Package 'gwer'

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Title Geographically Weighted Elliptical Regression

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Description Computes a elliptical regression model or a geographically weighted regression model with elliptical errors using Fisher's score algorithm. Provides diagnostic measures, residuals and analysis of variance. Cysneiros, F. J. A., Paula, G. A., and Galea, M. (2007) <doi:10.1016/j.spl.2007.01.012>.

Depends R (>= 2.14), sp (>= 0.8-3), stats

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R topics documented:

`anova.elliptical` *Analysis of Deviance for Elliptical Model Fits*

Description

Compute an analysis of deviance table for one or more elliptical model fits.

Usage

```
## S3 method for class 'elliptical'
anova(object, dispersion = NULL,
  test = c("Chisq"), ...)
```

Arguments

`object`	fit object for elliptical regression model.
`dispersion`	the dispersion parameter for the fitting family, by default obtained from object.
`test`	a character string representing that hypothesis test should be considered.
`...`	arguments to be used to form the default control argument if it is not supplied directly.

Value

An object of class `anova` inheriting from class `data.frame`

References

Cysneiros, F. J. A., Paula, G. A., and Galea, M. (2007). Heteroscedastic symmetrical linear models. Statistics & probability letters, 77(11), 1084-1090. https://doi.org/10.1016/j.spl.2007.01.012

See Also

elliptical

Examples

```
data(luzdat)
y <- luzdat$y
x1 <- luzdat$x1 ; x1 <- factor(x1) ; x1 <- C(x1,treatment)
x2 <- luzdat$x2
x3 <- (luzdat$x2)^2
luz <- data.frame(y,x1,x2,x3)
elliptical.fitt <- elliptical(y ~ x1+x2+x3, family = Student(df=5),
data=luz)
anova(elliptical.fitt)
```

Cauchy *Cauchy Distribution*

Description

Family objects for cauchy distribution provide a convenient way to specify the details of the models used by functions such as `elliptical`.

Usage

```
Cauchy()
```

Value

An object of class "family" for cauchy distribution.

References

Fang, K. T., Kotz, S. and NG, K. W. (1990, ISBN:9781315897943). Symmetric Multivariate and Related Distributions. London: Chapman and Hall.

See Also

family.elliptical, elliptical, gwer

Examples

```
data(luzdat)
y <- luzdat$y
x1 <- luzdat$x1 ; x1 <- factor(x1) ; x1 <- C(x1,treatment)
x2 <- luzdat$x2
x3 <- (luzdat$x2)^2
luz <- data.frame(y,x1,x2,x3)
elliptical.fitC <- elliptical(y ~ x1+x2+x3, family = Cauchy()
```

```
,data=luz)
family(elliptical.fitC)
```

`Cnormal` *Contaminated Normal Distribution*

Description

Family objects for contaminated normal distribution provide a convenient way to specify the details of the models used by functions such as `elliptical`.

Usage

```
Cnormal(parmt = stop("no epsi or sigma argument"))
```

Arguments

`parmt`	parameters vector (epsi, sigma).

Value

An object of class "family" for contaminated normal distribution.

References

Fang, K. T., Kotz, S. and NG, K. W. (1990, ISBN:9781315897943). Symmetric Multivariate and Related Distributions. London: Chapman and Hall.

See Also

`family.elliptical`, `elliptical`, `gwer`

Examples

```
## Not run:
data(luzdat)
y <- luzdat$y
x1 <- luzdat$x1 ; x1 <- factor(x1) ; x1 <- C(x1,treatment)
x2 <- luzdat$x2
x3 <- (luzdat$x2)^2
luz <- data.frame(y,x1,x2,x3)
elliptical.fitCn <- elliptical(y ~ x1+x2+x3, family = Cnormal(c(1,.5))
,data=luz)
family(elliptical.fitCn)

## End(Not run)
```

`elliptical` *Elliptical Regression Models*

Description

The function implements linear elliptical regression models, specified by giving a symbolic description of the systematic and stochastic components.

