Package ‘lrmest’

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Type Package

Title Different Types of Estimators to Deal with Multicollinearity

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Depends R (>= 3.2.2)

Imports MASS,psych

Description When multicollinearity exists among predictor variables of the linear model, least square estimators does not provide a better solution for estimating parameters. To deal with multicollinearity several estimators are proposed in the literature. Some of these estimators are Ordinary Least Square Estimator (OLSE), Ordinary Generalized Ordinary Least Square Estimator (OGOLSE), Ordinary Ridge Regression Estimator (ORRE), Ordinary Generalized Ridge Regression Estimator (OGRRE), Restricted Least Square Estimator (RLSE), Ordinary Generalized Restricted Least Square Estimator (OGRLSE), Ordinary Mixed Regression Estimator (OMRE), Ordinary Generalized Mixed Regression Estimator (OGMRE), Liu Estimator (LE), Ordinary Generalized Liu Estimator (OGLE), Restricted Liu Estimator (RLE), Ordinary Generalized Restricted Liu Estimator (OGRLE), Stochastic Restricted Liu Estimator (SRLE), Ordinary Generalized Stochastic Restricted Liu Estimator (OGSRLE), Type (1),(2),(3) Liu Estimator (Type-1,2,3 LTE), Ordinary Generalized Type (1),(2),(3) Liu Estimator (Type-1,2,3 OGLTE), Type (1),(2),(3) Adjusted Liu Estimator (Type-1,2,3 ALTE), Ordinary Generalized Type (1),(2),(3) Adjusted Liu Estimator (Type-1,2,3 OGALTE), Almost Unbiased Ridge Estimator (AURE), Ordinary Generalized Almost Unbiased Ridge Estimator (OGAURE), Almost Unbiased Liu Estimator (AULE), Ordinary Generalized Almost Unbiased Liu Estimator (OGAULE), Stochastic Restricted Ridge Estimator (SRRE), Ordinary Generalized Stochastic Restricted Ridge Estimator (OGSRRE), Restricted Ridge Regression Estimator (RRRE) and Ordinary Generalized Restricted Ridge Regression Estimator (OGRRRE). To select the best estimator in a practical situation the Mean Square Error (MSE) is used. Using this package scalar MSE value of all the above estimators and Prediction Sum of Square (PRESS) values of some of the estimators can be obtained, and the variation of the MSE and PRESS values for the relevant estimators can be shown graphically.

LazyData yes

Repository CRAN

License GPL-2 | GPL-3

NeedsCompilation no

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R topics documented:

`lrmest-package` *Estimation of varies types of estimators in the linear model*

Description

To combat multicollinearity several estimators have been introduced. By using this package some of those estimators and corresponding scalar Mean Square Error (MSE) values and Prediction Sum of Square (PRESS) values (Only for some estimators) can be found easily. In addition graphical methods are available to determine the variation of MSE values of those estimators and the variation of PRESS values of some of the estimators.

Details

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Type:	Package
Version:	3.0
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In this package functions have been written for several types of estimators in the linear model. By using those functions relevant estimators can be found.

Author(s)

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References

Akdeniz, F. and Erol, H. (2003) *Mean Squared Error Matrix Comparisons of Some Biased Estimators in Linear Regression* in *Communications in Statistics - Theory and Methods*, volume **32** DOI:10.1081/STA-120025385

Arumairajan, S. and Wijekoon, P. (2015)] *Optimal Generalized Biased Estimator in Linear Regression Model* in *Open Journal of Statistics*, pp. 403–411

Hubert, M.H. and Wijekoon, P. (2006) *Improvement of the Liu estimator in the linear regression medel*, Chapter (4-8)

Liu, K. (1993) *A new class of biased estimate in linear regression* in *Communications in Statistics-Theory and Methods* **22**, pp. 393–402

Nagler, J. (Updated 2011) Notes on Ordinary Least Square Estimators

Theil, H. and Goldberger, A.S. (1961) *On pure and mixed statistical estimation in economics* in *International Economic review* **2**, pp. 65–78

Revan, M. (2009) *A stochastic restricted ridge regression estimator* in *Journal of Multivariate Analysis*, volume **100**, issue 8, pp. 1706–1716

Rong,Jian-Ying (2010) *Adjustive Liu Type Estimators in linear regression models* in *communication in statistics-simulation and computation*, volume **39** DOI:10.1080/03610918.2010.484120

Sarkara, N. (1992), *A new estimator combining the ridge regression and the restricted least squares methods of estimation* in *Communications in Statistics - Theory and Methods*, volume **21**, pp. 1987–2000. DOI:10.1080/03610929208830893

See Also

optimum, pcd

Examples

```
## Portland cement dataset is used.
data(pcd)
attach(pcd)
k<-c(0:3/10)
d<-c(-3:3/10)
r<-c(2.1930,1.1533,0.75850)
R<-c(1,0,0,0,0,1,0,0,0,0,1,0)
dpn<-c(0.0439,0.0029,0.0325)
delt<-c(0,0,0)
aa1<-c(0.958451,1.021155,0.857821,1.040296)
aa2<-c(0.345454,1.387888,0.866466,1.354454)
aa3<-c(0.344841,1.344723,0.318451,1.523316)
optimum(Y~X1+X2+X3+X4-1,r,R,dpn,delt,aa1,aa2,aa3,k,d,data=pcd)
 # Model without the intercept is considered.
 ## Use "press=TRUE" to get the optimum PRESS values only for some of
# the estimators.
```

`alte1` *Type (1) Adjusted Liu Estimator*

Description

This function can be used to find the Type (1) Adjusted Liu Estimated values, corresponding scalar Mean Square Error (MSE) value and Prediction Sum of Square (PRESS) value in the linear model. Further the variation of MSE and PRESS values can be shown graphically.

Usage

```
alte1(formula, k, d, aa, press = FALSE, data = NULL, na.action, ...)
```

Arguments

`formula`	in this section interested model should be given. This should be given as a `formula`.
`k`	a single numeric value or a vector of set of numeric values. See 'Examples'.
`d`	a single numeric value or a vector of set of numeric values. See 'Examples'.
`aa`	this is a set of scalars belongs to real number system. Values for "aa" should be given as a `vector`, format. See 'Details'.
`press`	if "press=TRUE" then all the PRESS values and its corresponding parameter values are returned. Otherwise all the scalar MSE values and its corresponding parameter values are returned.
`data`	an optional data frame, list or environment containing the variables in the model. If not found in `data`, the variables are taken from `environment(formula)`, typically the environment from which the function is called.
`na.action`	if the dataset contain `NA` values, then `na.action` indicate what should happen to those `NA` values.
`...`	currently disregarded.

Details

Since formula has an implied intercept term, use either `y ~ x - 1` or `y ~ 0 + x` to remove the intercept.

In order to get the best results, optimal values for `k`,`d` and `aa` should be selected.

The way of finding `aa` can be determined from Rong,Jian-Ying (2010) *Adjustive Liu Type Estimators in linear regression models* in *communication in statistics-simulation and computation*, volume **39**

Use `matplot` so as to obtain the variation of scalar MSE values and PRESS values graphically. See 'Examples'.

Value

If `k` and `d` are single numeric values then `alte1` returns the Type (1) Adjusted Liu Estimated values, standard error values, t statistic values, p value, corresponding scalar MSE value and PRESS value.

If `k` and `d` are vector of set of numeric values then `alte1` returns the matrix of scalar MSE values and if "press=TRUE" then `alte1` returns the matrix of PRESS values of Type (1) Adjusted Liu Estimator by representing `k` and `d` as column names and row names respectively.

Author(s)

P.Wijekoon, A.Dissanayake

References

Rong,Jian-Ying (2010) *Adjustive Liu Type Estimators in linear regression models* in *communication in statistics-simulation and computation*, volume **39** DOI:10.1080/03610918.2010.484120

See Also

matplot

Examples

```
## Portland cement data set is used.
data(pcd)
k<-0.1650
d<--0.1300
aa<-c(0.958451,1.021155,0.857821,1.040296)
alte1(Y~X1+X2+X3+X4-1,k,d,aa,data=pcd)     # Model without the intercept is considered.

 ## To obtain the variation of MSE of Type (1) Adjusted Liu Estimator.
data(pcd)
k<-c(0:5/10)
d<-c(5:20/10)
aa<-c(0.958451,1.021155,0.857821,1.040296)
msemat<-alte1(Y~X1+X2+X3+X4-1,k,d,aa,data=pcd)
matplot(d,alte1(Y~X1+X2+X3+X4-1,k,d,aa,data=pcd),type="l",ylab=c("MSE"),
main=c("Plot of MSE of Type (1) Adjusted Liu Estimator"),
cex.lab=0.6,adj=1,cex.axis=0.6,cex.main=1,las=1,lty=3)
text(y=msemat[1,],x=d[1],labels=c(paste0("k=",k)),pos=4,cex=0.6)
 ## Use "press=TRUE" to obtain the variation of PRESS of Type (1) Adjusted Liu Estimator.
```

---

alte2 *Type (2) Adjusted Liu Estimator*

Description

This function can be used to find the Type (2) Adjusted Liu Estimated values, corresponding scalar Mean Square Error (MSE) value and Prediction Sum of Square (PRESS) value in the linear model. Further the variation of MSE and PRESS values can be shown graphically.

Usage

```
alte2(formula, k, d, aa, press = FALSE, data = NULL, na.action, ...)
```

Arguments

- `formula` — in this section interested model should be given. This should be given as a `formula`.
- `k` — a single numeric value or a vector of set of numeric values. See 'Examples'.
- `d` — a single numeric value or a vector of set of numeric values. See 'Examples'.
- `aa` — this is a set of scalars belongs to real number system. Values for "aa" should be given as a `vector`, format. See 'Details'.
- `press` — if "press=TRUE" then all the PRESS values and its corresponding parameter values are returned. Otherwise all the scalar MSE values and its corresponding parameter values are returned.
- `data` — an optional data frame, list or environment containing the variables in the model. If not found in `data`, the variables are taken from `environment(formula)`, typically the environment from which the function is called.
- `na.action` — if the dataset contain `NA` values, then `na.action` indicate what should happen to those `NA` values.
- `...` — currently disregarded.

Details

Since formula has an implied intercept term, use either `y ~ x - 1` or `y ~ 0 + x` to remove the intercept.

In order to get the best results, optimal values for `k`,`d` and `aa` should be selected.

The way of finding `aa` can be determined from Rong,Jian-Ying (2010) *Adjustive Liu Type Estimators in linear regression models* in *communication in statistics-simulation and computation*, volume **39**

Use `matplot` so as to obtain the variation of scalar MSE values and PRESS values graphically. See 'Examples'.

Value

If `k` and `d` are single numeric values then `alte2` returns the Type (2) Adjusted Liu Estimated values, standard error values, t statistic values, p value, corresponding scalar MSE value and PRESS value.

If `k` and `d` are vector of set of numeric values then `alte2` returns the matrix of scalar MSE values and if "press=TRUE" then `alte2` returns the matrix of PRESS values of Type (2) Adjusted Liu Estimator by representing `k` and `d` as column names and row names respectively.

Author(s)

P.Wijekoon, A.Dissanayake

References

Rong,Jian-Ying (2010) *Adjustive Liu Type Estimators in linear regression models* in *communication in statistics-simulation and computation*, volume **39** DOI:10.1080/03610918.2010.484120

See Also

matplot

Examples

```
## Portland cement data set is used.
data(pcd)
k<-0.1650
d<--0.1300
aa<-c(0.958451,1.021155,0.857821,1.040296)
alte2(Y~X1+X2+X3+X4-1,k,d,aa,data=pcd)     # Model without the intercept is considered.

 ## To obtain the variation of MSE of Type (2) Adjusted Liu Estimator.
data(pcd)
k<-c(0:5/10)
d<-c(5:25/10)
aa<-c(0.958451,1.021155,0.857821,1.040296)
msemat<-alte2(Y~X1+X2+X3+X4-1,k,d,aa,data=pcd)
matplot(d,alte2(Y~X1+X2+X3+X4-1,k,d,aa,data=pcd),type="l",ylab=c("MSE"),
main=c("Plot of MSE of Type (2) Adjusted Liu Estimator"),
cex.lab=0.6,adj=1,cex.axis=0.6,cex.main=1,las=1,lty=3)
text(y=msemat[1,],x=d[1],labels=c(paste0("k=",k)),pos=4,cex=0.6)
 ## Use "press=TRUE" to obtain the variation of PRESS of Type (2) Adjusted Liu Estimator.
```

---

alte3 *Type (3) Adjusted Liu Estimator*

Description

This function can be used to find the Type (3) Adjusted Liu Estimatd values, corresponding scalar Mean Square Error (MSE) value and Prediction Sum of Square (PRESS) value in the linear model. Further the variation of MSE and PRESS values can be shown graphically.

Usage

```
alte3(formula, k, d, aa, press = FALSE, data = NULL, na.action, ...)
```

Arguments

formula	in this section interested model should be given. This should be given as a formula.
k	a single numeric value or a vector of set of numeric values. See 'Examples'.
d	a single numeric value or a vector of set of numeric values. See 'Examples'.

aa	this is a set of scalars belongs to real number system. Values for "aa" should be given as a vector, format. See 'Details'.
press	if "press=TRUE" then all the PRESS values and its corresponding parameter values are returned. Otherwise all the scalar MSE values and its corresponding parameter values are returned.
data	an optional data frame, list or environment containing the variables in the model. If not found in data, the variables are taken from environment(formula), typically the environment from which the function is called.
na.action	if the dataset contain NA values, then na.action indicate what should happen to those NA values.
...	currently disregarded.

