Package ‘easyreg’

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Description Performs analysis of regression in simple designs with quantitative treatments,
including mixed models and non linear models.
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R topics documented:

easyreg-package .................................................. 2
bl .............................................................. 3
data1 ........................................................ 5
data2 ........................................................ 6
data3 ........................................................ 7
data4 ........................................................ 7
data5 ........................................................ 8
er1 ............................................................ 8
er2 ............................................................ 12
regplot ......................................................... 14
regtest ......................................................... 18

Index 21
Description

Performs analysis of regression in simple designs with quantitative treatments, including mixed models and non-linear models.

Details

- Package: easyreg
- Type: Package
- Version: 4.0
- Date: 2019-10-13
- License: GPL (>= 2)

Author(s)

Emmanuel Arnhold <emmanuelarnhold@yahoo.com.br>

References


Examples

```r
# analysis in completely randomized design
data(data1)
r1=er2(data1)
names(r1)
r1
r1[1]

# analysis in randomized block design
data(data2)
r2=er2(data2, design=2)
r2

# analysis in latin square design
data(data3)
```
$r^3 = \text{er2(data3, design=3)}$

# analysis in several latin squares
$\text{data(data4)}$
$r^4 = \text{er2(data4, design=4)}$

# the growth of Zagorje turkeys \cite{Kaps and Lamberson, 2009}

weight = c(44, 66, 100, 150, 265, 370, 455, 605, 770)
age = c(1, 7, 14, 21, 28, 35, 42, 49, 56)
data2 = \text{data.frame(age, weight)}$

# two linear
$\text{regplot(data2, model=5, start=c(25, 6, 10, 20))}$
$\text{regplot(data2, model=5, start=c(25, 6, 10, 20), digits=2)}$

# in other function
$\text{bl(data2)}$

---

**bl**

*Analysis of broken line regression*

**Description**

The function performs analysis of broken line regression

**Usage**

\[
\text{bl(data, model=1, alpha=0.05, xlab = "Explanatory Variable", ylab = "Response Variable", position = 1, digits = 6, mean = TRUE, sd=FALSE, legend = TRUE, lty=2, col="dark blue", pch=20, xlim="default.x",ylim="default.y", ...)}
\]

**Arguments**

- **data**: data is a data.frame The first column contain the treatments (explanatory variable) and the second column the response variable
- **model**: model for analysis: 1=two linear; 2=linear plateau (LRP); 3= model 1 with blocks random; 4 = model 2 with blocks random
- **alpha**: significant level for confidence intervals (parameters estimated)
- **xlab**: name of explanatory variable
- **ylab**: name of response variable
position  position of equation in the graph
top=1
bottomright=2
bottom=3
bottomleft=4
left=5
topleft=6 (default)
topright=7
right=8
center=9
digits number of digits (default=6)
mean mean=TRUE (plot mean of data) mean=FALSE (plot all data)
sd sd=FALSE (plot without standard deviation) sd=TRUE (plot with standard deviation)
legend legend=TRUE (plot legend) legend=FALSE (not plot legend)
lty line type
col line color
pch point type
xlim limits for x
ylim limits for y
... others graphical parameters (see par)

Value

Returns coefficients of the models, t test for coefficients, knot (break point), R squared, adjusted R squared, AIC, BIC, residuals and shapiro-wilk test for residuals.

Author(s)

Emmanuel Arnhold <emmanuelarnhold@yahoo.com.br>

References


See Also

lm, ea1(easyanova package), er1
Examples

# the growth of Zagorje turkeys (Kaps and Lamberson, 2009)
weight=c(44,66,100,150,265,370,455,605)
age=c(1,7,14,21,28,35,42,49)
data2=data.frame(age,weight)

# two linear
regplot(data2, model=5, start=c(25,6,10,20))
bl(data2, digits=2)

#linear and quadratic plateau
x=c(0,1,2,3,4,5,6)
y=c(1,2,3,6.1,5.9,6,6.1)
data=data.frame(x,y)
bl(data, model=2, lty=1, col=1, digits=2, position=8)

# effect os blocks
x=c(1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8)
y=c(4,12,9,20,16,25,21,31,28,42,33,46,33,46,34,44)
blocks=rep(c(1,2),8)
dat=data.frame(x,blocks,y)
bl(dat, 3)
bl(dat,4, sd=TRUE)
bl(dat,4, mean=FALSE)

data1: Sampaio (2010): page 134

Description

Quantitative treatments in completely randomized design.