Usage

```
elliptical(formula = formula(data), family = Normal,
  data = sys.parent(), dispersion = NULL, weights, subset,
  na.action = "na.fail", method = "elliptical.fit",
  control = glm.control(epsilon = 1e-04, maxit = 100, trace = F),
  model = F, x = F, y = T, contrasts = NULL, offset, ...)
```

Arguments

`formula`	regression model formula as in `glm`.
`family`	a description of the error distribution to be used in the model (see `elliptical.family` for details of family functions).
`data`	an optional data frame, list or environment containing the variables in the model.
`dispersion`	an optional fixed value for dispersion parameter.
`weights`	an optional vector of weights to be used in the fitting process.
`subset`	an optional vector specifying a subset of observations to be used in the fitting process.
`na.action`	a function which indicates what should happen when the data contain NAs (see `glm`).
`method`	optimization method used to estimate the parameters. The default method "elliptical.fit" uses Fisher's scoring method. The alternative "model.frame" returns the model frame and does no fitting.
`control`	a list of parameters for controlling the fitting process. For `egwr.fit` this is passed to `glm.control`.
`model`	a logical value indicating whether model frame should be included as a component of the returned value.
`x`	a logical value indicating whether the response vector used in the fitting process should be returned as components of the returned value.
`y`	a logical value indicating whether model matrix used in the fitting process should be returned as components of the returned value.
`contrasts`	an optional list. See the `contrasts.arg` of `model.matrix.default`.
`offset`	this can be used to specify an a priori known component to be included in the linear predictor during fitting as in `glm`.
`...`	arguments to be used to form the default control argument if it is not supplied directly.

Value

A list of class "elliptical":

`coefficients`	coefficients of location of the model fit.
`dispersion`	coefficients of dispersion of the model fit.
`residuals`	the standardized residuals, that is the residuals in the final iteration of the optimization process.
`fitted.values`	the fitted mean values.
`loglik`	the likelihood logarithm value of the adjusted model's.
`Wg`	the values of the function W_g(u).
`Wgder`	the values of the function W^'_g(u).
`v`	the values of the function V(u).
`rank`	the numeric rank of the fitted linear model.
`inter`	the number of iterations of optimization process.
`scale`	the values of the 4d_g for the specified distribution.
`scaledispersion`	the values of the 4f_g for the specified distribution.
`scalevariance`	the values of the scale variance for the specified distribution.
`df`	the degrees of freedom for fitted model.
`Xmodel`	is the model matrix.
`weights`	the working weights, that is the weights in the final iteration of optimization process
`df.residuals`	the residual degrees of freedom.
`family`	the `family` object used.
`formula`	the formula supplied.
`terms`	the `terms` object used.
`contrasts`	(where relevant) the contrasts used.
`control`	the value of the`control` argument used.
`call`	the matched call.
`y`	the response variable used.

References

Cysneiros, F. J. A., Paula, G. A., and Galea, M. (2007). Heteroscedastic symmetrical linear models. Statistics & probability letters, 77(11), 1084-1090. https://doi.org/10.1016/j.spl.2007.01.012

Fang, K. T., Kotz, S. and NG, K. W. (1990, ISBN:9781315897943). Symmetric Multivariate and Related Distributions. London: Chapman and Hall.

See Also

`glm`, `family.elliptical`, `elliptical.diag`

Examples

```
data(luzdat)
y <- luzdat$y
x1 <- luzdat$x1 ; x1 <- factor(x1) ; x1 <- C(x1,treatment)
x2 <- luzdat$x2
x3 <- (luzdat$x2)^2
luz <- data.frame(y,x1,x2,x3)
elliptical.fitt <- elliptical(y ~ x1+x2+x3, family = Student(df=5)
,data=luz)
elliptical.fitLII <- elliptical(y ~ x1+x2+x3, family = LogisII()
,data=luz)
```

`elliptical.diag` *Diagnostic for Elliptical Regression Models*

Description

This function obtains the values of the residuals and calculates the diagnostic measures for elliptical regression models.

Usage

```
elliptical.diag(ellipticalfit, weighting = "observed", ...)
```

Arguments

`ellipticalfit`	fit object for elliptical regression model.
`weighting`	type of model weighting used.
`...`	arguments to be used to form the default control argument if it is not supplied directly.

Value

returns a list of diagnostic arrays:

`resid`	ordinal residuals for the fit model.
`rs`	studentized residuals for the fit model.
`dispersion`	coefficient of dispersion for the model fit.
`GL`	generalized leverage for the model fit.
`GLbeta`	generalized leverage of location parameters estimation for the model fit.
`GLphi`	generalized leverage of dispersion parameters estimation for the model fit.
`Bi`	generalized leverage weighted by dispersion for the model fit.
`Om`	observed fisher information matrix of the model fit.
`Iom`	expected fisher information matrix of the model fit.
`a, b, c`	the value of D(a), D(b) and D(c), respectively, for the model fit.

