd ed). Routledge, New York. ISBN: 9780415211581.

Examples

```
alpha(items=c("i1","i2","i3","i4","i5"), data=cas)

# remove i1 as suggested in the previous example, returns higher alpha
alpha(items=c("i2","i3","i4","i5"), data=cas)
```

`assess` *Assess models with regression*

Description

Fit ordinary least squares (OLS) and logistic models. And fit models for causal inference such as differences-in-differences and interrupted time series. Run these models to evaluate program performance or test intervention effects (e.g., healthcare programs). Options are available for top coding the outcome variable as well as propensity scores. New data can optionally be returned that has these additional variables and constructed variables that are used for DID and ITS models.

Usage

```
assess(
  formula,
  data,
  regression = "none",
  did = "none",
  its = "none",
  intervention = NULL,
  int.time = NULL,
  treatment = NULL,
  interrupt = NULL,
  topcode = NULL,
  propensity = NULL,
  newdata = FALSE
)
```

Arguments

formula	a formula object. Use 'Y ~ .' in DID and ITS models to only specify the constructed model variables (e.g., right side of the DID model: Y ~ Post.All + Int.Var + DID). If regression=ols or regression=logistic, 'Y ~ .' will use all variables in the data.frame as is standard in formulas.
data	a data.frame in which to interpret the variables named in the formula.
regression	Select a regression method for standard regression models (i.e., neither DID nor ITS). Options are regression="ols" (ordinary least squares AKA linear) or regression="logistic". Default is regression="none" for no standard regression model.
did	option for Differences-in-Differences (DID) regression. Select did="two" for models with only 2 time points (e.g., pre/post-test). Select did="many" for >= 3 time points (e.g., monthly time points in 12 months of data). Default is did="none" for no DID.
its	option for Interrupted Time Series (ITS) regression. Select its="one" for one group (e.g., intervention only). Select its="two" for two groups (intervention and control). Default is did="none" for no ITS.
intervention	optional intervention variable name selected for DID, ITS, and propensity score models that indicate which cases are in the intervention or not.
int.time	optional intervention time variable name selected for DID or ITS models. This indicates the duration of time relative to when the intervention started.
treatment	optional treatment start period variable name selected for DID models. Select 1 value from 'int.time' to indicate the start of the intervention.
interrupt	optional interruption (or intervention) period(s) variable name selected for ITS models. Select 1 or 2 values from 'int.time' to indicate the start and/or key intervention periods.
topcode	optional value selected to top code Y (or left-hand side) of the formula. Analyses will be performed using the new top coded variable.
propensity	optional character vector of variable names to perform a propensity score model. This requires the 'intervention' option to be selected. All models will include 'pscore' (propensity score) in the analysis as a covariate adjustment using the propensity score.
newdata	optional logical value that indicates if you want the new data returned. newdata=TRUE will return the data with any new columns created from the DID, ITS, propensity score, or top coding. The default is newdata=FALSE. No new data will be returned if none was created.

Value

a list of results from selected regression models. Will return new data if selected. And returns relevant model information such as variable names, type of analysis, formula, study information, and summary of ITS effects if analyzed.

References

Angrist, J. D., & Pischke, J. S. (2009). Mostly Harmless Econometrics: An Empiricist's Companion. Princeton University Press. ISBN: 9780691120355.

Linden, A. (2015). Conducting Interrupted Time-series Analysis for Single- and Multiple-group Comparisons. The Stata Journal, 15, 2, 480-500. https://doi.org/10.1177/1536867X1501500208

Examples

```
# ordinary least squares R^2
summary(assess(hp ~ mpg+wt, data=mtcars, regression="ols")$model)

# logistic
summary(assess(formula=vs~mpg+wt+hp, data=mtcars, regression="logistic")$model)

# OLS with a propensity score
summary(assess(formula=los ~ month+program, data=hosprog, intervention = "program",
regression="ols", propensity=c("female","age","risk"))$model)

# OLS: top coding los at 8.27 and propensity score means (top.los and pscore)
summary(assess(formula=los ~ month+program, data=hosprog, intervention = "program",
regression="ols", topcode=8.27, propensity=c("female","age","risk"),
newdata=TRUE)$newdata[, c("los", "top.los", "pscore")])

# differences-in-differences model: using 2 time periods, pre- and post-intervention
summary(assess(formula=los ~ ., data=hosprog, intervention = "program",
int.time="month", treatment = 5, did="two")$DID)

# DID model: using time points
summary(assess(formula=los ~ ., data=hosprog, intervention = "program",
int.time="month", treatment = 5, did="many")$DID)

#interrupted time series model: two groups and 1 interruption (interrupt= 5)
summary(assess(formula=los ~ ., data=hosprog, intervention = "program",
int.time="month", its="two", interrupt = 5)$ITS)

#interrupted time series model: two groups and 2 interruptions (interrupt= c(5,9))
summary(assess(formula=los ~ ., data=hosprog, intervention = "program",
int.time="month", its="two", interrupt = c(5,9))$ITS)
```

---

cas *Patient survey data*

Description

Artificial data of a 5 item hospital satisfaction survey for a Cronbach's alpha scale (cas).