Usage

data(data1)
**Format**

A data frame with 24 observations on the following 2 variables.

- `treatment` a numeric vector
- `gain` a numeric vector

**References**


**Examples**

```r
data(data1)
summary(data1)
```

---

**Description**

Quantitative treatments in randomizad block design.

**Usage**

```r
data(data2)
```

**Format**

A data frame with 25 observations on the following 3 variables.

- `protein_level` a numeric vector
- `litter` a factor with levels `l1 l2 l3 l4 l5`
- `feed_conversion` a numeric vector

**References**


**Examples**

```r
data(data2)
summary(data2)
```
data3

**data3: fictional example**

---

**Description**

Quantitative treatments in Latin square design.

**Usage**

```r
data(data3)
```

**Format**

A data frame with 25 observations on the following 4 variables.

- `treatment` a numeric vector
- `animal` a factor with levels `a1 a2 a3 a4 a5`
- `period` a factor with levels `p1 p2 p3 p4 p5`
- `milk_fat` a numeric vector

**Examples**

```r
data(data3)
summary(data3)
```

---

data4

**data4: fictional example**

---

**Description**

Quantitative treatments in several Latin squares design.

**Usage**

```r
data(data4)
```

**Format**

A data frame with 50 observations on the following 5 variables.

- `treatment` a numeric vector
- `square` a numeric vector
- `animal` a factor with levels `a1 a2 a3 a4 a5`
- `period` a factor with levels `p1 p2 p3 p4 p5`
- `milk_fat` a numeric vector
Examples

```r
data(data4)
summary(data4)
```

---

**data5**

*data5: fictional example*

---

**Description**

Quantitative treatments and three response variable.

**Usage**

```r
data(data5)
```

**Format**

A data frame with 24 observations on the following 4 variables.

- `treatments` a numeric vector
- `variable1` a numeric vector
- `variable2` a numeric vector
- `variable3` a numeric vector

**Examples**

```r
data(data5)
summary(data5)
```

---

**er1**

*Analysis of regression*

---

**Description**

The function performs analysis of some linear and nonlinear models.

**Usage**

```r
er1(data, model = 1, start = c(a = 1, b = 1, c = 1, d = 1, e = 1),
mixed=FALSE, digits=6, alpha=0.05)
```
Arguments

data

data is a data.frame

The first column should contain the treatments (explanatory variable) and the remaining columns the response variables.

model

define the model

1 = "y~a+b*x" linear
2 = "y~a+b*x+c*x^2" quadratic
3 = "y ~ a + b * (x - c) * (x <= c)" linear plateau
4 = "y ~ (a + b * x + c * I(x^2)) * (x <= -0.5 * b/c) + (a + I(-b^2/(4 * c))) * (x > -0.5 * b/c)" quadratic plateau
5 = "ifelse(x>=d,(a-c*d)+(b+c)*x, a+b*x)" two linear
6 = "y~a*exp(b*x)" exponential
7 = "y~a*(1+b*(exp(-c*x)))^(-1)" logistic
8 = "y~a*(1-b*(exp(-c*x)))^3" van bertalanffy
9 = "y~a*(1-b*(exp(-c*x)))" brody
10 = "y~a*exp(-b*exp(-c*x))" gompertz
11 = "y~(a*x^b)*exp(-c*x)" lactation curve
12 = "y ~ a + b * (1 - exp(-c * x))" ruminal degradation curve
13 = "y~(a(1+exp(2-4*e*(x-e)))+b/(1+exp(2-4*d*(x-e))))" logistic bi-compartmental
14 = "y~a*(x^b)" exponential (allometric model)
15 = "y~a+b*x+c*x^2+d*x^3" cubic
16 = "y~a/(1+b*(exp(-c*x)))^d" richards
17 = "y~(a*(d+ (b*d)-(a*d) )*(1-exp(-c*(x-t1)))/(1-exp(-c*(t2-t1))))^(1/d)" schnute