Cmax	matrix of local influence for additive perturbation in response.
Lmax	matrix of local influence on coefficients (additive perturbation in predictors).
Cic	matrix of local influence for case-weight perturbation (Ci).
dmax	matrix of local influence for case-weight perturbation (dmax).
dmaxc	matrix of local influence for case-weight perturbation (|dmax|).
Ci	matrix of local influence on the scale.
Cih	main diagonal of the matrix of local influence on the scale.
h	main diagonal of the hat matrix.

References

Galea, M., Paula, G. A., and Cysneiros, F. J. A. (2005). On diagnostics in symmetrical nonlinear models. Statistics & Probability Letters, 73(4), 459-467. https://doi.org/10.1016/j.spl.2005.04.033

See Also

elliptical

Examples

```
data(luzdat)
y <- luzdat$y
x1 <- luzdat$x1 ; x1 <- factor(x1) ; x1 <- C(x1,treatment)
x2 <- luzdat$x2
x3 <- (luzdat$x2)^2
luz <- data.frame(y,x1,x2,x3)
elliptical.fitt <- elliptical(y ~ x1+x2+x3, family = Student(df=5),
data=luz)
elliptical.diag(elliptical.fitt)
```

---

elliptical.diag.plots *Diagnostic Plots for Elliptical Regression Models*

Description

This function produces diagnostic measures plots for elliptical regression models.

Usage

```
elliptical.diag.plots(ellipticalfit, ellipticaldiag = NULL, weighting,
  which, subset = NULL, iden = F, labels = NULL, ret = F, ...)
```

Arguments

`ellipticalfit`	fit object for elliptical regression model.
`ellipticaldiag`	objects containing the diagnostic measures, by default obtained from object.
`weighting`	type of model weighting used.
`which`	an optional numerical that indicates which plot is returned.
`subset`	optional vector specifying a subset of observations to be used in the fitting process.
`iden`	a logical value used to identify observations. if TRUE the observations can be identified in the graphic window.
`labels`	a optinal vector specifying a labels plots.
`ret`	a logical value to indicate funtion returns. If TRUE the return of the function will be to the diagnostic measures used.
`...`	arguments to be used to form the default control argument if it is not supplied directly.

Value

If `ret` is true, returns a list of diagnostic arrays (see `elliptical.diag` for more details).

References

Galea, M., Paula, G. A., and Cysneiros, F. J. A. (2005). On diagnostics in symmetrical nonlinear models. Statistics & Probability Letters, 73(4), 459-467. https://doi.org/10.1016/j.spl.2005.04.033

See Also

`elliptical`, `elliptical.diag`

Examples

```
data(luzdat)
y <- luzdat$y
x1 <- luzdat$x1 ; x1 <- factor(x1) ; x1 <- C(x1,treatment)
x2 <- luzdat$x2
x3 <- (luzdat$x2)^2
luz <- data.frame(y,x1,x2,x3)
elliptical.fitt <- elliptical(y ~ x1+x2+x3, family = Student(df=5),
data=luz)
elliptical.diag.plots(elliptical.fitt, which=3)
```

envelope *Simulated Envelope of Residuals*

Description

This function produces quantile-quantile plots with simulated envelope for response distribution in elliptical regression models.

Usage

```
envelope(object, B = 100, arg = arg, ...)
```

Arguments

object	fit object for elliptical regression model.
B	number of monte carlo simulations.
arg	a numerical or vector representing the distribution parameters used.
...	arguments to be used to form the default control argument if it is not supplied directly.

References

Galea, M., Paula, G. A., and Cysneiros, F. J. A. (2005). On diagnostics in symmetrical nonlinear models. Statistics & Probability Letters, 73(4), 459-467. https://doi.org/10.1016/j.spl.2005.04.033

See Also

glm, elliptical, elliptical.diag

Examples

```
data(luzdat)
y <- luzdat$y
x1 <- luzdat$x1 ; x1 <- factor(x1) ; x1 <- C(x1,treatment)
x2 <- luzdat$x2
x3 <- (luzdat$x2)^2
luz <- data.frame(y,x1,x2,x3)
elliptical.fitt <- elliptical(y ~ x1+x2+x3, family = Student(df=5),
data=luz)
envelope(elliptical.fitt, B=100, arg=5)
```

`family.elliptical` *Family Objects for Elliptical Models*

Description

Family objects provide a convenient way to specify the details of the models used by functions such as `elliptical`. See the documentation for `elliptical` or `egwr` for the details on how such model fitting takes place.