Details

Since formula has an implied intercept term, use either y ~ x - 1 or y ~ 0 + x to remove the intercept.

In order to get the best results, optimal values for k,d and aa should be selected.

The way of finding aa can be determined from Rong,Jian-Ying (2010) *Adjustive Liu Type Estimators in linear regression models* in *communication in statistics-simulation and computation*, volume **39**

Use matplot so as to obtain the variation of scalar MSE values and PRESS values graphically. See 'Examples'.

Value

If k and d are single numeric values then alte3 returns the Type (3) Adjusted Liu Estimated values, standard error values, t statistic values, p value, corresponding scalar MSE value and PRESS value.

If k and d are vector of set of numeric values then alte3 returns the matrix of scalar MSE values and if "press=TRUE" then alte3 returns the matrix of PRESS values of Type (3) Adjusted Liu Estimator by representing k and d as column names and row names respectively.

Author(s)

P.Wijekoon, A.Dissanayake

References

Rong,Jian-Ying (2010) *Adjustive Liu Type Estimators in linear regression models* in *communication in statistics-simulation and computation*, volume **39** DOI:10.1080/03610918.2010.484120

See Also

matplot

Examples

```
## Portland cement data set is used.
data(pcd)
k<-0.1650
d<--0.1300
aa<-c(0.958451,1.021155,0.857821,1.040296)
alte3(Y~X1+X2+X3+X4-1,k,d,aa,data=pcd)      # Model without the intercept is considered.

 ## To obtain the variation of MSE of Type (3) Adjusted Liu Estimator.
data(pcd)
k<-c(50:51/5)
d<-c(300:305/10)
aa<-c(0.958451,1.021155,0.857821,1.040296)
msemat<-alte3(Y~X1+X2+X3+X4-1,k,d,aa,data=pcd)
matplot(d,alte3(Y~X1+X2+X3+X4-1,k,d,aa,data=pcd),type="l",ylab=c("MSE"),
main=c("Plot of MSE of Type (3) Adjusted Liu Estimator"),
cex.lab=0.6,adj=1,cex.axis=0.6,cex.main=1,las=1,lty=3)
text(y=msemat[1,],x=d[1],labels=c(paste0("k=",k)),pos=4,cex=0.6)
 ## Use "press=TRUE" to obtain the variation of PRESS of Type (3) Adjusted Liu Estimator.
```

---

aul *Almost Unbiased Liu Estimator*

Description

`aul` can be used to find the Almost Unbiased Liu Estimated values and corresponding scalar Mean Square Error (MSE) value in the linear model. Further the variation of MSE can be shown graphically.

Usage

```
aul(formula, d, data = NULL, na.action, ...)
```

Arguments

`formula`	in this section interested model should be given. This should be given as a `formula`.
`d`	a single numeric value or a vector of set of numeric values. See 'Examples'.
`data`	an optional data frame, list or environment containing the variables in the model. If not found in `data`, the variables are taken from `environment(formula)`, typically the environment from which the function is called.
`na.action`	if the dataset contain `NA` values, then `na.action` indicate what should happen to those `NA` values.
`...`	currently disregarded.

Details

Since formula has an implied intercept term, use either `y ~ x - 1` or `y ~ 0 + x` to remove the intercept.

Use `plot` so as to obtained the variation of scalar MSE values graphically. See 'Examples'.

Value

If `d` is a single numeric value then `aul` returns the Almost Unbiased Liu Estimated values, standard error values, t statistic values, p value and corresponding scalar MSE value.

If `d` is a vector of set of numeric values then `aul` returns all the scalar MSE values and corresponding parameter values of Almost Unbiased Liu Estimator.

Author(s)

P.Wijekoon, A.Dissanayake

References

Akdeniz, F. and Erol, H. (2003) *Mean Squared Error Matrix Comparisons of Some Biased Estimators in Linear Regression* in *Communications in Statistics - Theory and Methods*, volume **32** DOI:10.1081/STA-120025385

See Also

`plot`

Examples

```
## Portland cement data set is used.
data(pcd)
d<-0.05
aul(Y~X1+X2+X3+X4-1,d,data=pcd)   # Model without the intercept is considered.

## To obtain the variation of MSE of Almost Unbiased Liu Estimator.
data(pcd)
d<-c(1:10/10)
plot(aul(Y~X1+X2+X3+X4-1,d,data=pcd),
main=c("Plot of MSE of Almost Unbiased Liu Estimator"),type="b",
cex.lab=0.6,adj=1,cex.axis=0.6,cex.main=1,
las=1,lty=3,cex=0.6)
mseval<-data.frame(aul(Y~X1+X2+X3+X4-1,d,data=pcd))
smse<-mseval[order(mseval[,2]),]
points(smse[1,],pch=16,cex=0.6)
```

aur *Almost Unbiased Ridge Estimator*

Description

aur can be used to find the Almost Unbiased Ridge Estimated values and corresponding scalar Mean Square Error (MSE) value in the linear model. Further the variation of MSE can be shown graphically.

Usage

```
aur(formula, k, data = NULL, na.action, ...)
```

Arguments

formula	in this section interested model should be given. This should be given as a formula.
k	a single numeric value or a vector of set of numeric values. See 'Examples'.
data	an optional data frame, list or environment containing the variables in the model. If not found in data, the variables are taken from environment(formula), typically the environment from which the function is called.
na.action	if the dataset contain NA values, then na.action indicate what should happen to those NA values.
...	currently disregarded.

Details

Since formula has an implied intercept term, use either y ~ x - 1 or y ~ 0 + x to remove the intercept.

Use plot so as to obtained the variation of scalar MSE values graphically. See 'Examples'.

Value

If k is a single numeric values then aur returns the Almost Unbiased Ridge Estimated values, standard error values, t statistic values, p value and corresponding scalar MSE value.

If k is a vector of set of numeric values then aur returns all the scalar MSE values and corresponding parameter values of Almost Unbiased Ridge Estimator.

Author(s)

P.Wijekoon, A.Dissanayake

References

Akdeniz, F. and Erol, H. (2003) *Mean Squared Error Matrix Comparisons of Some Biased Estimators in Linear Regression* in *Communications in Statistics - Theory and Methods*, volume **32** DOI:10.1081/STA-120025385

See Also

plot

Examples

```
## Portland cement data set is used.
data(pcd)
k<-0.05
aur(Y~X1+X2+X3+X4-1,k,data=pcd)   # Model without the intercept is considered.

## To obtain the variation of MSE of Almost Unbiased Ridge Estimator.
data(pcd)
k<-c(0:10/10)
plot(aur(Y~X1+X2+X3+X4-1,k,data=pcd),
main=c("Plot of MSE of Almost Unbiased Ridge Estimator"),type="b",
cex.lab=0.6,adj=1,cex.axis=0.6,cex.main=1,las=1,lty=3,cex=0.6)
mseval<-data.frame(aur(Y~X1+X2+X3+X4-1,k,data=pcd))
smse<-mseval[order(mseval[,2]),]
points(smse[1,],pch=16,cex=0.6)
```

---

checkm — *Check the degree of multicollinearity present in the dataset*

Description

Degree of multicollinearity present in the dataset can be determined by using two type of indicators, called VIF and Condition Number.

Usage

```
checkm(formula, data, na.action, ...)
```

Arguments

`formula`	in this section interested model should be given. This should be given as a `formula`.
`data`	an optional data frame, list or environment containing the variables in the model. If not found in `data`, the variables are taken from `environment(formula)`, typically the environment from which the function is called.
`na.action`	if the dataset contain `NA` values, then `na.action` indicate what should happen to those `NA` values.
`...`	currently disregarded.

Details

If all the values of VIF > 10 implies that multicollinearity present.
If condition number < 10 ; There is not multicollinearity.
30 < condition number < 100 ; There is a multicollinearity.
condition number >100 ; Severe multicollinearity.

Value

checkm returns the values of two multicllinearity indicators VIF and Condition Number.

Author(s)

P.Wijekoon, A.Dissanayake

Examples

```
## Portland cement data set is used.
data(pcd)
checkm(Y~X1+X2+X3+X4,data=pcd)
```

---

liu *Liu Estimator*

Description

liu can be used to find the Liu Estimated values and corresponding scalar Mean Square Error (MSE) value in the linear model. Further the variation of MSE can be shown graphically.

Usage

```
liu(formula, d, data = NULL, na.action, ...)
```

Arguments

formula	in this section interested model should be given. This should be given as a formula.
d	a single numeric value or a vector of set of numeric values. See 'Examples'.
data	an optional data frame, list or environment containing the variables in the model. If not found in data, the variables are taken from environment(formula), typically the environment from which the function is called.
na.action	if the dataset contain NA values, then na.action indicate what should happen to those NA values.
...	currently disregarded.

Details

Since formula has an implied intercept term, use either `y ~ x - 1` or `y ~ 0 + x` to remove the intercept.

Use `plot` so as to obtain the variation of scalar MSE values graphically. See 'Examples'.

Value

If `d` is a single numeric values then `liu` returns the Liu Estimated values, standard error values, t statistic values, p value and corresponding scalar MSE value.

If `d` is a vector of set of numeric values then `liu` returns all the scalar MSE values and corresponding parameter values of Liu Estimator.

Author(s)

P.Wijekoon, A.Dissanayake

References

Liu, K. (1993) *A new class of biased estimate in linear regression* in *Communications in Statistics-Theory and Methods* **22**, pp. 393–402.

See Also

`plot`

Examples

```
## Portland cement data set is used.
data(pcd)
d<-0.05
liu(Y~X1+X2+X3+X4-1,d,data=pcd)   # Model without the intercept is considered.

## To obtain the variation of MSE of Liu Estimator.
data(pcd)
d<-c(0:10/10)
plot(liu(Y~X1+X2+X3+X4-1,d,data=pcd),main=c("Plot of MSE of Liu Estimator"),
type="b",cex.lab=0.6,adj=1,cex.axis=0.6,cex.main=1,las=1,lty=3,cex=0.6)
mseval<-data.frame(liu(Y~X1+X2+X3+X4-1,d,data=pcd))
smse<-mseval[order(mseval[,2]),]
points(smse[1,],pch=16,cex=0.6)
```

lte1 *Type (1) Liu Estimator*

Description

This function can be used to find the Type (1) Liu Estimated values, corresponding scalar Mean Square Error (MSE) value and Prediction Sum of Square (PRESS) value in the linear model. Further the variation of MSE and PRESS values can be shown graphically.

Usage

```
lte1(formula, k, d, press = FALSE, data = NULL, na.action, ...)
```

Arguments

`formula`	in this section interested model should be given. This should be given as a `formula`.
`k`	a single numeric value or a vector of set of numeric values. See 'Examples'.
`d`	a single numeric value or a vector of set of numeric values. See 'Examples'.
`press`	if "press=TRUE" then all the PRESS values and its corresponding parameter values are returned. Otherwise all the scalar MSE values and its corresponding parameter values are returned.
`data`	an optional data frame, list or environment containing the variables in the model. If not found in `data`, the variables are taken from `environment(formula)`, typically the environment from which the function is called.
`na.action`	if the dataset contain `NA` values, then `na.action` indicate what should happen to those `NA` values.
`...`	currently disregarded.

Details

Since formula has an implied intercept term, use either `y ~ x - 1` or `y ~ 0 + x` to remove the intercept.

Use `matplot` so as to obtain the variation of scalar MSE values and PRESS values graphically. See 'Examples'.

Value

If `k` and `d` are single numeric values then `lte1` returns the Type (1) Liu Estimated values, standard error values, t statistic values, p value, corresponding scalar MSE value and PRESS value.

If `k` and `d` are vector of set of numeric values then `lte1` returns the matrix of scalar MSE values and if "press=TRUE" then `lte1` returns the matrix of PRESS values of Type (1) Liu Estimator by representing `k` and `d` as column names and row names respectively.

Author(s)

P.Wijekoon, A.Dissanayake

References

Rong,Jian-Ying (2010) *Adjustive Liu Type Estimators in linear regression models* in *communication in statistics-simulation and computation*, volume **39** DOI:10.1080/03610918.2010.484120

See Also

matplot

Examples

```
## Portland cement data set is used.
data(pcd)
k<-0.1650
d<--0.1300
lte1(Y~X1+X2+X3+X4-1,k,d,data=pcd)  # Model without the intercept is considered.

## To obtain the variation of MSE of Type (1) Liu Estimator.
data(pcd)
k<-c(0:4/5)
d<-c(0:25/10)
msemat<-lte1(Y~X1+X2+X3+X4-1,k,d,data=pcd)
matplot(d,lte1(Y~X1+X2+X3+X4-1,k,d,data=pcd),type="l",ylab=c("MSE"),
main=c("Plot of MSE of Type (1) Liu Estimator"),
cex.lab=0.6,adj=1,cex.axis=0.6,cex.main=1,las=1,lty=3)
text(y=msemat[1,],x=d[1],labels=c(paste0("k=",k)),pos=4,cex=0.6)
 ## Use "press=TRUE" to obtain the variation of PRESS of Type (1) Liu Estimator.
```

---

lte2 *Type (2) Liu Estimator*

Description

This function can be used to find the Type (2) Liu Estimated values, corresponding scalar Mean Square Error (MSE) value and Prediction Sum of Square (PRESS) value in the linear model. Further the variation of MSE and PRESS values can be shown graphically.

Usage

```
lte2(formula, k, d, press = FALSE, data = NULL, na.action, ...)
```

Arguments

formula	in this section interested model should be given. This should be given as a formula.
k	a single numeric value or a vector of set of numeric values. See 'Examples'.
d	a single numeric value or a vector of set of numeric values. See 'Examples'.
press	if "press=TRUE" then all the PRESS values and its corresponding parameter values are returned. Otherwise all the scalar MSE values and its corresponding parameter values are returned.
data	an optional data frame, list or environment containing the variables in the model. If not found in data, the variables are taken from environment(formula), typically the environment from which the function is called.
na.action	if the dataset contain NA values, then na.action indicate what should happen to those NA values.
...	currently disregarded.