Usage

```
cas
```

Format

cas:

An artificial data frame with 100 rows and 5 columns:

i1 - i5 5 survey items ...

Source

Artificial dataset created with rbinom for 5 items. For example, rbinom(100, 5, .9) generates 1 item. The prob argument is modified to give more or less consistent ratings per item.

---

group *Group level confidence intervals and between-group variation*

Description

Group level confidence intervals and between-group variation

Usage

```
group(
  x,
  y,
  z = NULL,
  dataf,
  dist = "t",
  conf.int = 0.95,
  increment = 1,
  rolling = NULL,
  quarts = FALSE,
  cluster = FALSE
)
```

Arguments

x	group predictor variable name.
y	outcome variable name.
z	time period variable name.
dataf	name of data frame object.
dist	indicate the distribution used for confidence intervals. Options for the t, binomial, and exact Poisson distributions. Options are 't', 'b', and 'p'. Default is the 't'.
conf.int	select the confidence interval level. Default is 0.95.
increment	specify the increment in time periods. Selecting 3 if data uses the month as the unit of time will give confidence intervals, each based on 3 months. Default is 1.

`rolling` indicate the number of time periods for the 'rolling average'. The rolling average consists of >1 time periods but subsequent point estimate increase by a unit of 1. For example, the common 12-month rolling average is based on months 1-12 of data, followed by the next estimate using months 2-13, 3-14, and so on until the last month in the data has been reached. Default is NULL.

`quarts` logical TRUE or FALSE that indicates whether to convert continuous x into 4 groups based on quartiles of x. Default is FALSE.

`cluster` logical TRUE or FALSE to generate measures of between-group variation such as the Intra-Class Correlation, Median Odds Ratio, or Design Effect. Default is FALSE. Uses binary outcome formula (between-group variance/(between-group variance + (3.14^2/3)) for ICC in Rabe-Hesketh which may be more appropriate for multilevel models. ICC, MOR, DE may be less reliable for binomial and Poisson distributions, use caution.

Value

list of confidence intervals for outcomes by groups, over time, and clustering measures. Some values returned in alphabetical and numerical order based on the group.

References

Merlo, J. (2006). A brief conceptual tutorial of multilevel analysis in social epidemiology: using measures of clustering in multilevel logistic regression to investigate contextual phenomena. Journal of Epidemiological Health, 60, 4, 290-297. https://doi.org/10.1136/jech.2004.029454.

Muthen, B. & Satorra, A. (1995). Complex Sample Data in Structural Equation Modeling. Sociological Methodology, 25, 267-316. https://doi.org/10.2307/271070.

Rabe-Hesketh, S. & Skrondal, A. (2008). Multilevel and Longitudinal Modeling Using Stata, Second Edition. ISBN: 978-1-59718-040-5.

Examples

```
#default t distribution results
group(x="program", y="los", dataf=hosprog)
#Rounding LOS to integers
hp2 <- hosprog; hp2$los2 <- round(hp2$los, 0)
#Exact Poisson confidence intervals
group(x="program", y="los2", dataf=hp2, dist="p")
#Rolling 6-months of data
group(x="program", y="los", z="month", dataf=hosprog, dist="t", rolling=6)
#Data returned separately for rolling 6-months of data and 3-month increments (e.g., quarters)
group(x="program", y="los", z="month", dataf=hosprog, dist="t", increment=3, rolling=6)
#Quartile groups for continuous risk score and returned clustering info
group(x="risk", y="los", dataf=hosprog, quarts=TRUE, cluster=TRUE)
#Binomial distribution with less conservative 90% confidence intervals
group(x="risk", y="rdm30", dataf=hosprog, quarts=TRUE, dist="b", conf.int=0.90)
```

hosp1 *Patient hospital program/intervention data, intervention group only*

Description

Patient hospital program/intervention data, intervention group only

Usage

```
hosp1
```

Format

`hosprog`**:**

An artificial data frame with 352 rows and 10 columns, intervention patients only:

survey Patient satisfaction survey mean score.

los Hospital length of stay (los)

cost Hospital stay cost

rdm30 Patient readmission within 30 days of discharge

death30 Patient death within 30 days of discharge

female Patient sex, 1 indicates female, 0 otherwise

age Patient age

risk Patient health risk score ranging from 0 to 1

month 12 month indicator (1 to 12)

program Indicates patient program participation. 1='yes', 0='no' ...