Usage

```
## S3 method for class 'elliptical'
family(object, ...)
```

Arguments

`object`	fit object for elliptical regression model.
`...`	arguments to be used to form the default control argument if it is not supplied directly.

Value

An object of class "family" (which has a concise print method). This is a list with elements:

`family`	character: the family name.
`g0, g1, g2, g3, g4, g5`	derived fuctions associated with the distribution family defined.
`df`	degree of freedom for t-student distribution.
`s, r`	shape parameters for generalized t-student distribution.
`alpha`	shape parameter for contaminated normal and generalized logistic distributions.
`mp`	shape parameter for generalized logistic distribution.
`epsi`	dispersion parameter for contaminated normal distribution.
`sigmap`	dispersion parameter for contaminated normal distribution.
`k`	shape parameter for power exponential distribution.

References

Fang, K. T., Kotz, S. and NG, K. W. (1990, ISBN:9781315897943). Symmetric Multivariate and Related Distributions. London: Chapman and Hall.

See Also

`elliptical`, `gwer`

Examples

```
data(luzdat)
y <- luzdat$y
x1 <- luzdat$x1 ; x1 <- factor(x1) ; x1 <- C(x1,treatment)
x2 <- luzdat$x2
x3 <- (luzdat$x2)^2
luz <- data.frame(y,x1,x2,x3)
elliptical.fitt <- elliptical(y ~ x1+x2+x3, family = Normal()
,data=luz)
family(elliptical.fitt)
```

Glogis *Generalized Logistic Distribution*

Description

Family objects for generalized logistic distribution provide a convenient way to specify the details of the models used by functions such as `elliptical`.

Usage

```
Glogis(parma = stop("no alpha=alpha(m) or m argument"))
```

Arguments

`parma`	parameter vector (alpha, m).

Value

An object of class "family" for generalized logistic distribution.

References

Fang, K. T., Kotz, S. and NG, K. W. (1990, ISBN:9781315897943). Symmetric Multivariate and Related Distributions. London: Chapman and Hall.

See Also

`family.elliptical`, `elliptical`, `gwer`

Examples

```
data(luzdat)
y <- luzdat$y
x1 <- luzdat$x1 ; x1 <- factor(x1) ; x1 <- C(x1,treatment)
x2 <- luzdat$x2
x3 <- (luzdat$x2)^2
luz <- data.frame(y,x1,x2,x3)
elliptical.fitGl <- elliptical(y ~ x1+x2+x3, family = Glogis(c(1,1))
```

```
,data=luz)
family(elliptical.fitGl)
```

`Gstudent` *Generalized Student Distribution*

Description

Family objects for generalized student distribution provide a convenient way to specify the details of the models used by functions such as `elliptical`.

Usage

```
Gstudent(parm = stop("no s or r argument"))
```

Arguments

`parm`	parameter vector (s, r) for this distribuition.

Value

An object of class "family" for generalized student distribution.

References

Fang, K. T., Kotz, S. and NG, K. W. (1990, ISBN:9781315897943). Symmetric Multivariate and Related Distributions. London: Chapman and Hall.

See Also

`family.elliptical`, `elliptical`, `gwer`

Examples

```
data(luzdat)
y <- luzdat$y
x1 <- luzdat$x1 ; x1 <- factor(x1) ; x1 <- C(x1,treatment)
x2 <- luzdat$x2
x3 <- (luzdat$x2)^2
luz <- data.frame(y,x1,x2,x3)
elliptical.fitGs <- elliptical(y ~ x1+x2+x3, family = Gstudent(c(1,1))
,data=luz)
family(elliptical.fitGs)
```

gwer *Geographically Weighted Elliptical Regression*

Description

The function implements geographically weighted elliptical regression to explore the non-stationarity for certain global bandwidth and chosen weighting scheme.