start

start values of the iteration process

mixed

FALSE/default for fixed model or TRUE for mixed model

digits

number of digits in results (default=6)

alpha

significant level of the confident intervals for parameters in the models

Value

Returns coefficients of the models, t test for coefficients, R squared, adjusted R squared, AIC, BIC, and residuals of the model

Author(s)

Emmanuel Arnhold <emmanuelarnhold@yahoo.com.br>

References


See Also

nls, nls2

Examples

# weights of an Angus cow at ages from 8 to 108 months (Kaps and Lamberson, 2009)

weight=c(280,340,430,480,550,580,590,600,590,600)
age=c(8,12,24,36,48,60,72,84,96,108)
data1=data.frame(age, weight)

# linear
er1(data1, model=1)

# quadratic
er1(data1, model=2)

# linear plateau
er1(data1, model=3)

# quadratic plateau
er1(data1, model=4)

# two linear
er1(data1, model=5, start=c(250,6,2,50))

# exponential
er1(data1, model=6, start=c(250,0.05))

# logistic
er1(data1, model=7, start=c(600,4,0.05))

# van bertalanffy
er1(data1, model=8, start=c(600,2,0.05))

# brody
er1(data1, model=9, start=c(600,4,0.05))

# gompertz
er1(data1, model=10, start=c(600,4,0.05))

# richards
er1(data1, model=16, start=c(600,2,0.05,1.4))

# allometric
er1(data1, model=14)

# cubic
er1(data1, model=15)
# growth of Zagorje turkeys (Kaps and Lamberson, 2009)

weight = c(44, 66, 100, 150, 265, 370, 455, 605, 770)
age = c(1, 7, 14, 21, 28, 35, 42, 49, 56)
data2 = data.frame(age, weight)

# two linear
er1(data2, model = 5, start = c(25, 6, 10, 20))

# gain weight measurements of turkey poults (Kaps and Lamberson, 2009)
methionine = c(80, 85, 90, 95, 100, 105, 110, 115, 120)
gain = c(102, 115, 125, 133, 140, 141, 142, 140, 142)
data3 = data.frame(methionine, gain)

# linear
er1(data3, model = 1)

# quadratic
er1(data3, model = 2)

# linear plateau
er1(data3, model = 3)

# quadratic plateau
er1(data3, model = 4)

# lactation curve
milk = c(25, 24, 26, 28, 30, 31, 27, 26, 25, 24, 23, 24, 22, 21, 22, 20, 21, 19, 18, 17, 18, 16, 17, 15, 16, 14)
data4 = data.frame(days, milk)
er1(data4, model = 11, start = c(16, 0.25, 0.004))

# ruminal degradation
time = c(2, 6, 9, 24, 48, 72, 96)
deg = c(20, 33, 46, 55, 66, 72, 76)
data5 = data.frame(time, deg)
er1(data5, model = 12)

# logistic bi-compartmental (gas production)
time = c(0, 12, 24, 36, 48, 60, 72, 84, 96, 108, 120, 144, 168, 192)
gas = c(0.002, 3.8, 8, 14.5, 16, 16.5, 17, 17.4, 17.9, 18.1, 18.8, 19, 19.2, 19.3)
data6=data.frame(time,gas)

er1(data6, model=13, start=c(19,4,0.025,0.004,5))

# Schnute model
# Pacific halibut weight-age data of females (Terrance and Richard, 1999)

age=c(4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,
19,20,21,22,23,24,28)
weight=c(1.7,2,3.9, 4.2,6.4,7.6,10.9,14.9,18.2,21.6,
25.4,28.8,30.9,35.6,37.9,34.7,44.8,52.6,49.1,56.7,58.6,54.1)

halibut=data.frame(age,weight)

t1=min(halibut[,2])
t2=max(halibut[,2])

er1(halibut,model=17, start=c(a=t1,b=t2,c=0.15,d=-0.50))

---

er2

**Analysis of polynomial regression**

**Description**

The function performs analysis of polynomial regression in simple designs with quantitative treatments.