Source

hosp1 is a subset of the artificial dataset hosprog. It is the intervention group's data used for single group interrupted time series.

hosprog *Patient hospital program/intervention data*

Description

Patient hospital program/intervention data

Usage

```
hosprog
```

Format

`hosprog`:

An artificial data frame with 720 rows and 10 columns:

survey Patient satisfaction survey mean score.

los Hospital length of stay (los)

cost Hospital stay cost

rdm30 Patient readmission within 30 days of discharge

death30 Patient death within 30 days of discharge

female Patient sex, 1 indicates female, 0 otherwise

age Patient age

risk Patient health risk score ranging from 0 to 1

month 12 month indicator (1 to 12)

program Indicates patient program participation. 1='yes', 0='no' ...

Source

Artificial dataset created by using runif. The strength in the association between each variable is weighted by multiplying each subsequent predictor in increments of 1. For example, Y equals runif(720) multiplied by 1 plus runif(720) multiplied by 2 and so on. This allows some predictors to have stronger correlations with Y.

`importance` *Importance of variables based on partial chi-square statistic*

Description

Calculates partial chi-square (Wald chi-square for individual coefficients) from assess class objects. The importance is the partial chi-square minus its degrees of freedom based on the regression coefficients (Harrell, 2015). A higher chi-square indicates a larger effect by the predictors. Therefore, the rank of the chi-square can indicate which predictors can contribute more in explaining the variation in the outcome variable.

Usage

```
importance(model)
```

Arguments

`model`	an assess class object or models with lm or glm class.

Value

a data.frame object with partial X^2 summary statistics.

References

Harrell, F. E., Jr. (2016). Regression Modeling Strategies. Springer International Publishing. ISBN: 978-3-319-19424-0.

Examples

```
# OLS regression
importance(assess(mpg ~ hp + wt + cyl, data=mtcars, regression= "ols")$model)

# logistic regression
importance(assess(vs~mpg+wt+hp, data=mtcars, regression= "logistic")$model)
```

`interpret` *Interpret model output*

Description

Provides simple interpretations of regression coefficients and Cronbach's alpha from assess and alpha function classes. The interpretations describe coefficients and significance values as well as modifying item scales. The interpretations are text comments associated with specific parameters of the various analyses.

Usage

```
interpret(object)
```

Arguments

`object`	alpha and assess class objects: alpha, ITS, DID, linear (ols) or logistic models.

Value

a list with interpretations of Cronbach's alpha scales or regression model results.

Examples

```
# Interpret Cronbach's alpha
interpret(alpha(items=c("i1","i2","i3","i4","i5"), data=cas))

# interpret a standard linear (OLS) regression
hos1 <- assess(formula=survey ~ program + month, data=hosprog, regression= "ols")
interpret(hos1)$model

# interpret a differences-in-differences model
hos2 <- assess(formula=survey ~ ., data=hosprog, intervention = "program",
int.time="month", treatment = 5, did="two", newdata=TRUE)
interpret(hos2)$did  #interpret(hos2) also runs, returns ITS results if present
```

```
# interpret an interrupted time series model
hos3 <- assess(formula=survey ~ ., data=hosprog, intervention = "program",
int.time="month", its="two", interrupt = 5)
interpret(hos3)$its
```

`itsEffect` *Interrupted time series analysis effects*

Description

Calculates effects for intervention and control groups based on interrupted time series models from an assess class object. Within a period (or interruption), the effect that represents the trend during the period is calculated for both groups as well as the difference between the groups. Summary statistics are provided that include the effect sizes, t-statistic, standard errors, p-values, and 95% confidence intervals of the effect sizes. These values are provided for the intervention group, control group (when applicable), and the differences between the two groups (Linden, 2015). These values are automatically generated while running a model in assess.