Details

Since formula has an implied intercept term, use either `y ~ x - 1` or `y ~ 0 + x` to remove the intercept.

Use matplot so as to obtain the variation of scalar MSE values and PRESS values graphically. See 'Examples'.

Value

If k and d are single numeric values then lte2 returns the Type (2) Liu Estimated values, standard error values, t statistic values, p value, corresponding scalar MSE value and PRESS value.

If k and d are vector of set of numeric values then lte2 returns the matrix of scalar MSE values and if "press=TRUE" then lte2 returns the matrix of PRESS values of Type (2) Liu Estimator by representing k and d as column names and row names respectively.

Author(s)

P.Wijekoon, A.Dissanayake

References

Rong,Jian-Ying (2010) *Adjustive Liu Type Estimators in linear regression models* in *communication in statistics-simulation and computation*, volume **39** DOI:10.1080/03610918.2010.484120

See Also

matplot

Examples

```
## Portland cement data set is used.
data(pcd)
k<-0.1650
d<--0.1300
lte2(Y~X1+X2+X3+X4-1,k,d,data=pcd)      # Model without the intercept is considered.

## To obtain the variation of MSE of Type (2) Liu Estimator.
data(pcd)
k<-c(0:4/10)
d<-c(5:25/10)
msemat<-lte2(Y~X1+X2+X3+X4-1,k,d,data=pcd)
matplot(d,lte2(Y~X1+X2+X3+X4-1,k,d,data=pcd),type="l",ylab=c("MSE"),
main=c("Plot of MSE of Type (2) Liu Estimator"),
cex.lab=0.6,adj=1,cex.axis=0.6,cex.main=1,las=1,lty=3)
text(y=msemat[1,],x=d[1],labels=c(paste0("k=",k)),pos=4,cex=0.6)
 ## Use "press=TRUE" to obtain the variation of PRESS of Type (2) Liu Estimator.
```

---

lte3 *Type (3) Liu Estimator*

Description

This function can be used to find the Type (3) Liu Estimated values, corresponding scalar Mean Square Error (MSE) value and Prediction Sum of Square (PRESS) value in the linear model. Further the variation of MSE and PRESS values can be shown graphically.

Usage

```
lte3(formula, k, d, press = FALSE, data = NULL, na.action, ...)
```

Arguments

`formula`	in this section interested model should be given. This should be given as a `formula`.
`k`	a single numeric value or a vector of set of numeric values. See 'Examples'.
`d`	a single numeric value or a vector of set of numeric values. See 'Examples'.
`press`	if "press=TRUE" then all the PRESS values and its corresponding parameter values are returned. Otherwise all the scalar MSE values and its corresponding parameter values are returned.
`data`	an optional data frame, list or environment containing the variables in the model. If not found in `data`, the variables are taken from `environment(formula)`, typically the environment from which the function is called.
`na.action`	if the dataset contain `NA` values, then `na.action` indicate what should happen to those `NA` values.
`...`	currently disregarded.

Details

Since formula has an implied intercept term, use either `y ~ x - 1` or `y ~ 0 + x` to remove the intercept.

Use `matplot` so as to obtain the variation of scalar MSE values and PRESS values graphically. See 'Examples'.

Value

If `k` and `d` are single numeric values then `lte3` returns the Type (3) Liu Estimated values, standard error values, t statistic values, p value, corresponding scalar MSE value and PRESS value.

If `k` and `d` are vector of set of numeric values then `lte3` returns the matrix of scalar MSE values and if "press=TRUE" then `lte3` returns the matrix of PRESS values of Type (3) Liu Estimator by representing `k` and `d` as column names and row names respectively.

Author(s)

P.Wijekoon, A.Dissanayake

References

Rong,Jian-Ying (2010) *Adjustive Liu Type Estimators in linear regression models* in *communication in statistics-simulation and computation*, volume **39** DOI:10.1080/03610918.2010.484120

See Also

`matplot`

Examples

```
## Portland cement data set is used.
data(pcd)
k<-0.1650
d<--0.1300
lte3(Y~X1+X2+X3+X4-1,k,d,data=pcd)   # Model without the intercept is considered.

## To obtain the variation of MSE of Type (3) Liu Estimator.
data(pcd)
k<-c(50:51/10)
d<-c(300:305/10)
msemat<-lte3(Y~X1+X2+X3+X4-1,k,d,data=pcd)
matplot(d,lte3(Y~X1+X2+X3+X4-1,k,d,data=pcd),type="l",ylab=c("MSE"),
main=c("Plot of MSE of Type (3) Liu Estimator"),
cex.lab=0.6,adj=1,cex.axis=0.6,cex.main=1,las=1,lty=3)
text(y=msemat[1,],x=d[1],labels=c(paste0("k=",k)),pos=4,cex=0.6)
 ## Use "press=TRUE" to obtain the variation of PRESS of Type (3) Liu Estimator.
```

mixe *Ordinary Mixed Regression Estimator*

Description

mixe can be used to obtain the Mixed Regression Estimated values and corresponding scalar Mean Square Error (MSE) value.

Usage

```
mixe(formula, r, R, dpn, delt, data, na.action, ...)
```

Arguments

formula	in this section interested model should be given. This should be given as a formula.
r	is a j by 1 matrix of linear restriction, $r = R\beta + \delta + \nu$. Values for r should be given as either a vector or a matrix. See 'Examples'.
R	is a j by p of full row rank $j \leq p$ matrix of linear restriction, $r = R\beta + \delta + \nu$. Values for R should be given as either a vector or a matrix. See 'Examples'.
dpn	dispersion matrix of vector of disturbances of linear restricted model, $r = R\beta + \delta + \nu$. Values for dpn should be given as either a vector (only the diagonal elements) or a matrix. See 'Examples'.
delt	values of $E(r) - R\beta$ and that should be given as either a vector or a matrix. See 'Examples'.
data	an optional data frame, list or environment containing the variables in the model. If not found in data, the variables are taken from environment(formula), typically the environment from which the function is called.
na.action	if the dataset contain NA values, then na.action indicate what should happen to those NA values.
...	currently disregarded.

Details

Since formula has an implied intercept term, use either y ~ x - 1 or y ~ 0 + x to remove the intercept.

In order to calculate the Mixed Regression Estimator the prior information are required. Therefore those prior information should be mentioned within the function.

Value

mixe returns the Mixed Regression Estimated values, standard error values, t statistic values,p value and corresponding scalar MSE value.

Author(s)

P.Wijekoon, A.Dissanayake

References

Theil, H. and Goldberger, A.S. (1961) *On pure and mixed statistical estimation in economics* in *International Economic review*, volume **2**, pp. 65–78

Examples

```
## Portland cement data set is used.
data(pcd)
r<-c(2.1930,1.1533,0.75850)
R<-c(1,0,0,0,0,1,0,0,0,0,1,0)
dpn<-c(0.0439,0.0029,0.0325)
delt<-c(0,0,0)
mixe(Y~X1+X2+X3+X4-1,r,R,dpn,delt,data=pcd) # Model without the intercept is considered.
```

---

ogalt1 — *Ordinary Generalized Type (1) Adjusted Liu Estimator*

Description

This function can be used to find the Ordinary Generalized Type (1) Adjusted Liu Estimated values, corresponding scalar Mean Square Error (MSE) value in the linear model. Further the variation of MSE values can be shown graphically.

Usage

```
ogalt1(formula, k, d, aa, data = NULL, na.action, ...)
```

Arguments

`formula`	in this section interested model should be given. This should be given as a `formula`.
`k`	a single numeric value or a vector of set of numeric values. See ‘Example’.
`d`	a single numeric value or a vector of set of numeric values. See ‘Example’.
`aa`	this is a set of scalars belongs to real number system. Values for “aa” should be given as a `vector`, format. See ‘Details’.
`data`	an optional data frame, list or environment containing the variables in the model. If not found in `data`, the variables are taken from `environment(formula)`, typically the environment from which the function is called.
`na.action`	if the dataset contain `NA` values, then `na.action` indicate what should happen to those `NA` values.
`...`	currently disregarded.

Details

Since formula has an implied intercept term, use either `y ~ x - 1` or `y ~ 0 + x` to remove the intercept.

In order to get the best results, optimal values for `k`,`d` and `aa` should be selected.

The way of finding `aa` can be determined from Rong,Jian-Ying (2010) *Adjustive Liu Type Estimators in linear regression models* in *communication in statistics-simulation and computation*, volume **39**

Use `matplot` so as to obtain the variation of scalar MSE values graphically. See 'Examples'.

Value

If `k` and `d` are single numeric values then `ogalt1` returns the Ordinary Generalized Type (1) Adjusted Liu Estimated values, standard error values, t statistic values, p value, corresponding scalar MSE value.

If `k` and `d` are vector of set of numeric values then `ogalt1` returns the matrix of scalar MSE values of Ordinary Generalized Type (1) Adjusted Liu Estimator by representing `k` and `d` as column names and row names respectively.

Author(s)

P.Wijekoon, A.Dissanayake

References

Arumairajan, S. and Wijekoon, P. (2015)] *Optimal Generalized Biased Estimator in Linear Regression Model* in *Open Journal of Statistics*, pp. 403–411

Rong,Jian-Ying (2010) *Adjustive Liu Type Estimators in linear regression models* in *communication in statistics-simulation and computation*, volume **39** DOI:10.1080/03610918.2010.484120

See Also

`matplot`

Examples

```
## Portland cement data set is used.
data(pcd)
k<-0.1650
d<--0.1300
aa<-c(0.958451,1.021155,0.857821,1.040296)
ogalt1(Y~X1+X2+X3+X4-1,k,d,aa,data=pcd)
# Model without the intercept is considered.
```

```
 ## To obtain the variation of MSE of Ordinary Generalized
 ## Type (1) Adjusted Liu Estimator.
data(pcd)
k<-c(0:5/10)
d<-c(390:420/10)
aa<-c(0.958451,1.021155,0.857821,1.040296)
msemat<-ogalt1(Y~X1+X2+X3+X4-1,k,d,aa,data=pcd)
matplot(d,ogalt1(Y~X1+X2+X3+X4-1,k,d,aa,data=pcd),type="l",ylab=c("MSE"),
main=c("Plot of MSE of Ordinary Generalized Type (1) Adjusted Liu
Estimator"),cex.lab=0.6,adj=1,cex.axis=0.6,cex.main=1,las=1,lty=3)
text(y=msemat[1,],x=d[1],labels=c(paste0("k=",k)),pos=4,cex=0.6)
```

---

ogalt2 *Ordinary Generalized Type (2) Adjusted Liu Estimator*

Description

This function can be used to find the Ordinary Generalized Type (2) Adjusted Liu Estimated values, corresponding scalar Mean Square Error (MSE) in the linear model. Further the variation of MSE values can be shown graphically.

Usage

```
ogalt2(formula, k, d, aa, data = NULL, na.action, ...)
```

Arguments

`formula`	in this section interested model should be given. This should be given as a `formula`.
`k`	a single numeric value or a vector of set of numeric values. See 'Example'.
`d`	a single numeric value or a vector of set of numeric values. See 'Example'.
`aa`	this is a set of scalars belongs to real number system. Values for "aa" should be given as a `vector`, format. See 'Details'.
`data`	an optional data frame, list or environment containing the variables in the model. If not found in `data`, the variables are taken from `environment(formula)`, typically the environment from which the function is called.
`na.action`	if the dataset contain `NA` values, then `na.action` indicate what should happen to those `NA` values.
`...`	currently disregarded.

Details

Since formula has an implied intercept term, use either `y ~ x - 1` or `y ~ 0 + x` to remove the intercept.

In order to get the best results, optimal values for `k`,`d` and `aa` should be selected.

The way of finding `aa` can be determined from Rong,Jian-Ying (2010) *Adjustive Liu Type Estimators in linear regression models* in *communication in statistics-simulation and computation*, volume **39**

Use `matplot` so as to obtain the variation of scalar MSE values graphically. See 'Examples'.

Value

If `k` and `d` are single numeric values then `ogalt2` returns the Ordinary Generalized Type (2) Adjusted Liu Estimated values, standard error values, t statistic values, p value, corresponding scalar MSE value.

If `k` and `d` are vector of set of numeric values then `ogalt2` returns the matrix of scalar MSE values of Ordinary Generalized Type (2) Adjusted Liu Estimator by representing `k` and `d` as column names and row names respectively.

Author(s)

P.Wijekoon, A.Dissanayake

References

Arumairajan, S. and Wijekoon, P. (2015)] *Optimal Generalized Biased Estimator in Linear Regression Model* in *Open Journal of Statistics*, pp. 403–411

Rong,Jian-Ying (2010) *Adjustive Liu Type Estimators in linear regression models* in *communication in statistics-simulation and computation*, volume **39** DOI:10.1080/03610918.2010.484120

See Also

`matplot`

Examples

```
## Portland cement data set is used.
data(pcd)
k<-0.1650
d<--0.1300
aa<-c(0.958451,1.021155,0.857821,1.040296)
ogalt2(Y~X1+X2+X3+X4-1,k,d,aa,data=pcd)
# Model without the intercept is considered.
```

```
 ## To obtain the variation of MSE of Ordinary Generalized
 # Type (2) Adjusted Liu Estimator.
data(pcd)
k<-c(0:5/10)
d<-c(390:430/10)
aa<-c(0.958451,1.021155,0.857821,1.040296)
msemat<-ogalt2(Y~X1+X2+X3+X4-1,k,d,aa,data=pcd)
matplot(d,ogalt2(Y~X1+X2+X3+X4-1,k,d,aa,data=pcd),type="l",ylab=c("MSE"),
main=c("Plot of MSE of Ordinary Generalized Type (2) Adjusted
Liu Estimator"),cex.lab=0.6,adj=1,cex.axis=0.6,cex.main=1,las=1,lty=3)
text(y=msemat[1,],x=d[1],labels=c(paste0("k=",k)),pos=4,cex=0.6)
```

`ogalt3` *Ordinary Generalized Type (3) Adjusted Liu Estimator*

Description

This function can be used to find the Ordinary Generalized Type (3) Adjusted Liu Estimatd values, corresponding scalar Mean Square Error (MSE) value in the linear model. Further the variation of MSE values can be shown graphically.