**Usage**

`er2(data, design = 1, list = FALSE, type = 2)`

**Arguments**

data: data is a data.frame
data frame with two columns, treatments and response (completely randomized design)
data frame with three columns, treatments, blocks and response (randomized block design)
data frame with four columns, treatments, rows, cols and response (Latin square design)
data frame with five columns, treatments, square, rows, cols and response (several Latin squares)
design 1 = completely randomized design
2 = randomized block design
3 = latin square design
4 = several latin squares

list FALSE = a single response variable
TRUE = multivariable response

type type is form of obtain sum of squares
1 = a sequential sum of squares
2 = a partial sum of squares

Details
The response and the treatments must be numeric. Other variables can be numeric or factors.

Value
Returns analysis of variance, models, t test for coefficients and R squared and adjusted R squared.

Author(s)
Emmanuel Arnhold <emmanuelarnhold@yahoo.com.br>

References


See Also
lm, lme(package nlme), ea1(package easyanova), er1

Examples
# analysis in completely randomized design
data(data1)
r1=er2(data1)
names(r1)
r1
r1[1]

# analysis in randomized block design
data(data2)
r2=er2(data2, design=2)
r2

# analysis in latin square design
data(data3)
r3=er2(data3, design=3)
r3

# analysis in several latin squares
data(data4)
r4=er2(data4, design=4)
r4

# data
treatments=rep(c(0.5,1.5,2,2.5,3), c(3,3,3,3,3,3))
r1=rnorm(18,60,3)
r2=r1*1:18
r3=r1*18:1
r4=r1*c(c(1:10),10,10,10,10,10,10,10,10,10)
data6=data.frame(treatments,r1,r2,r3, r4)

# use the argument list = TRUE
er2(data6, design=1, list=TRUE)

---

**regplot**

Plot data and equation

**Description**

The function plot data and equation

**Usage**

```r
regplot(data, model=1, start=c(a=1,b=1,c=1,d=1,e=1), xlab="Explanatory Variable", ylab="Response Variable", position=1, digits=6, mean=TRUE, sd=FALSE, legend = TRUE, lty=2, col="dark blue", pch=20, xlim="defalt.x",ylim="defalt.y",...)
```

**Arguments**

data: data is a data.frame The first column contain the treatments (explanatory variable) and the remaining column the response variable

model: define the model

1 = "y~a+b*x" linear
2 = "y~a+b*x+c*x^2" quadratic
3 = "y ~ a + b * (x - c) * (x <= c)" linear plateau
4 = "y ~ (a + b * x + c * I(x^2)) * (x <= -0.5 * b/c) + (a + I(-b^2/(4 * c))) * (x > -0.5 * b/c)" quadratic plateau
5 = "ifelse(x>=d,(a-c*d)+(b+c)*x, a+b*x)" two linear
6 = "y~a*exp(b*x)" exponential
7 = "y~a*(1+b*(exp(-c*x)))^1" logistic
8 = "y~a*(1-b*(exp(-c*x))^3" van bertalanffy
9 = "y~a*(1-b*(exp(-c*x)))" brody
10 = "y~a*exp(-b*exp(-c*x))" gompertz
11 = "y~(a*x*b)*exp(-c*x))" lactation curve
12 = "y~a + b * (1 - exp(-c * x))" ruminal degradation curve
13 = "y~(a/(1+exp(2-4*c*(x-e)))+b/(1+exp(2-4*d*(x-e))))" logistic bi-compartmental
14 = "y~a*(x^b)" exponential (allometric model)
15 = "y~a*b*x+c*x^2+d*x^3" cubic
16 = "y~a/(1+b*(exp(-c*x)))^d" richards
17 = "y~(a^d+ ((b^d)-(a^d) )*((1-exp(-c*(x-t1)))/ (1-exp(-c*(t2-t1))))^((1/d))" schnute