Usage

```
itsEffect(model, type)
```

Arguments

`model`	an interrupted time series (ITS) model with the "lm" class,
`type`	analysis type for single or multiple groups and single or multiple time periods. If selected type="sgst", it is single-group single-time; type="sgmt", it is single-group multiple-time; type="mgst", it is multiple-group single-time; and type="mgmt", it is multiple-group multiple-time.

Value

a data.frame object of ITS effects and summary statistics. Generally run within the assess function.

References

Linden, Ariel. (2015). Conducting Interrupted Time-series Analysis for Single- and Multiple-group Comparisons. The Stata Journal, 2015, 15(2), 480-500, https://doi.org/10.1177/1536867X1501500208

Examples

```
i21 <- assess(formula=survey ~ ., data=hosprog, intervention = "program",topcode =NULL,
int.time="month", regression="none", interrupt=5, its="two", newdata=TRUE, propensity=NULL)
itsEffect(model= i21$ITS, type= "mgst")
```

`plot.assess` *Prediction plot of treatment and control groups for DID and ITS models*

Description

Provides partial prediction plots for treatment and control groups from difference-in-difference (DID) and interrupted time series (ITS) models. The graph will produce lines for treatment/intervention and control groups to gain understanding through a visual representation of the regression coefficients. By default, the treatment/intervention group is represented with a blue line, the control group is represented with a red line, and the counterfactual line, when available, is a dashed line. There are many options to change the plot.

Usage

```
## S3 method for class 'assess'
plot(
  x,
  y,
  xlim = NULL,
  ylim = NULL,
  main = NULL,
  lwd = NULL,
  col = NULL,
  tcol = NULL,
  cfact = FALSE,
  conf.int = FALSE,
  adj.alpha = NULL,
  add.means = FALSE,
  add.legend = NULL,
  cex = NULL,
  cex.axis = NULL,
  cex.lab = NULL,
  cex.main = NULL,
  cex.text = NULL,
  cex.legend = NULL,
  name = FALSE,
  coefs = FALSE,
  round.c = NULL,
  pos.text = NULL,
  arrow = FALSE,
  xshift = NULL,
  ...
)
```

Arguments

x	assess object. Either difference-in-difference or interrupted time series model with no covariate adjustment.
y	type of model, specify either 'DID' (difference-in-difference) or 'ITS' (interrupted time series). Will not accept other models.
xlim	specify plot's x-axis limits with a 2 value vector.
ylim	specify plot's y-axis limits with a 2 value vector.
main	the main title of the plot.
lwd	select the line width.
col	specify intervention and control group colors in a vector. Defaults to, if nothing selected, c("blue", "red") or "blue" for single-group Interrupted Time Series models.
tcol	specify treatment or interruption line color as a single character vector. Defaults to "gray" if nothing selected.
cfact	logical TRUE or FALSE that indicates whether a counterfactual line should be included. Defaults to FALSE.
conf.int	logical TRUE or FALSE that indicates whether a 95% confidence interval bands should be included. Defaults to FALSE.
adj.alpha	factor modifying the opacity alpha of the confidence interval bands, in the range of 0 to 1. Default is NULL; if conf.int=TRUE, defaults to 0.4.
add.means	adds group means by time period based on model data. Default is FALSE
add.legend	add a legend by selecting the location as "bottomright", "bottom", "bottomleft", "left", "topleft", "top", "topright", "right", "center". No legend if nothing selected.
cex	A numerical value giving the amount by which plotting text and symbols should be magnified relative to the default of 1.
cex.axis	The magnification to be used for axis annotation relative to the current setting of cex.
cex.lab	The magnification to be used for x and y labels relative to the current setting of cex.
cex.main	The magnification to be used for main titles relative to the current setting of cex.
cex.text	The magnification to be used for the text added into the plot relative to the current setting of 1.
cex.legend	The magnification to be used for the legend added into the plot relative to the current setting of 1.
name	logical TRUE or FALSE that indicates whether coefficient names should be added to the plot. Default is FALSE. It is overridden if coefs = TRUE.
coefs	logical TRUE or FALSE that indicates whether coefficient names, values, and p-value significance symbols ('+' p<0.10; '' *p<0.05;* '' **p<0.01;** '' p<0.001) should be added to the plot. Default is FALSE. coefs = TRUE overrides name = FALSE.

round.c	an integer indicating the number of decimal places to be used for rounding coefficient values.
pos.text	a list of named integer value(s) between 1 to 4 indicating the position of the text added into the plot. List name(s) should use coefficient variable names.
arrow	logical TRUE or FALSE that indicates whether arrows and coefficient names should be added to visualize effects. Default is FALSE.
xshift	shifts one or two of some of the overlapping intervention associated arrows along the x-axis for a better view. Vector values of at least length 1 or 2 can be positive or negative. And xshift should be specified in the order of the coefficients. Only 1 or 2 of the furthest right, vertical lines for the intervention group is shifted (i.e., not left). One line is shifted when there is 1 treatment/interruption period and 2 shifts for 2 periods. (e.g., "DID" before "DID.Trend" for DID models with argument did="many").
...	additional arguments.