Usage

```
ogalt3(formula, k, d, aa, data = NULL, na.action, ...)
```

Arguments

`formula`	in this section interested model should be given. This should be given as a `formula`.
`k`	a single numeric value or a vector of set of numeric values. See 'Example'.
`d`	a single numeric value or a vector of set of numeric values. See 'Example'.
`aa`	this is a set of scalars belongs to real number system. Values for "aa" should be given as a `vector`, format. See 'Details'.
`data`	an optional data frame, list or environment containing the variables in the model. If not found in `data`, the variables are taken from `environment(formula)`, typically the environment from which the function is called.
`na.action`	if the dataset contain `NA` values, then `na.action` indicate what should happen to those `NA` values.
`...`	currently disregarded.

Details

Since formula has an implied intercept term, use either `y ~ x - 1` or `y ~ 0 + x` to remove the intercept.

In order to get the best results, optimal values for `k`,`d` and `aa` should be selected.

The way of finding `aa` can be determined from Rong,Jian-Ying (2010) *Adjustive Liu Type Estimators in linear regression models* in *communication in statistics-simulation and computation*, volume **39**

Use `matplot` so as to obtain the variation of scalar MSE values graphically. See 'Examples'.

Value

If `k` and `d` are single numeric values then `ogalt3` returns the Ordinary Generalized Type (3) Adjusted Liu Estimated values, standard error values, t statistic values, p value, corresponding scalar MSE value.

If `k` and `d` are vector of set of numeric values then `ogalt3` returns the matrix of scalar MSE values of Ordinary Generalized Type (3) Adjusted Liu Estimator by representing `k` and `d` as column names and row names respectively.

Author(s)

P.Wijekoon, A.Dissanayake

References

Arumairajan, S. and Wijekoon, P. (2015)] *Optimal Generalized Biased Estimator in Linear Regression Model* in *Open Journal of Statistics*, pp. 403–411

Rong,Jian-Ying (2010) *Adjustive Liu Type Estimators in linear regression models* in *communication in statistics-simulation and computation*, volume **39** DOI:10.1080/03610918.2010.484120

See Also

`matplot`

Examples

```
## Portland cement data set is used.
data(pcd)
k<-0.1650
d<--0.1300
aa<-c(0.958451,1.021155,0.857821,1.040296)
ogalt3(Y~X1+X2+X3+X4-1,k,d,aa,data=pcd)
# Model without the intercept is considered.
```

```
 ## To obtain the variation of MSE of Ordinary Generalized
 # Type (3) Adjusted Liu Estimator.
data(pcd)
k<-c(0:5/10)
d<-c(-420:-380/10)
aa<-c(0.958451,1.021155,0.857821,1.040296)
msemat<-ogalt3(Y~X1+X2+X3+X4-1,k,d,aa,data=pcd)
matplot(d,ogalt3(Y~X1+X2+X3+X4-1,k,d,aa,data=pcd),type="l",ylab=c("MSE"),
main=c("Plot of MSE of Ordinary Generalized Type (3) Adjusted Liu
Estimator"),cex.lab=0.6,adj=1,cex.axis=0.6,cex.main=1,las=1,lty=3)
text(y=msemat[1,],x=d[1],labels=c(paste0("k=",k)),pos=4,cex=0.6)
```

---

ogaul *Ordinary Generalized Almost Unbiased Liu Estimator*

Description

ogaul can be used to find the Ordinary Generalized Almost Unbiased Liu Estimated values and corresponding scalar Mean Square Error (MSE) value in the linear model. Further the variation of MSE can be shown graphically.

Usage

```
ogaul(formula, d, data = NULL, na.action, ...)
```

Arguments

formula	in this section interested model should be given. This should be given as a formula.
d	a single numeric value or a vector of set of numeric values. See 'Example'.
data	an optional data frame, list or environment containing the variables in the model. If not found in data, the variables are taken from environment(formula), typically the environment from which the function is called.
na.action	if the dataset contain NA values, then na.action indicate what should happen to those NA values.
...	currently disregarded.

Details

Since formula has an implied intercept term, use either y ~ x - 1 or y ~ 0 + x to remove the intercept.

Use plot so as to obtained the variation of scalar MSE values graphically. See 'Examples'.

Value

If d is a single numeric value then ogaul returns the Ordinary Generalized Almost Unbiased Liu Estimated values, standard error values, t statistic values, p value and corresponding scalar MSE value.

If d is a vector of set of numeric values then ogaul returns all the scalar MSE values and corresponding parameter values of Ordinary Generalized Almost Unbiased Liu Estimator.

Author(s)

P.Wijekoon, A.Dissanayake

References

Arumairajan, S. and Wijekoon, P. (2015)] *Optimal Generalized Biased Estimator in Linear Regression Model* in *Open Journal of Statistics*, pp. 403–411

Akdeniz, F. and Erol, H. (2003) *Mean Squared Error Matrix Comparisons of Some Biased Estimators in Linear Regression* in *Communications in Statistics - Theory and Methods*, volume **32** DOI:10.1081/STA-120025385

See Also

plot

Examples

```
## Portland cement data set is used.
data(pcd)
d<-0.05
ogaul(Y~X1+X2+X3+X4-1,d,data=pcd)
# Model without the intercept is considered.

## To obtain the variation of MSE of
# Ordinary Generalized Almost Unbiased Liu Estimator.
data(pcd)
d<-c(1:10/10)
plot(ogaul(Y~X1+X2+X3+X4-1,d,data=pcd),
main=c("Plot of MSE of Ordinary Generalized Almost Unbiased Liu Estimator"),
type="b",cex.lab=0.6,adj=1,cex.axis=0.6,cex.main=1,las=1,lty=3,cex=0.6)
mseval<-data.frame(ogaul(Y~X1+X2+X3+X4-1,d,data=pcd))
smse<-mseval[order(mseval[,2]),]
points(smse[1,],pch=16,cex=0.6)
```

ogaur *Ordinary Generalized Almost Unbiased Ridge Estimator*

Description

ogaur can be used to find the Ordinary Generalized Almost Unbiased Ridge Estimated values and corresponding scalar Mean Square Error (MSE) value in the linear model. Further the variation of MSE can be shown graphically.

Usage

```
ogaur(formula, k, data = NULL, na.action, ...)
```

Arguments

formula	in this section interested model should be given. This should be given as a formula.
k	a single numeric value or a vector of set of numeric values. See 'Example'.
data	an optional data frame, list or environment containing the variables in the model. If not found in data, the variables are taken from environment(formula), typically the environment from which the function is called.
na.action	if the dataset contain NA values, then na.action indicate what should happen to those NA values.
...	currently disregarded.

Details

Since formula has an implied intercept term, use either y ~ x - 1 or y ~ 0 + x to remove the intercept.

Use plot so as to obtained the variation of scalar MSE values graphically. See 'Examples'.

Value

If k is a single numeric values then ogaur returns the Ordinary Generalized Almost Unbiased Ridge Estimated values, standard error values, t statistic values, p value and corresponding scalar MSE value.

If k is a vector of set of numeric values then ogaur returns all the scalar MSE values and corresponding parameter values of Ordinary Generalized Almost Unbiased Ridge Estimator.

Author(s)

P.Wijekoon, A.Dissanayake

References

Arumairajan, S. and Wijekoon, P. (2015)] *Optimal Generalized Biased Estimator in Linear Regression Model* in *Open Journal of Statistics*, pp. 403–411

Akdeniz, F. and Erol, H. (2003) *Mean Squared Error Matrix Comparisons of Some Biased Estimators in Linear Regression* in *Communications in Statistics - Theory and Methods*, volume **32** DOI:10.1081/STA-120025385

See Also

`plot`

Examples

```
## Portland cement data set is used.
data(pcd)
k<-0.05
ogaur(Y~X1+X2+X3+X4-1,k,data=pcd)
# Model without the intercept is considered.

## To obtain the variation of MSE of
# Ordinary Generalized Almost Unbiased Ridge Estimator.
data(pcd)
k<-c(0:10/10)
plot(ogaur(Y~X1+X2+X3+X4-1,k,data=pcd),
main=c("Plot of MSE of Ordinary Generalized
Almost Unbiased Ridge Estimator"),type="b",
cex.lab=0.6,adj=1,cex.axis=0.6,cex.main=1,las=1,lty=3,cex=0.6)
mseval<-data.frame(ogaur(Y~X1+X2+X3+X4-1,k,data=pcd))
smse<-mseval[order(mseval[,2]),]
points(smse[1,],pch=16,cex=0.6)
```

`ogliu` *Ordinary Generalized Liu Estimator*

Description

`ogliu` can be used to find the Ordinary Generalized Liu Estimated values and corresponding scalar Mean Square Error (MSE) value in the linear model. Further the variation of MSE can be shown graphically.

Usage

```
ogliu(formula, d, data = NULL, na.action, ...)
```

Arguments

`formula`	in this section interested model should be given. This should be given as a `formula`.
`d`	a single numeric value or a vector of set of numeric values. See 'Example'.
`data`	an optional data frame, list or environment containing the variables in the model. If not found in `data`, the variables are taken from `environment(formula)`, typically the environment from which the function is called.
`na.action`	if the dataset contain `NA` values, then `na.action` indicate what should happen to those `NA` values.
`...`	currently disregarded.

Details

Since formula has an implied intercept term, use either `y ~ x - 1` or `y ~ 0 + x` to remove the intercept.

Use `plot` so as to obtain the variation of scalar MSE values graphically. See 'Examples'.

Value

If `d` is a single numeric values then `ogliu` returns the Ordinary Generalized Liu Estimated values, standard error values, t statistic values, p value and corresponding scalar MSE value.

If `d` is a vector of set of numeric values then `ogliu` returns all the scalar MSE values and corresponding parameter values of Ordinary Generalized Liu Estimator.

Author(s)

P.Wijekoon, A.Dissanayake

References

Arumairajan, S. and Wijekoon, P. (2015)] *Optimal Generalized Biased Estimator in Linear Regression Model* in *Open Journal of Statistics*, pp. 403–411

Liu, K. (1993) *A new class of biased estimate in linear regression* in *Communications in Statistics-Theory and Methods* **22**, pp. 393–402.

See Also

`plot`

Examples

```
## Portland cement data set is used.
data(pcd)
d<-0.05
ogliu(Y~X1+X2+X3+X4-1,d,data=pcd)
# Model without the intercept is considered.

## To obtain the variation of MSE of Ordinary Generalized Liu Estimator.
data(pcd)
d<-c(0:10/10)
plot(ogliu(Y~X1+X2+X3+X4-1,d,data=pcd),main=c("Plot of MSE of
Ordinary Generalized Liu Estimator"),type="b",cex.lab=0.6,adj=1,
cex.axis=0.6,cex.main=1,las=1,lty=3,cex=0.6)
mseval<-data.frame(ogliu(Y~X1+X2+X3+X4-1,d,data=pcd))
smse<-mseval[order(mseval[,2]),]
points(smse[1,],pch=16,cex=0.6)
```

---

oglt1 *Ordinary Generalized Type (1) Liu Estimator*

Description

This function can be used to find the Ordinary Generalized Type (1) Liu Estimated values, corresponding scalar Mean Square Error (MSE) value in the linear model. Further the variation of MSE values can be shown graphically.

Usage

```
oglt1(formula, k, d, data = NULL, na.action, ...)
```

Arguments

formula	in this section interested model should be given. This should be given as a formula.
k	a single numeric value or a vector of set of numeric values. See 'Example'.
d	a single numeric value or a vector of set of numeric values. See 'Example'.
data	an optional data frame, list or environment containing the variables in the model. If not found in data, the variables are taken from environment(formula), typically the environment from which the function is called.
na.action	if the dataset contain NA values, then na.action indicate what should happen to those NA values.
...	currently disregarded.

Details

Since formula has an implied intercept term, use either y ~ x - 1 or y ~ 0 + x to remove the intercept.

Use matplot so as to obtain the variation of scalar MSE values graphically. See 'Examples'.

Value

If k and d are single numeric values then oglt1 returns the Ordinary Generalized Type (1) Liu Estimated values, standard error values, t statistic values, p value, corresponding scalar MSE value.

If k and d are vector of set of numeric values then oglt1 returns the matrix of scalar MSE values of Ordinary Generalized Type (1) Liu Estimator by representing k and d as column names and row names respectively.