start start (iterations) values of model
xlab names of variable x
ylab names of variable y
position position of equation in the graph
top=1
bottomright=2
bottom=3
bottomleft=4
left=5
topleft=6 (default)
topright=7
right=8
center=9
digits number of digits (defalt=6)
mean mean=TRUE (plot mean of data) mean=FALSE (plot all data)
sd sd=FALSE (plot without standard deviation) sd=TRUE (plot with standard deviation)
legend legend=TRUE (plot legend) legend=FALSE (not plot legend)
lty line type
col line color
pch point type
xlim limits for x
ylim limits for y
... others graphical parameters (see par)

Author(s)
Emmanuel Arnhold <emmanuelarnhold@yahoo.com.br>
References


See Also

nls,er1,er2,bl

Examples

# weights of Angus cow at ages from 8 to 108 months (Kaps and Lamberson, 2009)
weight=c(280,340,430,480,550,580,590,600,590,600)
age=c(8,12,24,36,48,60,72,84,96,108)
data1=data.frame(age, weight)

# linear
regplot(data1, model=1, digits=3, position=3, ylab="weight", xlab="age")

# quadratic
regplot(data1, model=2, digits=3, position=3, col=1, ylim=c(200,700))

# linear plateau
regplot(data1, model=3, ylab="weight", xlab="age", lty=5, col="dark green", position=3, ylim=c(200,700), xlim=c(0,150), lwd=2)

# quadratic plateau
regplot(data1, model=4, ylab="weight", xlab="age")

# two linear
regplot(data1, model=5, start=c(250,6,2,50),digits=3, position=3 )

# exponential
regplot(data1, model=6, start=c(250,0.05))

# logistic
regplot(data1, model=7, start=c(600,4,0.05))

# van bertalanffy
regplot(data1, model=8, start=c(600,2,0.05))

# brody
regplot(data1, model=9, start=c(600,4,0.05))

# gompertz
regplot(data1, model=10, start=c(600,4,0.05))

# Richards
regplot(data1, model=16, start=c(600,2,0.05,1.4))

# allometric
regplot(data1, model=14)

# cubic
regplot(data1, model=15)

# growth of Zagorje turkeys (Kaps and Lamberson, 2009)

weight=c(44,66,100,150,265,370,455,605,770)
age=c(1,7,14,21,28,35,42,49,56)

data2=data.frame(age,weight)

# two linear
regplot(data2, model=5, start=c(25,6,10,20))

# weight gain measurements of turkey poults (Kaps and Lamberson, 2009)
methionine=c(80,85,90,95,100,105,110,115,120)
gain=c(102,115,125,133,140,141,142,140,142)

data3=data.frame(methionine, gain)

# linear
regplot(data3, model=1)

# quadratic
regplot(data3, model=2)

# linear plateau
regplot(data3, model=3)

# quadratic plateau
regplot(data3, model=4)

# lactation curve
milk=c(25,24,26,28,30,31,27,26,25,24,23,24,22,22,20,21,19,18,17,18,18,16,17,15,16,14)

data4=data.frame(days,milk)

regplot(data4, model=11, start=c(16,0.25,0.004))

# ruminal degradation
time=c(2,6,9,24,48,72,96)
deg=c(20,33,46,55,66,72,76)
data5=data.frame(time,deg)

regplot(data5, model=12)

# logistic bi-compartmental (gas production)
time=c(0,12,24,36,48,60,72,84,96,108,120,144,168,192)
gas=c(0.002,3.8,8,14.5,16,16.5,17,17.4,17.9,18.1,18.8,19,19.2,19.3)
data6=data.frame(time,gas)

regplot(data6, model=13, start=c(19,4,0.025,0.004,5))