Value

plot of partial predictions for treatment and control groups.

Examples

```
am2 <- assess(formula= los ~ ., data=hosprog, intervention = "program",
topcode =NULL, int.time="month", regression="none", treatment= 5,
interrupt=c(5,9), did="two", its="two", newdata=TRUE, propensity=NULL)
plot(am2, "DID", add.legend="bottomleft", ylim=c(2, 8))  #DID model, basic plot
plot(am2, "ITS", add.legend="top", ylim=c(2, 8))         #ITS model, basic plot
plot(am2, "DID", add.legend="topleft", main="DID study", col=c("dodgerblue","magenta"),
ylim=c(2, 8), lwd=6, cex=3, cex.axis=2, cex.lab=1.5, cex.main=3, cex.text=2,
arrow=TRUE, xshift=0.02, coefs=TRUE, round.c=2 )
plot(am2, "ITS", add.legend="top", xlim=c(-.5, 13), ylim=c(2, 8), main="ITS study",
col=c("cyan","hotpink"), tcol="springgreen", lwd=7, cex=2, cex.axis=2, cex.lab=2,
cex.main=3, cex.text=1.2, cex.legend=1.25, name=FALSE, coefs=TRUE, round.c=1,
pos.text= list("txp5"=3, "post9"=4), arrow=TRUE, xshift=c(.5, 1.5),
cfact=T, conf.int=TRUE, adj.alpha=0.2)
```

---

plot.group *Confidence interval graphs for group class objects*

Description

Confidence interval graphs for group class objects

Usage

```
## S3 method for class 'group'
plot(
  x,
  y = "group",
  order = "alpha",
  gcol = "blue",
  gband = FALSE,
  pcol = "red",
  overall = FALSE,
  ocol = "gray",
  oband = FALSE,
  tgt = NULL,
  tcol = "gray",
  tpline = NULL,
  tpcol = "gray",
  xlim = NULL,
  ylim = NULL,
  main = NULL,
  lwd = 1,
  adj.alpha = 0.4,
  cex = 1,
  cex.axis = 1,
  cex.lab = 1,
  cex.main = 1,
  cex.text = 1,
  round.c = 2,
  name = FALSE,
  abbrv = 5,
  ...
)
```

Arguments

x	group object.
y	type of confidence interval object, specify either 'group', 'time', or 'roll'.
order	specify confidence interval object order as 'alpha' or 'numeric' for alphabetical or numerical ordering in the 'group' graph.
gcol	pick confidence interval line colors for groups in the 'group' graph. Default is 'blue'.
gband	logical TRUE or FALSE that indicates whether group lines have confidence bands for trend over time results. Default is FALSE.
pcol	select point color for 'group' only confidence intervals. Default is 'red'.
overall	logical TRUE or FALSE that indicates whether to include the overall sample confidence intervals (i.e., not each group). Default is FALSE.
ocol	indicate the optional overall line color. Default is 'gray' when overall=TRUE.

oband	logical TRUE or FALSE that indicates whether to add an overall confidence band. Default is FALSE.
tgt	specify 1 or more values on the x-axis of where to add a target line. Default is NULL.
tcol	select a color for the target line. Default is 'gray'.
tpline	add one or time point vertical line(s) using x-axis values when y='time' or y='roll'. Default is NULL.
tpcol	specify a color for the time point line, tpline. Default is NULL.
xlim	specify plot's x-axis limits with a 2 value vector.
ylim	specify plot's y-axis limits with a 2 value vector.
main	the main title of the plot.
lwd	select the line width. Default is 1.
adj.alpha	factor modifying the opacity alpha of the confidence interval bands, in the range of 0 to 1. Default is 0.4.
cex	A numerical value giving the amount by which plotting text and symbols should be magnified relative to the default of 1.
cex.axis	The magnification to be used for axis annotation relative to the current setting of cex. Default is 1.
cex.lab	The magnification to be used for x and y labels relative to the current setting of cex. Default is 1.
cex.main	The magnification to be used for main titles relative to the current setting of cex. Default is 1.
cex.text	The magnification to be used for the text added into the plot relative to the current setting of 1.
round.c	an integer indicating the number of decimal places. Default is 2. to be used for rounding coefficient values.
name	logical TRUE or FALSE that indicates whether group names should be added to the 'time' or 'roll' plots. Default is FALSE.
abbrv	the minimum length of the abbreviations. Default is 5.
...	additional arguments.