Author(s)

P.Wijekoon, A.Dissanayake

References

Arumairajan, S. and Wijekoon, P. (2015)] *Optimal Generalized Biased Estimator in Linear Regression Model* in *Open Journal of Statistics*, pp. 403–411

Rong,Jian-Ying (2010) *Adjustive Liu Type Estimators in linear regression models* in *communication in statistics-simulation and computation*, volume **39** DOI:10.1080/03610918.2010.484120

See Also

matplot

Examples

```
## Portland cement data set is used.
data(pcd)
k<-0.1650
d<--0.1300
oglt1(Y~X1+X2+X3+X4-1,k,d,data=pcd)
# Model without the intercept is considered.

## To obtain the variation of MSE of Ordinary Generalized Type (1) Liu
# Estimator.
data(pcd)
k<-c(0:5/10)
d<-c(420:450/10)
msemat<-oglt1(Y~X1+X2+X3+X4-1,k,d,data=pcd)
matplot(d,oglt1(Y~X1+X2+X3+X4-1,k,d,data=pcd),type="l",ylab=c("MSE"),
main=c("Plot of MSE of Ordinary Generalized Type (1) Liu Estimator"),
cex.lab=0.6,adj=1,cex.axis=0.6,cex.main=1,las=1,lty=3)
text(y=msemat[1,],x=d[1],labels=c(paste0("k=",k)),pos=4,cex=0.6)
```

oglt2 *Ordinary Generalized Type (2) Liu Estimator*

Description

This function can be used to find the Type (2) Liu Estimated values, corresponding scalar Mean Square Error (MSE) value in the linear model. Further the variation of MSE values can be shown graphically.

Usage

```
oglt2(formula, k, d, data = NULL, na.action, ...)
```

Arguments

`formula`	in this section interested model should be given. This should be given as a `formula`.
`k`	a single numeric value or a vector of set of numeric values. See 'Example'.
`d`	a single numeric value or a vector of set of numeric values. See 'Example'.
`data`	an optional data frame, list or environment containing the variables in the model. If not found in `data`, the variables are taken from `environment(formula)`, typically the environment from which the function is called.
`na.action`	if the dataset contain `NA` values, then `na.action` indicate what should happen to those `NA` values.
`...`	currently disregarded.

Details

Since formula has an implied intercept term, use either `y ~ x - 1` or `y ~ 0 + x` to remove the intercept.

Use `matplot` so as to obtain the variation of scalar MSE values graphically. See 'Examples'.

Value

If `k` and `d` are single numeric values then `oglt2` returns the Ordinary Generalized Type (2) Liu Estimated values, standard error values, t statistic values, p value, corresponding scalar MSE value.

If `k` and `d` are vector of set of numeric values then `oglt2` returns the matrix of scalar MSE values of Ordinary Generalized Type (2) Liu Estimator by representing `k` and `d` as column names and row names respectively.

Author(s)

P.Wijekoon, A.Dissanayake

References

Arumairajan, S. and Wijekoon, P. (2015)] *Optimal Generalized Biased Estimator in Linear Regression Model* in *Open Journal of Statistics*, pp. 403–411

Rong,Jian-Ying (2010) *Adjustive Liu Type Estimators in linear regression models* in *communication in statistics-simulation and computation*, volume **39** DOI:10.1080/03610918.2010.484120

See Also

matplot

Examples

```
## Portland cement data set is used.
data(pcd)
k<-0.1650
d<--0.1300
oglt2(Y~X1+X2+X3+X4-1,k,d,data=pcd)
# Model without the intercept is considered.

## To obtain the variation of MSE of Ordinary Generalized Type (2) Liu
# Estimator.
data(pcd)
k<-c(0:5/10)
d<-c(425:440/10)
msemat<-oglt2(Y~X1+X2+X3+X4-1,k,d,data=pcd)
matplot(d,oglt2(Y~X1+X2+X3+X4-1,k,d,data=pcd),type="l",ylab=c("MSE"),
main=c("Plot of MSE of Ordinary Generalized Type (2) Liu Estimator"),
cex.lab=0.6,adj=1,cex.axis=0.6,cex.main=1,las=1,lty=3)
text(y=msemat[1,],x=d[1],labels=c(paste0("k=",k)),pos=4,cex=0.6)
```

---

oglt3 — *Ordinary Generalized Type (3) Liu Estimator*

Description

This function can be used to find the Ordinary Generalized Type (3) Liu Estimated values, corresponding scalar Mean Square Error (MSE) value in the linear model. Further the variation of MSE values can be shown graphically.

Usage

```
oglt3(formula, k, d, data = NULL, na.action, ...)
```

Arguments

`formula`	in this section interested model should be given. This should be given as a `formula`.
`k`	a single numeric value or a vector of set of numeric values. See 'Example'.
`d`	a single numeric value or a vector of set of numeric values. See 'Example'.
`data`	an optional data frame, list or environment containing the variables in the model. If not found in `data`, the variables are taken from `environment(formula)`, typically the environment from which the function is called.
`na.action`	if the dataset contain `NA` values, then `na.action` indicate what should happen to those `NA` values.
`...`	currently disregarded.

Details

Since formula has an implied intercept term, use either `y ~ x - 1` or `y ~ 0 + x` to remove the intercept.

Use `matplot` so as to obtain the variation of scalar MSE values graphically. See 'Examples'

Value

If `k` and `d` are single numeric values then `oglt3` returns the Ordinary Generalized Type (3) Liu Estimated values, standard error values, t statistic values, p value, corresponding scalar MSE value.

If `k` and `d` are vector of set of numeric values then `oglt3` returns the matrix of scalar MSE values of Ordinary Generalized Type (3) Liu Estimator by representing `k` and `d` as column names and row names respectively.

Author(s)

P.Wijekoon, A.Dissanayake

References

Arumairajan, S. and Wijekoon, P. (2015)] *Optimal Generalized Biased Estimator in Linear Regression Model* in *Open Journal of Statistics*, pp. 403–411

Rong,Jian-Ying (2010) *Adjustive Liu Type Estimators in linear regression models* in *communication in statistics-simulation and computation*, volume **39** DOI:10.1080/03610918.2010.484120

See Also

`matplot`

Examples

```
## Portland cement data set is used.
data(pcd)
k<-0.1650
d<--0.1300
oglt3(Y~X1+X2+X3+X4-1,k,d,data=pcd)
# Model without the intercept is considered.

## To obtain the variation of MSE of Ordinary Generalized Type (3)
# Liu Estimator.
data(pcd)
k<-c(0:5/10)
d<-c(-440:-420/10)
msemat<-oglt3(Y~X1+X2+X3+X4-1,k,d,data=pcd)
matplot(d,oglt3(Y~X1+X2+X3+X4-1,k,d,data=pcd),type="l",ylab=c("MSE"),
main=c("Plot of MSE of Ordinary Generalized Type (3) Liu Estimator"),
cex.lab=0.6,adj=1,cex.axis=0.6,cex.main=1,las=1,lty=3)
text(y=msemat[1,],x=d[1],labels=c(paste0("k=",k)),pos=4,cex=0.6)
```

---

ogmix *Ordinary Generalized Mixed Regression Estimator*

Description

ogmix can be used to obtain the Mixed Regression Estimated values and corresponding scalar Mean Square Error (MSE) value.

Usage

```
ogmix(formula, r, R, dpn, delt, data, na.action, ...)
```

Arguments

formula	in this section interested model should be given. This should be given as a formula.
r	is a j by 1 matrix of linear restriction, $r = R\beta + \delta + \nu$. Values for r should be given as either a vector or a matrix. See 'Examples'.
R	is a j by p of full row rank $j \leq p$ matrix of linear restriction, $r = R\beta + \delta + \nu$. Values for R should be given as either a vector or a matrix. See 'Examples'.
dpn	dispersion matrix of vector of disturbances of linear restricted model, $r = R\beta + \delta + \nu$. Values for dpn should be given as either a vector (only the diagonal elements) or a matrix. See 'Examples'.
delt	values of $E(r) - R\beta$ and that should be given as either a vector or a matrix. See 'Examples'.
data	an optional data frame, list or environment containing the variables in the model. If not found in data, the variables are taken from environment(formula), typically the environment from which the function is called.

`na.action` if the dataset contain `NA` values, then `na.action` indicate what should happen to those `NA` values.

`...` currently disregarded.

Details

Since formula has an implied intercept term, use either `y ~ x - 1` or `y ~ 0 + x` to remove the intercept.

In order to calculate the Ordinary Generalized Mixed Regression Estimator the prior information are required. Therefore those prior information should be mentioned within the function.

Value

`ogmix` returns the Ordinary Generalized Mixed Regression Estimated values, standard error values, t statistic values,p value and corresponding scalar MSE value.

Author(s)

P.Wijekoon, A.Dissanayake

References

Arumairajan, S. and Wijekoon, P. (2015)] *Optimal Generalized Biased Estimator in Linear Regression Model* in *Open Journal of Statistics*, pp. 403–411

Theil, H. and Goldberger, A.S. (1961) *On pure and mixed statistical estimation in economics* in *International Economic review*, volume **2**, pp. 65–78

Examples

```
## Portland cement data set is used.
data(pcd)
r<-c(2.1930,1.1533,0.75850)
R<-c(1,0,0,0,0,1,0,0,0,0,1,0)
dpn<-c(0.0439,0.0029,0.0325)
delt<-c(0,0,0)
ogmix(Y~X1+X2+X3+X4-1,r,R,dpn,delt,data=pcd)
# Model without the intercept is considered.
```

`ogols` *Ordinary Generalized Ordinary Least Square Estimators*

Description

`ogols` can be used to calculate the values of Ordinary Generalized Ordinary Least Square Estimated values and corresponding scaler Mean Square Error (MSE) value.

Usage

```
ogols(formula, data, na.action, ...)
```

Arguments

formula	in this section interested model should be given. This should be given as a formula.
data	an optional data frame, list or environment containing the variables in the model. If not found in data, the variables are taken from environment(formula), typically the environment from which the function is called.
na.action	if the dataset contain NA values, then na.action indicate what should happen to those NA values.
...	currently disregarded.

Details

Since formula has an implied intercept term, use either y ~ x - 1 or y ~ 0 + x to remove the intercept.

Value

ogols returns the Ordinary Generalized Ordinary Least Square Estimated values, standard error values, t statistic values,p value and corresponding scalar MSE value.

Author(s)

P.Wijekoon, A.Dissanayake

References

Arumairajan, S. and Wijekoon, P. (2015)] *Optimal Generalized Biased Estimator in Linear Regression Model* in *Open Journal of Statistics*, pp. 403–411

Nagler, J. (Updated 2011) Notes on Ordinary Least Square Estimators.

Examples

```
## Portland cement data set is used.
data(pcd)
ogols(Y~X1+X2+X3+X4-1,data=pcd)
# Model without the intercept is considered.
```

ogre *Ordinary Generalized Ridge Regression Estimator*

Description

This function can be used to find the Ordinary Generalized Ridge Regression Estimated values and corresponding scalar Mean Square Error (MSE) value. Further the variation of MSE can be determined graphically.

Usage

```
ogre(formula, k, data = NULL, na.action, ...)
```

Arguments

formula	in this section interested model should be given. This should be given as a formula.
k	a single numeric value or a vector of set of numeric values. See 'Example'.
data	an optional data frame, list or environment containing the variables in the model. If not found in data, the variables are taken from environment(formula), typically the environment from which the function is called.
na.action	if the dataset contain NA values, then na.action indicate what should happen to those NA values.
...	currently disregarded.

Details

Since formula has an implied intercept term, use either y ~ x - 1 or y ~ 0 + x to remove the intercept.

Use plot so as to obtain the variation of scalar MSE values graphically. See 'Examples'.

Value

If k is a single numeric values then ogre returns the Ordinary Generalized Ridge Regression Estimated values, standard error values, t statistic values, p value and corresponding scalar MSE value.

If k is a vector of set of numeric values then ogre returns all the scalar MSE values and corresponding parameter values of Ordinary Generalized Ridge Regression Estimator.

Author(s)

P.Wijekoon, A.Dissanayake

References

Arumairajan, S. and Wijekoon, P. (2015)] *Optimal Generalized Biased Estimator in Linear Regression Model* in *Open Journal of Statistics*, pp. 403–411

Hoerl, A.E. and Kennard, R.W. (1970) *Ridge Regression Biased estimation for non orthogonal problem*, **12**, pp.55–67.

See Also

plot

Examples

```
## Portland cement data set is used.
data(pcd)
k<-0.01
ogre(Y~X1+X2+X3+X4-1,k,data=pcd)
# Model without the intercept is considered.

 ## To obtain the variation of MSE of
# Ordinary Generalized Ridge Regression Estimator.
data(pcd)
k<-c(0:10/10)
plot(ogre(Y~X1+X2+X3+X4-1,k,data=pcd),
main=c("Plot of MSE of Ordinary Generalized Ridge Regression
Estimator"),type="b",cex.lab=0.6,adj=1,cex.axis=0.6,cex.main=1,las=1,lty=3,cex=0.6)
mseval<-data.frame(ogre(Y~X1+X2+X3+X4-1,k,data=pcd))
smse<-mseval[order(mseval[,2]),]
points(smse[1,],pch=16,cex=0.6)
```

---

ogrliu — *Ordinary Generalized Restricted Liu Estimator*

Description

This function can be used to find the Ordinary Generalized Restricted Liu Estimated values and corresponding scalar Mean Square Error (MSE) value. Further the variation of MSE can be shown graphically.

Usage

```
ogrliu(formula, r, R, delt, d, data = NULL, na.action, ...)
```

Arguments

`formula`	in this section interested model should be given. This should be given as a `formula`.
`r`	is a j by 1 matrix of linear restriction, $r = R\beta + \delta + \nu$. Values for `r` should be given as either a `vector` or a `matrix`. See 'Examples'.
`R`	is a j by p of full row rank $j \leq p$ matrix of linear restriction, $r = R\beta + \delta + \nu$. Values for `R` should be given as either a `vector` or a `matrix`. See 'Examples'.
`delt`	values of $E(r) - R\beta$ and that should be given as either a `vector` or a `matrix`. See 'Examples'.
`d`	a single numeric value or a vector of set of numeric values. See 'Example'.
`data`	an optional data frame, list or environment containing the variables in the model. If not found in `data`, the variables are taken from `environment(formula)`, typically the environment from which the function is called.
`na.action`	if the dataset contain `NA` values, then `na.action` indicate what should happen to those `NA` values.
`...`	currently disregarded.

