Package 'sla'

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Type Package

Title Two-Group Straight Line ANCOVA

Description Provides directly interpretable estimated coefficients for four models in connection with the two-group straight line ANCOVA problem: (A) the full model, which requires the fitting of two intercepts and two slopes; (B) a reduced model, which requires the fitting of a single intercept and single slope; (C) a reduced model, which requires the fitting of two separate intercepts and a single, common slope; and (D) a reduced model, which requires the fitting of a single, common intercept and two separate slopes. The summary function provides tests of fit for the (null) hypotheses of: (1) equivalent data sets, (2) equivalent slopes, and (3) equivalent intercepts.

Version 0.1

License GPL-2

Depends R (>= 3.0.2)

Suggests MASS, car, ISwR, knitr

VignetteBuilder knitr

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R topics documented:

`sla-package` *Two-Group, Straight-Line ANCOVA*

Description

Fits four linear models ("A", "B", "C", and "D") for the two-group, straight-line ANCOVA problem. (A) Model "A", the full model - fits two intercepts and two slopes (separate intercepts and slopes for each group); (B) Model "B", a reduced model - fits single intercept and single slope to all the data (ignoring group designation); (C) Model "C", a reduced model - fits two different intercepts and a single, common slope; (D) Model "D", a reduced model - fits a single, common intercept and two different slopes.

Details

Package:	sla
Type:	Package
Version:	1.0
Date:	2014-08-24
License:	GPL-2

The `'sla'` function fits four linear models ("A", "B", "C", and "D"), described above, in connection with the two-group, straight-line ANCOVA problem. The `'print'` function produces directly interpretable coefficients (intercepts and slopes) for each model "A", "B", "C", and "D". The `'summary'` function presents two tables. The top table displays the number of parameters fit, the residual degrees of freedom, the residual sum of squares, and the residual mean square for each model "A", "B", "C", and "D". The bottom table displays reductions in sums of squares, F statistics, and probabilities associated with models "B", "C", and "D",respectively, vs. model "A", thus testing for three null hypotheses: (1) equivalence of the data sets for the two groups, (2) equivalence of slopes for the two groups, and (3) equivalence of intercepts for the two groups.

Author(s)

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References

Dalgaard P (2002) *Introductory Statistics with R*. Springer.
Draper NR and Smith H (1998) *Applied Regression Analysis*. 3rd ed. Wiley.
Fox J (2008) *Applied Regression Analysis and General Linear Models*, 2nd ed. Sage.
Fox J and Weisberg S (2011) *An R Companion to Applied Regression*, 2nd ed. Sage.
Searle SR (1971) *Linear Models*, Wiley.
Venables WN and Ripley BD (2002) *Modern Applied Statistics with S*. 4th ed. Springer.

Examples

```
data(eqslo)
eqsloObj <- sla(eqslo)
eqsloObj
summary(eqsloObj)
attributes(eqsloObj)
eqsloObj$Mod.C # best fitting reduced model, equivalent slopes, different intercepts
summary(eqsloObj$Mod.C) # lm summary of Model C
plot(eqsloObj, mod = 'C') # plot of data eqslo, fitted lines with equal slopes, different intercepts
```

`eqint` *Equivalent Intercepts Data Frame - eqint*

Description

A small (input) data frame comprised of three columns in specific order: (1) Factor (group) variable at two levels, (2) x; a numerical regressor vector, and (3) y; a numerical criterion vector. The data are contrived to yield statistically equivalent intercepts but statistically different slopes.

Usage

```
data("eqint")
```

Format

A data frame with 10 observations on the following 3 variables.

`group` a factor with levels `one` `two`

`x` a numeric vector

`y` a numeric vector

Details

For the general two-group, straight line ANCOVA problem, the full model fits four parameters - two intercepts and two slopes, one intercept and one slope for each of the two groups. One of the reduced models fits three parameters - a single, common intercept, and two separate slopes. The data in the eqint data frame are contrived to yield statistically equivalent intercepts and statistically different slopes.

References

Dalgaard P (2002) *Introductory Statistics with R*. Springer. Draper NR and Smith H (1998) *Applied Regression Analysis*. 3rd ed. Wiley.
Fox J (2008) *Applied Regression Analysis and General Linear Models*, 2nd ed. Sage.
Venables WN and Ripley BD (2002) *Modern Applied Statistics with S*. 4th ed. Springer.

Examples

```
data(eqint)
str(eqint)
eqintObj <- sla(eqint)
plot(eqintObj, mod = "A")
```

---

eqslo *Equivalent Slopes Data Frame - eqslo*

Description

A small (input) data frame comprised of three columns in specific order: (1) Factor (group) variable at two levels, (2) x; a numerical regressor vector, and (3) y; a numerical criterion vector. The data are contrived to yield statistically equivalent slopes but statistically different intercepts.

Usage

```
data("eqslo")
```

Format

A data frame with 10 observations on the following 3 variables.