Value

plot of group level confidence intervals, including estimates over time periods.

Examples

```
#Simple graph for confidence intervals using the t-distribution
gr1 <- group(x="program", y="los", z="month", dataf=hosprog, dist="t",
increment=3, rolling=6)
# Group level confidence intervals
plot(x=gr1, y="group", order="numeric", lwd=4, gcol= "blue", pcol="red",
overall=TRUE, oband=TRUE, ocol="gray", tcol="green", tgt=4.5,
cex=1, cex.axis=1, cex.lab=1, cex.text=2,
```

```
cex.main=1.25, name=TRUE, adj.alpha=.2)
#Trend plots over time in the 3 month increments (i.e., quarters)
plot(x=gr1, y="time", lwd=4, gcol=c("red", "blue"), gband=TRUE, overall=TRUE,
  oband=TRUE, ocol="gray", tcol="green", tgt=4, tpline=3,
  tpcol="yellow", name=TRUE, cex.axis=1, cex.lab=1, cex.text=2,
  cex.main=1.25, adj.alpha=.3)
#Plot for rolling 6-month averages
plot(x=gr1, y="roll", lwd=4, gcol=c("red", "blue"), gband=TRUE, overall=TRUE,
  oband=TRUE, ocol="gray", tcol="green", tgt=4, tpline=c(4,6),
  tpcol="yellow", name=TRUE, cex.axis=1, cex.lab=1, cex.text=2,
  cex.main=1.25, adj.alpha=.3)
```

`plot.importance` *Plot of variable importance ranked by partial chi-square statistic*

Description

Plots an importance class object. Produces a dot chart that places the predictor variable with the highest partial chi-square (Wald chi-square for individual coefficients) at the bottom. It is a metric of the partial chi-square minus its degrees of freedom (Harrell, 2015). Predictor variables with significant p-values at the 0.05 alpha are highlighted red. Consider graphical parameters of mar=c(4.2, 2, 3.5, 3) and oma = c(0, 0, 0, 3).

Usage

```
## S3 method for class 'importance'
plot(x, y, ...)
```

Arguments

`x`	importance object.
`y`	not currently used.
`...`	additional arguments.

Value

plot of variable importance, significant variables highlighted in red.

References

Harrell, F. E., Jr. (2016). Regression Modeling Strategies. Springer International Publishing. ISBN: 978-3-319-19424-0.

Examples

```
# OLS regression
plot(importance(assess(mpg ~ hp + wt + cyl, data=mtcars, regression= "ols")$model))

# logistic regression
plot(importance(assess(vs~mpg+wt+hp, data=mtcars, regression= "logistic")$model))
```

print.alpha *Print alpha results*

Description

Formats alpha class results to display summary statistics of scale information. These include the overall alpha, scale mean and standard deviation, item statistics, scale statistics if an item is removed from the scale, and the total sample size.

Usage

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

Arguments

x	alpha object from Cronbach's alpha calculation.
...	Additional arguments.

Value

formatted alpha results.

Examples

```
print(alpha(items=c("i1","i2","i3","i4","i5"), data=cas))
```

print.interpret *Print interpret object*

Description

Formats interpretations from interpret class objects. Provides simple interpretations of regression coefficients and Cronbach's alpha. Print specific model interpretations (or run all), returned in sentence and paragraph formats.

Usage

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

Arguments

x	interpret object.
...	Additional arguments.

Value

formatted interpret object results.

Examples

```
#Cronbach's alpha
print(interpret(alpha(items=c("i1","i2","i3","i4","i5"), data=cas)))

#' # interpret a standard linear (OLS) regression
hos1 <- assess(formula=survey ~ program + month, data=hosprog, regression= "ols")
print(interpret(hos1)$model)

# interpret a differences-in-differences model
hos2 <- assess(formula=survey ~ ., data=hosprog, intervention = "program",
int.time="month", treatment = 5, did="two", newdata=TRUE)
interpret(hos2)$did

# interpret an interrupted time series model
hos3 <- assess(formula=survey ~ ., data=hosprog, intervention = "program",
int.time="month", its="two", interrupt = 5)
interpret(hos3)$its
```

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