Details

Since formula has an implied intercept term, use either `y ~ x - 1` or `y ~ 0 + x` to remove the intercept.

Use `plot` so as to obtain the variation of scalar MSE values graphically. See 'Examples'.

Value

If `d` is a single numeric values then `rliu` returns the Restricted Liu Estimated values, standard error values, t statistic values, p value and corresponding scalar MSE value.

If `d` is a vector of set of numeric values then `ogrliu` returns all the scalar MSE values and corresponding parameter values of Ordinary Generalized Restricted Liu Estimator.

Author(s)

P.Wijekoon, A.Dissanayake

References

Arumairajan, S. and Wijekoon, P. (2015)] *Optimal Generalized Biased Estimator in Linear Regression Model* in *Open Journal of Statistics*, pp. 403–411

Hubert, M.H. and Wijekoon, P. (2006) *Improvement of the Liu estimator in the linear regression medel*, Chapter (4-8)

See Also

`plot`

Examples

```
data(pcd)
d<-0.05
r<-c(2.1930,1.1533,0.75850)
R<-c(1,0,0,0,0,1,0,0,0,0,1,0)
delt<-c(0,0,0)
ogrliu(Y~X1+X2+X3+X4-1,r,R,delt,d,data=pcd)
# Model without the intercept is considered.

## To obtain the variation of MSE of
# Ordinary Generalized Resticted Liu Estimator.
data(pcd)
d<-c(0:10/10)
r<-c(2.1930,1.1533,0.75850)
R<-c(1,0,0,0,0,1,0,0,0,0,1,0)
delt<-c(0,0,0)
plot(ogrliu(Y~X1+X2+X3+X4-1,r,R,delt,d,data=pcd),
main=c("Plot of MSE of Ordinary Generalized Restricted Liu
Estimator"),type="b",cex.lab=0.6,adj=1,cex.axis=0.6,cex.main=1,las=1,lty=3,cex=0.6)
mseval<-data.frame(ogrliu(Y~X1+X2+X3+X4-1,r,R,delt,d,data=pcd))
smse<-mseval[order(mseval[,2]),]
points(smse[1,],pch=16,cex=0.6)
```

`ogrls` *Ordinary Generalized Restricted Least Square Estimator*

Description

This function can be used to find the Ordinary Generalized Restricted Least Square Estimated values and corresponding scalar Mean Square Error (MSE) value.

Usage

```
ogrls(formula, r, R, delt, data, na.action, ...)
```

Arguments

`formula`	in this section interested model should be given. This should be given as a `formula`.
`r`	is a j by 1 matrix of linear restriction, $r = R\beta + \delta + \nu$. Values for `r` should be given as either a `vector` or a `matrix`. See 'Examples'.
`R`	is a j by p of full row rank $j \leq p$ matrix of linear restriction, $r = R\beta + \delta + \nu$. Values for `R` should be given as either a `vector` or a `matrix`. See 'Examples'.
`delt`	values of $E(r) - R\beta$ and that should be given as either a `vector` or a `matrix`. See 'Examples'.
`data`	an optional data frame, list or environment containing the variables in the model. If not found in `data`, the variables are taken from `environment(formula)`, typically the environment from which the function is called.

na.action	if the dataset contain NA values, then na.action indicate what should happen to those NA values.
...	currently disregarded.

Details

Since formula has an implied intercept term, use either y ~ x - 1 or y ~ 0 + x to remove the intercept.

In order to find the results of Ordinary Generalized Restricted Least Square Estimator, prior information should be specified.

Value

ogrls returns the Ordinary Generalized Restricted Least Square Estimated values, standard error values, t statistic values,p value and corresponding scalar MSE value.

Author(s)

P.Wijekoon, A.Dissanayake

References

Arumairajan, S. and Wijekoon, P. (2015)] *Optimal Generalized Biased Estimator in Linear Regression Model* in *Open Journal of Statistics*, pp. 403–411

Hubert, M.H. and Wijekoon, P. (2006) *Improvement of the Liu estimator in the linear regression medel*, Chapter (4-8)

Examples

```
## Portland cement data set is used.
data(pcd)
r<-c(2.1930,1.1533,0.75850)
R<-c(1,0,0,0,0,1,0,0,0,0,1,0)
delt<-c(0,0,0)
ogrls(Y~X1+X2+X3+X4-1,r,R,delt,data=pcd)
# Model without the intercept is considered.
```

---

ogrrre *Ordinary Generalized Restricted Ridge Regression Estimator*

Description

This function can be used to find the Ordinary Generalized Restricted Ridge Regression Estimated values and corresponding scalar Mean Square Error (MSE) value. Further the variation of MSE can be shown graphically.

Usage

```
ogrrre(formula, r, R, dpn, delt, k, data = NULL, na.action, ...)
```

Arguments

- `formula`: in this section interested model should be given. This should be given as a `formula`.
- `r`: is a j by 1 matrix of linear restriction, $r = R\beta + \delta + \nu$. Values for `r` should be given as either a `vector` or a `matrix`. See 'Examples'.
- `R`: is a j by p of full row rank $j \leq p$ matrix of linear restriction, $r = R\beta + \delta + \nu$. Values for `R` should be given as either a `vector` or a `matrix`. See 'Examples'.
- `dpn`: dispersion matrix of vector of disturbances of linear restricted model, $r = R\beta + \delta + \nu$. Values for `dpn` should be given as either a `vector` (only the diagonal elements) or a `matrix`. See 'Examples'.
- `delt`: values of $E(r) - R\beta$ and that should be given as either a `vector` or a `matrix`. See 'Examples'.
- `k`: a single numeric value or a vector of set of numeric values. See 'Example'.
- `data`: an optional data frame, list or environment containing the variables in the model. If not found in `data`, the variables are taken from `environment(formula)`, typically the environment from which the function is called.
- `na.action`: if the dataset contain `NA` values, then `na.action` indicate what should happen to those `NA` values.
- `...`: currently disregarded.

Details

Since formula has an implied intercept term, use either `y ~ x - 1` or `y ~ 0 + x` to remove the intercept.

Use `plot` so as to obtain the variation of scalar MSE values graphically. See 'Examples'.

Value

If `k` is a single numeric values then `ogrrre` returns the Ordinary Generalized Restricted Ridge Regression Estimated values, standard error values, t statistic values, p value and corresponding scalar MSE value.

If `k` is a vector of set of numeric values then `ogrrre` returns all the scalar MSE values and corresponding parameter values of Ordinary Generalized Restricted Ridge Regression Estimator.

Author(s)

P.Wijekoon, A.Dissanayake

References

Arumairajan, S. and Wijekoon, P. (2015)] *Optimal Generalized Biased Estimator in Linear Regression Model* in *Open Journal of Statistics*, pp. 403–411

Sarkara, N. (1992), *A new estimator combining the ridge regression and the restricted least squares methods of estimation* in *Communications in Statistics - Theory and Methods*, volume **21**, pp. 1987–2000. DOI:10.1080/03610929208830893

See Also

plot

Examples

```
## Portland cement data set is used.
data(pcd)
k<-0.05
r<-c(2.1930,1.1533,0.75850)
R<-c(1,0,0,0,0,1,0,0,0,0,1,0)
dpn<-c(0.0439,0.0029,0.0325)
delt<-c(0,0,0)
ogrrre(Y~X1+X2+X3+X4-1,r,R,dpn,delt,k,data=pcd)
 # Model without the intercept is considered.

## To obtain variation of MSE of Ordinary Generalized Restricted
# Ridge Regression Estimator.
data(pcd)
k<-c(0:10/10)
r<-c(2.1930,1.1533,0.75850)
R<-c(1,0,0,0,0,1,0,0,0,0,1,0)
dpn<-c(0.0439,0.0029,0.0325)
delt<-c(0,0,0)
plot(ogrrre(Y~X1+X2+X3+X4-1,r,R,dpn,delt,k,data=pcd),
main=c("Plot of MSE of Ordinary Generalized Restricted Ridge Regression
Estimator"),type="b",cex.lab=0.6,adj=1,cex.axis=0.6,cex.main=1,las=1,lty=3,cex=0.6)
mseval<-data.frame(ogrrre(Y~X1+X2+X3+X4-1,r,R,dpn,delt,k,data=pcd))
smse<-mseval[order(mseval[,2]),]
points(smse[1,],pch=16,cex=0.6)
```

---

ogsrliu *Ordinary Generalized Stochastic Restricted Liu Estimator*

Description

This function can be used to find the Ordinary Generalized Stochastic Restricted Liu Estimated values and corresponding scalar Mean Square Error (MSE) value. Further the variation of MSE can be shown graphically.

Usage

```
ogsrliu(formula, r, R, dpn, delt, d, data = NULL, na.action, ...)
```

Arguments

formula	in this section interested model should be given. This should be given as a formula.
r	is a j by 1 matrix of linear restriction, $r = R\beta + \delta + \nu$. Values for r should be given as either a vector or a matrix. See 'Examples'.
R	is a j by p of full row rank $j \leq p$ matrix of linear restriction, $r = R\beta + \delta + \nu$. Values for R should be given as either a vector or a matrix. See 'Examples'.
dpn	dispersion matrix of vector of disturbances of linear restricted model, $r = R\beta + \delta + \nu$. Values for dpn should be given as either a vector (only the diagonal elements) or a matrix. See 'Examples'.
delt	values of $E(r) - R\beta$ and that should be given as either a vector or a matrix. See 'Examples'.
d	a single numeric value or a vector of set of numeric values. See 'Example'.
data	an optional data frame, list or environment containing the variables in the model. If not found in data, the variables are taken from environment(formula), typically the environment from which the function is called.
na.action	if the dataset contain NA values, then na.action indicate what should happen to those NA values.
...	currently disregarded.

Details

Since formula has an implied intercept term, use either y ~ x - 1 or y ~ 0 + x to remove the intercept.

Use plot so as to obtain the variation of scalar MSE values graphically. See 'Examples'.

Value

If d is a single numeric values then ogsrliu returns the Ordinary Generalized Stochastic Restricted Liu Estimated values, standard error values, t statistic values, p value and corresponding scalar MSE value.

If d is a vector of set of numeric values then ogsrliu returns all the scalar MSE values and corresponding parameter values of Ordinary Generalized Stochastic Resticted Liu Estimator.

Author(s)

P.Wijekoon, A.Dissanayake

References

Arumairajan, S. and Wijekoon, P. (2015)] *Optimal Generalized Biased Estimator in Linear Regression Model* in *Open Journal of Statistics*, pp. 403–411

Hubert, M.H. and Wijekoon, P. (2006) *Improvement of the Liu estimator in the linear regression medel*, Chapter (4-8)

See Also

plot

Examples

```
## Portland cement data set is used.
data(pcd)
d<-0.05
r<-c(2.1930,1.1533,0.75850)
R<-c(1,0,0,0,0,1,0,0,0,0,1,0)
dpn<-c(0.0439,0.0029,0.0325)
delt<-c(0,0,0)
ogsrliu(Y~X1+X2+X3+X4-1,r,R,dpn,delt,d,data=pcd)
 # Model without the intercept is considered.

## To obtain the variation of MSE of Ordinary Generalized Stochastic
# Restricted Liu Estimator.
data(pcd)
d<-c(0:10/10)
r<-c(2.1930,1.1533,0.75850)
R<-c(1,0,0,0,0,1,0,0,0,0,1,0)
dpn<-c(0.0439,0.0029,0.0325)
delt<-c(0,0,0)
plot(ogsrliu(Y~X1+X2+X3+X4-1,r,R,dpn,delt,d,data=pcd),
main=c("Plot of MSE of Ordinary Generalized Stochastic Restricted Liu
Estimator"),type="b",cex.lab=0.6,adj=1,cex.axis=0.6,cex.main=1,las=1,lty=3,cex=0.6)
mseval<-data.frame(ogsrliu(Y~X1+X2+X3+X4-1,r,R,dpn,delt,d,data=pcd))
smse<-mseval[order(mseval[,2]),]
points(smse[1,],pch=16,cex=0.6)
```

---

ogsrre — *Ordinary Generalized Stochastic Restricted Ridge Estimator*

Description

This function can be used to find the Ordinary Generalized Stochastic Restricted Ridge Estimated values and corresponding scalar Mean Square Error (MSE) value. Further the variation of MSE can be shown graphically.

Usage

```
ogsrre(formula, r, R, dpn, delt, k, data = NULL, na.action, ...)
```

Arguments

formula	in this section interested model should be given. This should be given as a formula.
r	is a j by 1 matrix of linear restriction, $r = R\beta + \delta + \nu$. Values for r should be given as either a vector or a matrix. See 'Examples'.
R	is a j by p of full row rank $j \leq p$ matrix of linear restriction, $r = R\beta + \delta + \nu$. Values for R should be given as either a vector or a matrix. See 'Examples'.
dpn	dispersion matrix of vector of disturbances of linear restricted model, $r = R\beta + \delta + \nu$. Values for dpn should be given as either a vector (only the diagonal elements) or a matrix. See 'Examples'.
delt	values of $E(r) - R\beta$ and that should be given as either a vector or a matrix. See 'Examples'.
k	a single numeric value or a vector of set of numeric values. See 'Example'.
data	an optional data frame, list or environment containing the variables in the model. If not found in data, the variables are taken from environment(formula), typically the environment from which the function is called.
na.action	if the dataset contain NA values, then na.action indicate what should happen to those NA values.
...	currently disregarded.