# multiple curves
time=c(0,12,24,48,64,72,96)
t1=c(36,48,59,72,85,86,87)
t2=c(14,25,36,49,59,65,72)
t3=c(55,78,86,87,86,87,88)
data=data.frame(time,t1,t2,t3)

regplot(data, model=12)
regplot(data, model=4)

# include standard deviation in graph
data(data1)

regplot(data1, sd=TRUE)

# Schnute model
# pacific halibut weight-age data of females (Terrance and Richard, 1999)
age=c(4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,28)
weight=c(1.7,2,3.9,4.2,6.4,7.6,10.9,14.9,18.1,21.6,25.4,28.8,30.9,35.6,37.9,34.7,44.8,52.6,49.1,56.7,58.6,54.1)
halibut=data.frame(age,weight)

t1=min(halibut[,2])
t2=max(halibut[,2])

regplot(halibut,model=17,start=c(t1,t2,0.22,-0.63), ylim=c(0,100))
Description

This function performs test of models and parameters

Usage

regtest(data, model = 1, start = c(a = 1, b = 1, c = 1, d = 1, e = 1))

Arguments

data: data is a data.frame. The first column contains explanatory variable, second column contains treatments and the third column contains the response variable.

model: define the model
1 = "y~a+b*x" linear
2 = "y~a+b*x+c*x^2" quadratic
3 = "y ~ a + b * (x - c) * (x <= c)" linear plateau
4 = "y ~ (a + b * x + c * I(x^2)) * (x <= -0.5 * b/c) + (a + I(-b^2/(4 * c))) * (x > -0.5 * b/c)" quadratic plateau
5 = "ifelse(x>=d,(a-c*d)+(b+c)*x, a+b*x)" two linear
6 = "y~a*exp(b*x)" exponential
7 = "y~a*(1+b*exp(-c*x))^(-1)" logistic
8 = "y~a*(1-b*(exp(-c*x)))^3" van bertalanffy
9 = "y~a*(1-b*(exp(-c*x)))" brody
10 = "y~a*exp(-b*exp(-c*x))" gompertz
11 = "y~(a*x^n)*exp(-c*x)" lactation curve
12 = "y ~ a + b * (1 - exp(-c * x))" ruminal degradation curve
13 = "y~(a(1-exp(2-4*c*(x-e)))+(b/(1+exp(2-4*d*(x-e))))" logistic bi-compartmental
14 = "y~a*(x^b)" exponential (allometric model)
15 = "y~a+b*x+c*x^2+d*x^3" cubic
16 = "y~a/(1+b*(exp(-c*x)))^d" richards
17 = "y=(a^d+ (b*d)-(a*c^d))(((1-exp(-c*(x-t1)))/(1-exp(-c*(t2-t1)))))^d(1/d)" schnute

start: start values of iterations

Value

Returns coefficients of the models, test for coefficients, AIC and BIC.

Author(s)

Emmanuel Arnhold <emmanuelarnhold@yahoo.com.br>

See Also

lm, ea1(easyanova package), pr2, regplot
Examples

```r
x <- c(1, 1, 2, 2, 3, 3, 4, 4)
y <- c(5, 5.3, 6, 8, 8.9, 12, 14, 18, 25, 25, 29, 32)
t <- c("t1", "t2", "t3", "t1", "t2", "t3", "t1", "t2", "t3", "t1", "t2", "t3")
data <- data.frame(x, t, y)
# linear
regtest(data, model=1)
# quadratic
regtest(data, model=2)
# exponential
regtest(data, model=6)
# ... etc
```
Index

bl, 3

data1, 5
data2, 6
data3, 7
data4, 7
data5, 8
easyreg (easyreg-package), 2
easyreg-package, 2
er1, 8
er2, 12

regplot, 14
regtest, 18