`group` a factor with levels `one` `two`

`x` a numeric vector

`y` a numeric vector

Details

For the general two-group, straight line ANCOVA problem, the full model fits four parameters - two intercepts and two slopes, one intercept and one slope for each of the two groups. One of the reduced models fits three parameters - two separate intercepts, and a single, common slope. The data in the eqslo data frame are contrived to yield statistically equivalent (parallel) slopes and statistically different intercepts.

References

Dalgaard P (2002) *Introductory Statistics with R*. Springer. Draper NR and Smith H (1998) *Applied Regression Analysis*. 3rd ed. Wiley.
Fox J (2008) *Applied Regression Analysis and General Linear Models*, 2nd ed. Sage.
Venables WN and Ripley BD (2002) *Modern Applied Statistics with S*. 4th ed. Springer.

Examples

```
data(eqslo)
str(eqslo)
eqsloObj <- sla(eqslo)
plot(eqsloObj, mod = "A")
```

`hellung` *hellung - data frame*

Description

Data frame concerned with growth conditions of *Tetrahymena* cells, collected by Per Hellung-Larsen. Data are from two groups of cell cultures where glucose was either added or not added to the growth medium. For each culture the average cell diameter and cell concentration were recorded.

Usage

```
data("hellung")
```

Format

A data frame with 51 observations on the following 3 variables.

`glucose` a factor with levels `Yes` `No`

`conc` a numeric vector

`diameter` a numeric vector

Details

A plot of the diameter by concentration data reveals that the data are distributed exponentially. For interest with two-group, straight line ANCOVA the raw conc and diameter values should be transformed to their common logs. Cf. hellunglog data frame in this package.

Source

Dalgaard P (2002) *Introductory Statistics with R*. Springer. pp. 172-182.

References

Dalgaard P (2002) *Introductory Statistics with R*. Springer.

Examples

```
data(hellung) # cf. hellunglog data frame
```

`hellunglog` *hellunglog - data frame*

Description

Data frame concerned with growth conditions of *Tetrahymena* cells, collected by Per Hellung-Larsen. Data are from two groups of cell cultures where glucose was either added or not added to the growth medium. For each culture the average cell diameter and cell concentration were recorded.

Usage

```
data("hellunglog")
```

Format

A data frame with 51 observations on the following 3 variables.

`glucose` a factor with levels `Yes` `No`

`log10conc` a numeric vector

`log10diam` a numeric vector

Details

A plot of the original diameter by concentration data (found in hellung data frame) reveals that the data are distributed exponentially. For interest with two-group, straight line ANCOVA the raw conc and diameter values have been transformed to their common logs, designated as log10conc and log10diam. Cf. hellung data frame in this package.

Source

Dalgaard P (2002) *Introductory Statistics with R*. Springer. pp. 172-182.

References

Dalgaard P (2002) *Introductory Statistics with R*. Springer.

Examples

```
data(hellunglog)
hellunglogObj <- sla(hellunglog)
hellunglogObj
summary(hellunglogObj)
plot(hellunglogObj, mod = "A")
```

sla *Two-Group, Straight-Line ANCOVA: Four Models*

Description

Fits four linear models ("A", "B", "C", and "D") for the two-group, straight-line ANCOVA problem. (A) Model "A", the full model - fits two intercepts and two slopes (separate intercepts and slopes for each group); (B) Model "B", a reduced model - fits single intercept and single slope to all the data (ignoring group designation); (C) Model "C", a reduced model - fits two different intercepts and a single, common slope; (D) Model "D", a reduced model - fits a single, common intercept and two different slopes.

Usage

```
sla(facxy, ...)
## Default S3 method:
sla(facxy, ...)
## S3 method for class 'sla'
print(x, ...)
## S3 method for class 'sla'
summary(object, ...)
## S3 method for class 'sla'
plot(x, modelType2Plot = "A", ...)
```

Arguments

facxy	a data frame with three columns in specific order: (1) factor (Group) variable, (2) numeric x-axis predictor, regressor (or independent) variable, and (3) numeric y-axis criterion (or dependent) variable.
x	an object of class 'sla', i.e., a list containing data frames, coefficients, and fitted models.
object	an object of class 'sla', i.e., a list containing data frames, coefficients, and fitted models.
modelType2Plot	a character letter, "A", "B", "C", or "D", to indicate which model, with its associated fitted lines (abline), to plot.
...	not used.

Value

Returns an object of class "sla", which is a list containing the following components:

Call	model call
INPUT.df	input data frame
Summary of Input Data Frame	produced from the generic function summary().
Mod.A	an object of class "lm" for the fit of Model A.

`Mod.B` an object of class "lm" for the fit of Model B.

`Mod.C` an object of class "lm" for the fit of Model C.

`Mod.D` an object of class "lm" for the fit of Model D.