Details

Since formula has an implied intercept term, use either y ~ x - 1 or y ~ 0 + x to remove the intercept.

Use plot so as to obtain the variation of scalar MSE values graphically. See 'Examples'.

Value

If k is a single numeric values then ogsrre returns the Ordinary Generalized Stochastic Restricted Ridge Estimated values, standard error values, t statistic values, p value and corresponding scalar MSE value.

If k is a vector of set of numeric values then ogsrre returns all the scalar MSE values and corresponding parameter values of Ordinary Generalized Stochastic Restricted Ridge Estimator.

Author(s)

P.Wijekoon, A.Dissanayake

References

Arumairajan, S. and Wijekoon, P. (2015)] *Optimal Generalized Biased Estimator in Linear Regression Model* in *Open Journal of Statistics*, pp. 403–411

Revan, M. (2009) *A stochastic restricted ridge regression estimator* in *Journal of Multivariate Analysis*, volume **100**, issue 8, pp. 1706–1716

See Also

plot

Examples

```
## Portland cement data set is used.
data(pcd)
k<-0.05
r<-c(2.1930,1.1533,0.75850)
R<-c(1,0,0,0,0,1,0,0,0,0,1,0)
dpn<-c(0.0439,0.0029,0.0325)
delt<-c(0,0,0)
ogsrre(Y~X1+X2+X3+X4-1,r,R,dpn,delt,k,data=pcd)
 # Model without the intercept is considered.

## To obtain variation of MSE of Ordinary Generalized Stochastic
# Restricted Ridge Estimator.
data(pcd)
k<-c(0:10/10)
r<-c(2.1930,1.1533,0.75850)
R<-c(1,0,0,0,0,1,0,0,0,0,1,0)
dpn<-c(0.0439,0.0029,0.0325)
delt<-c(0,0,0)
plot(ogsrre(Y~X1+X2+X3+X4-1,r,R,dpn,delt,k,data=pcd),
main=c("Plot of MSE of Ordinary Generalized Stochastic Restricted Ridge
Estimator"),type="b",cex.lab=0.6,adj=1,cex.axis=0.6,cex.main=1,las=1,lty=3,cex=0.6)
mseval<-data.frame(ogsrre(Y~X1+X2+X3+X4-1,r,R,dpn,delt,k,data=pcd))
smse<-mseval[order(mseval[,2]),]
points(smse[1,],pch=16,cex=0.6)
```

---

ols *Ordinary Least Square Estimators*

Description

`ols` can be used to calculate the values of Ordinary Least Square Estimated values and corresponding scaler Mean Square Error (MSE) value.

Usage

```
ols(formula, data, na.action, ...)
```

Arguments

formula — in this section interested model should be given. This should be given as a formula.

data — an optional data frame, list or environment containing the variables in the model. If not found in data, the variables are taken from environment(formula), typically the environment from which the function is called.

na.action — if the dataset contain NA values, then na.action indicate what should happen to those NA values.

... — currently disregarded.

Details

Since formula has an implied intercept term, use either y ~ x - 1 or y ~ 0 + x to remove the intercept.

If there is any dependence present among the independent variables (multicollinearity) then it will be indicated as a warning massage. In case of multicollinearity Ordinary Least Square Estimators are not the best estimators.

Value

ols returns the Ordinary Least Square Estimated values, standard error values, t statistic values,p value and corresponding scalar MSE value. In addition if the dataset contains multicollinearity then it will be indicated as a warning massage.

Author(s)

P.Wijekoon, A.Dissanayake

References

Nagler, J. (Updated 2011) Notes on Ordinary Least Square Estimators.

See Also

checkm

Examples

```
## Portland cement data set is used.
data(pcd)
ols(Y~X1+X2+X3+X4-1,data=pcd)    # Model without the intercept is considered.
```

`optimum` *Summary of optimum scalar Mean Square Error values of all estimators and optimum Prediction Sum of Square values of some of the estimators*

Description

`optimum` can be used to obtain the optimal scalar Mean Square Error (MSE) values and its corresponding parameter values (`k` and/or `d`) of all estimators and the optimum Prediction Sum of Square (PRESS) values and its corresponding parameter values `k` and `d` of some of the estimators considered in this package.

Usage

```
optimum(formula , r, R, dpn, delt, aa1, aa2, aa3, k, d,
        press = FALSE, data = NULL, na.action, ...)
```

Arguments

`formula`	in this section interested model should be given. This should be given as a `formula`.
`r`	is a j by 1 matrix of linear restriction, $r = R\beta + \delta + \nu$. Values for `r` should be given as either a `vector` or a `matrix`. See 'Examples'.
`R`	is a j by p of full row rank $j \leq p$ matrix of linear restriction, $r = R\beta + \delta + \nu$. Values for `R` should be given as either a `vector` or a `matrix`. See 'Examples'.
`dpn`	dispersion matrix of vector of disturbances of linear restricted model, $r = R\beta + \delta + \nu$. Values for `dpn` should be given as either a `vector` (only the diagonal elements) or a `matrix`. See 'Examples'.
`delt`	values of $E(r) - R\beta$ and that should be given as either a `vector` or a `matrix`. See 'Examples'.
`aa1`	adjusted parameters of Type (1) Adjusted Liu Estimators and that should be a set of scalars belongs to real number system. Values for "aa1" should be given as a `vector`, format. See 'Details'.
`aa2`	adjusted parameters of Type (2) Adjusted Liu Estimators and that should be a set of scalars belongs to real number system. Values for "aa2" should be given as a `vector`, format. See 'Details'.
`aa3`	adjusted parameters of Type (3) Adjusted Liu Estimators and that should be a set of scalars belongs to real number system. Values for "aa3" should be given as a `vector`, format. See 'Details'.
`k`	a vector of set of numeric values. See 'Examples'.
`d`	a vector of set of numeric values. See 'Examples'.
`press`	an optional object specifying the PRESS values. That is, if "press=TRUE" then summary of PRESS of some of the estimators are returned with corresponding `k` and `d` values. Otherwise summary of scalar MSE of all estimators are returned with corresponding `k` and/or `d` values.

`data` an optional data frame, list or environment containing the variables in the model. If not found in `data`, the variables are taken from `environment(formula)`, typically the environment from which the function is called.

`na.action` if the dataset contain `NA` values, then `na.action` indicate what should happen to those `NA` values.

`...` currently disregarded.

Details

Since formula has an implied intercept term, use either `y ~ x - 1` or `y ~ 0 + x` to remove the intercept.

Optimum scalar MSE values of all estimators can be found for a given range of parameters. Hence the best estimator can be found based on the MSE criteria. Further prior information should be given in order to obtained the results.

The way of finding `aa1`, `aa2` and `aa3` can be determined from Rong,Jian-Ying, (2010), *Adjustive Liu Type Estimators in linear regression models* in *communication in statistics-simulation and computation*, volume **39**

Value

By default, `optimum` returns the optimum scalar MSE values and corresponding parameter values of all estimators. If “press=TRUE” then `optimum` return the optimum PRESS values and corresponding parameter values of some of the estimators.

Note

Conversion of estimators and corresponding `k` and/or `d` values are given below.

`SRRE` = `MIXE` `k=0`
`OGSRRE` = `MIXE` `k=0`
`RE` = `OLS` `k=0`
`OGRE` = `OLS` `k=0`
`RLE` = `RLS` `d=1`
`OGRLE` = `RLS` `d=1`
`LE` = `OLS` `d=1`
`OGLE` = `OLS` `d=1`
`RRRE` = `RLS` `k=0`
`OGRRRE` = `RLS` `k=0`
`SRLE` = `MIXE` `d=1`
`OGSRLE` = `MIXE` `d=1`
`AURE` = `OLS` `k=0`
`OGAURE` = `OLS` `k=0`
`AULE` = `OLS` `d=1`
`OGAULE` = `OLS` `d=1`
`LTE1` = `RE` `d=0`
`OGLTE1` = `RE` `d=0`

LTE1 = OLS k=0 and d=0
OGLTE1 = OLS k=0 and d=0
LTE2 = RE d=0
OGLTE2 = RE d=0
LTE2 = OLS k=0 and d=0
OGLTE2 = OLS k=0 and d=0

Author(s)

P.Wijekoon, A.Dissanayake

Examples

```
## portland cement data set is used.
data(pcd)
attach(pcd)
k<-c(0:3/10)
d<-c(-3:3/10)
r<-c(2.1930,1.1533,0.75850)
R<-c(1,0,0,0,0,1,0,0,0,0,1,0)
dpn<-c(0.0439,0.0029,0.0325)
delt<-c(0,0,0)
aa1<-c(0.958451,1.021155,0.857821,1.040296)
aa2<-c(0.345454,1.387888,0.866466,1.354454)
aa3<-c(0.344841,1.344723,0.318451,1.523316)
optimum(Y~X1+X2+X3+X4-1,r,R,dpn,delt,aa1,aa2,aa3,k,d,data=pcd)
 # Model without the intercept is considered.
    ## Use "press=TRUE" to get the optimum PRESS values only for some of the estimators.
```

---

pcd *Portland Cement Dataset*

Description

These data come from an experiment investigation of the heat evolved during the setting and hardening of Portland cements of varied composition and the dependence of this heat on the percentages of four components in the clinkers from which the cement was produced.

Usage

```
data(pcd)
```

Format

A data frame with 13 observations on the following 5 variables.

Y The heat evolved after 180 days of caring. (Calories per gram)

X1 Tricalcium Aluminate.

X2 Tricalcium Silicate.

X3 Tetracalcium Aluminoferrite.

X4 β Dicalcium Silicate.

References

Mishra, S.K. (2004) *Estimation under Multicollinearity: Application of Restricted Liu and Maximum Entropy Estimators to the Portland Cement Dataset*,North-Eastern Hill University (NEHU).

Examples

```
data(pcd)
```

---

rid — *Ordinary Ridge Regression Estimator*

Description

This function can be used to find the Ordinary Ridge Regression Estimated values and corresponding scalar Mean Square Error (MSE) value. Further the variation of MSE can be determined graphically.

Usage

```
rid(formula, k, data = NULL, na.action, ...)
```

Arguments

formula	in this section interested model should be given. This should be given as a formula.
k	a single numeric value or a vector of set of numeric values. See 'Examples'.
data	an optional data frame, list or environment containing the variables in the model. If not found in data, the variables are taken from environment(formula), typically the environment from which the function is called.
na.action	if the dataset contain NA values, then na.action indicate what should happen to those NA values.
...	currently disregarded.

Details

Since formula has an implied intercept term, use either y ~ x - 1 or y ~ 0 + x to remove the intercept.

Use plot so as to obtain the variation of scalar MSE values graphically. See 'Examples'.

Value

If k is a single numeric values then rid returns the Ordinary Ridge Regression Estimated values, standard error values, t statistic values, p value and corresponding scalar MSE value.

If k is a vector of set of numeric values then rid returns all the scalar MSE values and corresponding parameter values of Ordinary Ridge Regression Estimator.

Author(s)

P.Wijekoon, A.Dissanayake

References

Hoerl, A.E. and Kennard, R.W. (1970) *Ridge Regression Biased estimation for non orthogonal problem*, **12**, pp.55–67.

See Also

plot

Examples

```
## Portland cement data set is used.
data(pcd)
k<-0.01
rid(Y~X1+X2+X3+X4-1,k,data=pcd)  # Model without the intercept is considered.

 ## To obtain the variation of MSE of Ordinary Ridge Regression Estimator.
data(pcd)
k<-c(0:10/10)
plot(rid(Y~X1+X2+X3+X4-1,k,data=pcd),
main=c("Plot of MSE of Ordinary Ridge Regression Estimator"),
type="b",cex.lab=0.6,adj=1,cex.axis=0.6,cex.main=1,las=1,lty=3,cex=0.6)
mseval<-data.frame(rid(Y~X1+X2+X3+X4-1,k,data=pcd))
smse<-mseval[order(mseval[,2]),]
points(smse[1,],pch=16,cex=0.6)
```

---

rliu *Restricted Liu Estimator*

Description

This function can be used to find the Restricted Liu Estimated values and corresponding scalar Mean Square Error (MSE) value. Further the variation of MSE can be shown graphically.

Usage

```
rliu(formula, r, R, delt, d, data = NULL, na.action, ...)
```

Arguments

`formula`	in this section interested model should be given. This should be given as a `formula`.
`r`	is a j by 1 matrix of linear restriction, $r = R\beta + \delta + \nu$. Values for `r` should be given as either a `vector` or a `matrix`. See 'Examples'.
`R`	is a j by p of full row rank $j \leq p$ matrix of linear restriction, $r = R\beta + \delta + \nu$. Values for `R` should be given as either a `vector` or a `matrix`. See 'Examples'.
`delt`	values of $E(r) - R\beta$ and that should be given as either a `vector` or a `matrix`. See 'Examples'.
`d`	a single numeric value or a vector of set of numeric values. See 'Examples'.
`data`	an optional data frame, list or environment containing the variables in the model. If not found in `data`, the variables are taken from `environment(formula)`, typically the environment from which the function is called.
`na.action`	if the dataset contain `NA` values, then `na.action` indicate what should happen to those `NA` values.
`...`	currently disregarded.

Details

Since formula has an implied intercept term, use either `y ~ x - 1` or `y ~ 0 + x` to remove the intercept.

Use `plot` so as to obtain the variation of scalar MSE values graphically. See 'Examples'.

Value

If `d` is a single numeric values then `rliu` returns the Restricted Liu Estimated values, standard error values, t statistic values, p value and corresponding scalar MSE value.

If `d` is a vector of set of numeric values then `rliu` returns all the scalar MSE values and corresponding parameter values of Restricted Liu Estimator.

Author(s)

P.Wijekoon, A.Dissanayake

References

Hubert, M.H. and Wijekoon, P. (2006) *Improvement of the Liu estimator in the linear regression medel*, Chapter (4-8)

See Also

`plot`

Examples

```
data(pcd)
d<-0.05
r<-c(2.1930,1.1533,0.75850)
R<-c(1,0,0,0,0,1,0,0,0,0,1,0)
delt<-c(0,0,0)
rliu(Y~X1+X2+X3+X4-1,r,R,delt,d,data=pcd)   # Model without the intercept is considered.

## To obtain the variation of MSE of Resticted Liu Estimator.
data(pcd)
d<-c(0:10/10)
r<-c(2.1930,1.1533,0.75850)
R<-c(1,0,0,0,0,1,0,0,0,0,1,0)
delt<-c(0,0,0)
plot(rliu(Y~X1+X2+X3+X4-1,r,R,delt,d,data=pcd),
main=c("Plot of MSE of Restricted Liu Estimator"),type="b",
cex.lab=0.6,adj=1,cex.axis=0.6,cex.main=1,las=1,lty=3,cex=0.6)
mseval<-data.frame(rliu(Y~X1+X2+X3+X4-1,r,R,delt,d,data=pcd))
smse<-mseval[order(mseval[,2]),]
points(smse[1,],pch=16,cex=0.6)
```

`rls` *Restricted Least Square Estimator*

Description

This function can be used to find the Restricted Least Square Estimated values and corresponding scalar Mean Square Error (MSE) value.

Usage

```
rls(formula, r, R, delt, data, na.action, ...)
```

Arguments

`formula`	in this section interested model should be given. This should be given as a `formula`.
`r`	is a j by 1 matrix of linear restriction, $r = R\beta + \delta + \nu$. Values for `r` should be given as either a `vector` or a `matrix`. See 'Examples'.
`R`	is a j by p of full row rank $j \leq p$ matrix of linear restriction, $r = R\beta + \delta + \nu$. Values for `R` should be given as either a `vector` or a `matrix`. See 'Examples'.
`delt`	values of $E(r) - R\beta$ and that should be given as either a `vector` or a `matrix`. See 'Examples'.
`data`	an optional data frame, list or environment containing the variables in the model. If not found in `data`, the variables are taken from `environment(formula)`, typically the environment from which the function is called.

na.action	if the dataset contain NA values, then na.action indicate what should happen to those NA values.
...	currently disregarded.

Details

Since formula has an implied intercept term, use either y ~ x - 1 or y ~ 0 + x to remove the intercept.

In order to find the results of Restricted Least Square Estimator, prior information should be specified.

Value

rls returns the Restricted Least Square Estimated values, standard error values, t statistic values,p value and corresponding scalar MSE value.

Author(s)

P.Wijekoon, A.Dissanayake

References

Hubert, M.H. and Wijekoon, P. (2006) *Improvement of the Liu estimator in the linear regression medel*, Chapter (4-8)

Examples

```
## Portland cement data set is used.
data(pcd)
r<-c(2.1930,1.1533,0.75850)
R<-c(1,0,0,0,0,1,0,0,0,0,1,0)
delt<-c(0,0,0)
rls(Y~X1+X2+X3+X4-1,r,R,delt,data=pcd)    # Model without the intercept is considered.
```

---

rrre *Restricted Ridge Regression Estimator*

Description

This function can be used to find the Restricted Ridge Regression Estimated values and corresponding scalar Mean Square Error (MSE) value. Further the variation of MSE can be shown graphically.

Usage

```
rrre(formula, r, R, dpn, delt, k, data = NULL, na.action, ...)
```

Arguments

formula	in this section interested model should be given. This should be given as a formula.
r	is a j by 1 matrix of linear restriction, $r = R\beta + \delta + \nu$. Values for r should be given as either a vector or a matrix. See 'Examples'.
R	is a j by p of full row rank $j \leq p$ matrix of linear restriction, $r = R\beta + \delta + \nu$. Values for R should be given as either a vector or a matrix. See 'Examples'.
dpn	dispersion matrix of vector of disturbances of linear restricted model, $r = R\beta + \delta + \nu$. Values for dpn should be given as either a vector (only the diagonal elements) or a matrix. See 'Examples'.
delt	values of $E(r) - R\beta$ and that should be given as either a vector or a matrix. See 'Examples'.
k	a single numeric value or a vector of set of numeric values. See 'Examples'.
data	an optional data frame, list or environment containing the variables in the model. If not found in data, the variables are taken from environment(formula), typically the environment from which the function is called.
na.action	if the dataset contain NA values, then na.action indicate what should happen to those NA values.
...	currently disregarded.

Details

Since formula has an implied intercept term, use either `y ~ x - 1` or `y ~ 0 + x` to remove the intercept.

Use plot so as to obtain the variation of scalar MSE values graphically. See 'Examples'.

Value

If k is a single numeric values then rrre returns the Restricted Ridge Regression Estimated values, standard error values, t statistic values, p value and corresponding scalar MSE value.

If k is a vector of set of numeric values then rrre returns all the scalar MSE values and corresponding parameter values of Restricted Ridge Regression Estimator.

Author(s)

P.Wijekoon, A.Dissanayake

References

Sarkara, N. (1992), *A new estimator combining the ridge regression and the restricted least squares methods of estimation* in *Communications in Statistics - Theory and Methods*, volume **21**, pp. 1987–2000. DOI:10.1080/03610929208830893

See Also

plot

Examples

```
## Portland cement data set is used.
data(pcd)
k<-0.05
r<-c(2.1930,1.1533,0.75850)
R<-c(1,0,0,0,0,1,0,0,0,0,1,0)
dpn<-c(0.0439,0.0029,0.0325)
delt<-c(0,0,0)
rrre(Y~X1+X2+X3+X4-1,r,R,dpn,delt,k,data=pcd)
 # Model without the intercept is considered.

## To obtain variation of MSE of Restricted Ridge Regression Estimator.
data(pcd)
k<-c(0:10/10)
r<-c(2.1930,1.1533,0.75850)
R<-c(1,0,0,0,0,1,0,0,0,0,1,0)
dpn<-c(0.0439,0.0029,0.0325)
delt<-c(0,0,0)
plot(rrre(Y~X1+X2+X3+X4-1,r,R,dpn,delt,k,data=pcd),
main=c("Plot of MSE of Restricted Ridge Regression Estimator"),
type="b",cex.lab=0.6,adj=1,cex.axis=0.6,cex.main=1,las=1,lty=3,cex=0.6)
mseval<-data.frame(rrre(Y~X1+X2+X3+X4-1,r,R,dpn,delt,k,data=pcd))
smse<-mseval[order(mseval[,2]),]
points(smse[1,],pch=16,cex=0.6)
```

---

srliu *Stochastic Restricted Liu Estimator*

Description

This function can be used to find the Stochastic Restricted Liu Estimated values and corresponding scalar Mean Square Error (MSE) value. Further the variation of MSE can be shown graphically.

Usage

```
srliu(formula, r, R, dpn, delt, d, data = NULL, na.action, ...)
```

Arguments

formula	in this section interested model should be given. This should be given as a formula.
r	is a j by 1 matrix of linear restriction, $r = R\beta + \delta + \nu$. Values for r should be given as either a vector or a matrix. See 'Examples'.
R	is a j by p of full row rank $j \leq p$ matrix of linear restriction, $r = R\beta + \delta + \nu$. Values for R should be given as either a vector or a matrix. See 'Examples'.

dpn	dispersion matrix of vector of disturbances of linear restricted model, $r = R\beta + \delta + \nu$. Values for dpn should be given as either a vector (only the diagonal elements) or a matrix. See 'Examples'.
delt	values of $E(r) - R\beta$ and that should be given as either a vector or a matrix. See 'Examples'.
d	a single numeric value or a vector of set of numeric values. See 'Examples'.
data	an optional data frame, list or environment containing the variables in the model. If not found in data, the variables are taken from environment(formula), typically the environment from which the function is called.
na.action	if the dataset contain NA values, then na.action indicate what should happen to those NA values.
...	currently disregarded.

Details

Since formula has an implied intercept term, use either y ~ x - 1 or y ~ 0 + x to remove the intercept.

Use plot so as to obtain the variation of scalar MSE values graphically. See 'Examples'.

Value

If d is a single numeric values then srliu returns the Stochastic Restricted Liu Estimated values, standard error values, t statistic values, p value and corresponding scalar MSE value.

If d is a vector of set of numeric values then srliu returns all the scalar MSE values and corresponding parameter values of Stochastic Resticted Liu Estimator.

Author(s)

P.Wijekoon, A.Dissanayake

References

Hubert, M.H. and Wijekoon, P. (2006) *Improvement of the Liu estimator in the linear regression medel*, Chapter (4-8)

See Also

plot

Examples

```
## Portland cement data set is used.
data(pcd)
d<-0.05
r<-c(2.1930,1.1533,0.75850)
R<-c(1,0,0,0,0,1,0,0,0,0,1,0)
```

```
dpn<-c(0.0439,0.0029,0.0325)
delt<-c(0,0,0)
srliu(Y~X1+X2+X3+X4-1,r,R,dpn,delt,d,data=pcd)
 # Model without the intercept is considered.

## To obtain the variation of MSE of Stochastic Restricted Liu Estimator.
data(pcd)
d<-c(0:10/10)
r<-c(2.1930,1.1533,0.75850)
R<-c(1,0,0,0,0,1,0,0,0,0,1,0)
dpn<-c(0.0439,0.0029,0.0325)
delt<-c(0,0,0)
plot(srliu(Y~X1+X2+X3+X4-1,r,R,dpn,delt,d,data=pcd),
main=c("Plot of MSE of Stochastic Restricted Liu Estimator"),type="b",
cex.lab=0.6,adj=1,cex.axis=0.6,cex.main=1,las=1,lty=3,cex=0.6)
mseval<-data.frame(srliu(Y~X1+X2+X3+X4-1,r,R,dpn,delt,d,data=pcd))
smse<-mseval[order(mseval[,2]),]
points(smse[1,],pch=16,cex=0.6)
```

---

srre *Stochastic Restricted Ridge Estimator*

Description

This function can be used to find the Stochastic Restricted Ridge Estimated values and corresponding scalar Mean Square Error (MSE) value. Further the variation of MSE can be shown graphically.

Usage

```
srre(formula, r, R, dpn, delt, k, data = NULL, na.action, ...)
```

Arguments

formula	in this section interested model should be given. This should be given as a formula.
r	is a j by 1 matrix of linear restriction, $r = R\beta + \delta + \nu$. Values for r should be given as either a vector or a matrix. See 'Examples'.
R	is a j by p of full row rank $j \leq p$ matrix of linear restriction, $r = R\beta + \delta + \nu$. Values for R should be given as either a vector or a matrix. See 'Examples'.
dpn	dispersion matrix of vector of disturbances of linear restricted model, $r = R\beta + \delta + \nu$. Values for dpn should be given as either a vector (only the diagonal elements) or a matrix. See 'Examples'.
delt	values of $E(r) - R\beta$ and that should be given as either a vector or a matrix. See 'Examples'.
k	a single numeric value or a vector of set of numeric values. See 'Examples'.

`data`	an optional data frame, list or environment containing the variables in the model. If not found in `data`, the variables are taken from `environment(formula)`, typically the environment from which the function is called.
`na.action`	if the dataset contain `NA` values, then `na.action` indicate what should happen to those `NA` values.
`...`	currently disregarded.

Details

Since formula has an implied intercept term, use either `y ~ x - 1` or `y ~ 0 + x` to remove the intercept.

Use `plot` so as to obtain the variation of scalar MSE values graphically. See 'Examples'.

Value

If `k` is a single numeric values then `srre` returns the Stochastic Restricted Ridge Estimated values, standard error values, t statistic values, p value and corresponding scalar MSE value.

If `k` is a vector of set of numeric values then `srre` returns all the scalar MSE values and corresponding parameter values of Stochastic Restricted Ridge Estimator.

Author(s)

P.Wijekoon, A.Dissanayake

References

Revan, M. (2009) *A stochastic restricted ridge regression estimator* in *Journal of Multivariate Analysis*, volume **100**, issue 8, pp. 1706–1716

See Also

`plot`

Examples

```
## Portland cement data set is used.
data(pcd)
k<-0.05
r<-c(2.1930,1.1533,0.75850)
R<-c(1,0,0,0,0,1,0,0,0,0,1,0)
dpn<-c(0.0439,0.0029,0.0325)
delt<-c(0,0,0)
srre(Y~X1+X2+X3+X4-1,r,R,dpn,delt,k,data=pcd)
 # Model without the intercept is considered.

## To obtain variation of MSE of Stochastic Restricted Ridge Estimator.
data(pcd)
k<-c(0:10/10)
```

```
r<-c(2.1930,1.1533,0.75850)
R<-c(1,0,0,0,0,1,0,0,0,0,1,0)
dpn<-c(0.0439,0.0029,0.0325)
delt<-c(0,0,0)
plot(srre(Y~X1+X2+X3+X4-1,r,R,dpn,delt,k,data=pcd),
main=c("Plot of MSE of Stochastic Restricted Ridge Estimator"),
type="b",cex.lab=0.6,adj=1,cex.axis=0.6,cex.main=1,las=1,lty=3,cex=0.6)
mseval<-data.frame(srre(Y~X1+X2+X3+X4-1,r,R,dpn,delt,k,data=pcd))
smse<-mseval[order(mseval[,2]),]
points(smse[1,],pch=16,cex=0.6)
```

Index