`Fit.Table` a data frame containing a description of the fit, number of parameters estimated, residual degrees of freedom, residual sum of squares, and residual mean square for each model "lm" fit, i.e., for models A, B, C and D.

`Test.Table` a data frame containing a description of three tests of (reduced) models B, C, and D vs. the (full) model A, the degrees of freedom associated with the anova() comparison of the reduced and full models [note: always 2, 1, and 1], the difference between the residual sums of squares between the reduced and full models, the F statistic associated with the test, and the probability associated with the corresponding F statistic for the test.

`Fit.Table.Pretty` a data frame containing essentially the same information as in Fit.Table but displayed in a prettier format.

`Test.Table.Pretty` a data frame containing essentially the same information as in Test.Table but displayed in a prettier format.

Note

(1) The hellung data frame with conc and diameter raw values is available in the ISwR library from Dalgaard P (2002) *Introductory Statistics with R*. Springer.
(2) Simulated data sets (without setting the seed) using the code provided in the examples yield the desired outcomes 95 percent of the time.

Author(s)

W Greg Alvord

References

Dalgaard P (2002) *Introductory Statistics with R*. Springer.
Draper NR and Smith H (1998) *Applied Regression Analysis*. 3rd ed. Wiley.
Fox J (2008) *Applied Regression Analysis and General Linear Models*, 2nd ed. Sage.
Fox J and Weisberg S (2011) *An R Companion to Applied Regression*, 2nd ed. Sage.
Searle SR (1971) *Linear Models*, Wiley.
Venables WN and Ripley BD (2002) *Modern Applied Statistics with S*. 4th ed. Springer.

Examples

```
data(eqslo)
eqsloObj <- sla(eqslo)
eqsloObj
summary(eqsloObj)
attributes(eqsloObj)
eqsloObj$Mod.C # best fitting reduced model, equivalent slopes, different intercepts
summary(eqsloObj$Mod.C) # lm summary of Model C
```

```
plot(eqsloObj, mod = 'C') # plot of data eqslo, fitted lines with equal slopes, different intercepts
##
data(eqint)
eqintObj <- sla(eqint)
eqintObj
summary(eqintObj)
attributes(eqintObj)
eqintObj$Mod.D # best fitting reduced model, equivalent intercepts, different slopes
summary(eqintObj$Mod.D) # lm summary of Model D
plot(eqintObj, mod = 'D') # plot of data eqint, fitted lines with equal intercepts, different slopes
##
## See MASS, 4th ed., pp 139-144 for ANCOVA of whiteside data
##
library(MASS)
data(whiteside)
whitesideObj <- sla(whiteside)
summary(whitesideObj) # See MASS, 4th ed., pp 139-144 for ANCOVA of whiteside data
par(mfrow = c(2,2))
plot(whitesideObj, "A") # different intercepts and different slopes
plot(whitesideObj, "B") # common intercept and common slope
plot(whitesideObj, "C") # different intercepts, common slope
plot(whitesideObj, "D") # different slopes, common intercept
##
## See Dalgaard, pp. 172-182 for ANCOVA of (log10) hellung data
##
data(hellunglog)
hellunglogObj <- sla(hellunglog)
hellunglogObj
summary(hellunglogObj) # See Dalgaard, pp. 172-182 for ANCOVA of (log10) hellung data
par(mfrow = c(2,2))
plot(hellunglogObj, "A") # different intercepts and different slopes
plot(hellunglogObj, "B") # common intercept and common slope
plot(hellunglogObj, "C") # different intercepts, common slope
plot(hellunglogObj, "D") # different slopes, common intercept
##
## Simulate data for common slope, different intercepts
##
group <- c(rep('A', 50), rep('B', 50))
x <- rep(1:50, 2)
set.seed(50) #
y1 <- rnorm(50) + 4*.05*x[1:50]
set.seed(100)
y2 <- rnorm(50) + 7 + y1
y <- c(y1, y2)
esdf <- data.frame(group, x, y)
esdfObj <- sla(esdf)
esdfObj
summary(esdfObj)
par(mfrow = c(2,2))
plot(esdfObj, mod = 'A')
plot(esdfObj, mod = 'B')
plot(esdfObj, mod = 'C')
plot(esdfObj, mod = 'D')
```

```
##
## Simulate data for common intercept, different slopes
##
group <- c(rep('A', 50), rep('B', 50))
x <- rep(1:50, 2)
set.seed(49) #
y1 <- rnorm(50) + 1*.03*x[1:50]
set.seed(99) #
y2 <- rnorm(50) + 1*.25*x[51:100]
y <- c(y1, y2)
eidf <- data.frame(group, x, y)
eidfObj <- sla(eidf)
eidfObj
summary(eidfObj)
par(mfrow = c(2,2))
plot(eidfObj, mod = 'A')
plot(eidfObj, mod = 'B')
plot(eidfObj, mod = 'C')
plot(eidfObj, mod = 'D')
```

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