Usage

```
gwer(formula, coords, bandwidth, gweight = gwr.Gauss, adapt = NULL,
  spdisp = F, family = Normal, data = sys.parent(),
  dispersion = NULL, weights, subset, fit.points,
  na.action = "na.fail", method = "gwer.fit", longlat = NULL,
  control = glm.control(epsilon = 1e-04, maxit = 100, trace = F),
  model = F, x = F, y = T, contrasts = NULL, parplot = F, offset,
  type = "pearson", gwr.diag = F, ...)
```

Arguments

formula	regression model formula as in glm.
coords	matrix of coordinates of points representing the spatial positions of the observations.
bandwidth	value of the selected bandwidth (see gwer.sel for bandwidth optimization).
gweight	geographical weighting function, at present gwr.Gauss() is default.
adapt	defines the type of bandwidth used. either NULL (default) or a proportion between 0 and 1 of observations to include in weighting scheme (k-nearest neighbours).
spdisp	if TRUE dispersion parameter varies geographically.
family	a description of the error distribution to be used in the model (see elliptical.family for details of family functions).
data	model data frame, or may be a SpatialPointsDataFrame or SpatialPolygonsDataFrame as defined in package **sp**.
dispersion	an optional fixed value for dispersion parameter.
weights	an optional vector of weights to be used in the fitting process for local models.
subset	an optional vector specifying a subset of observations to be used in the fitting process.
fit.points	an object containing the coordinates of fit points, often an object from package **sp**. If missing, the coordinates given through the data argument object, or the coords argument are used.
na.action	a function which indicates what should happen when the data contain NAs (see glm).

method	the method to be used in fitting local models. The default method "gwer.fit" uses Fisher's scoring method. The alternative "model.frame" returns the model frame and does no fitting.
longlat	TRUE if point coordinates are longitude-latitude decimal degrees, in which case distances are measured in kilometers. If x is a SpatialPoints object, the value is taken from the object itself.
control	a list of parameters for controlling the fitting process. For gwer.fit this is passed to glm.control.
model	a logical value indicating whether model frame should be included as a component of the returned value.
x	a logical value indicating whether the response vector used in the fitting process should be returned as components of the returned value.
y	a logical value indicating whether model matrix used in the fitting process should be returned as components of the returned value.
contrasts	an optional list. See the contrasts.arg of model.matrix.default.
parplot	if TRUE the parameters boxplots are plotted.
offset	this can be used to specify an a priori known component to be included in the linear predictor during fitting as in glm.
type	character that indicates the type of residuals should consider as return.
gwr.diag	if TRUE is calculated the diagnostic measures of the model and provided in return.
...	arguments to be used to form the default control argument if it is not supplied directly.

Value

A list of class "gwer":

SDF	a SpatialPointsDataFrame (may be gridded) or SpatialPolygonsDataFrame object (see package **sp**) with fit.points, weights, GWR coefficient estimates, dispersion and the residuals of type in its data slot.
coef	regression parameters matrix of the fitted model.
se	standard errors matrix for the parameters of the fitted model.
pvalue	p-value matrix for the significance tests of parameters of the fitted model.
lhat	hat matrix of the geographically weighted elliptical model.
lm	elliptical regression on the same model formula.
Weights	matrix for geographical weighting.
results	a list of results values for fitted geographically weighted elliptical model.
fitted	the fitted mean values of the geographically weighted elliptical model.
diag	a list of diagnostic matrices ('leverage', 'global influence' and 'local influence'), see elliptical.diag for more details.
residuals	a list of all residuals type ('ordinal', 'studentized' and 'deviance').
this.call	the function call used.

References

Brunsdon, C., Fotheringham, A. S. and Charlton, M. E. (1996). Geographically weighted regression: a method for exploring spatial nonstationarity. Geographical analysis, 28(4), 281-298. https://doi.org/10.1111/j.1538-4632.1996.tb00936.x

Fang, K. T., Kotz, S. and NG, K. W. (1990, ISBN:9781315897943). Symmetric Multivariate and Related Distributions. London: Chapman and Hall.

See Also

gwer.sel, elliptical, family.elliptical

Examples

```
data(columbus, package="spData")
fit.lm <- lm(CRIME ~ INC, data=columbus)
summary(fit.lm)
gwer.bw <- gwer.sel(CRIME ~ INC, data=columbus, family = Normal(),
                coords=cbind(columbus$X, columbus$Y))
fit.gwer <- gwer(CRIME ~ INC, family = Normal(), bandwidth = gwer.bw,
                parplot = TRUE, data=columbus, method = "gwer.fit",
                coords=cbind(columbus$X, columbus$Y))

data(columbus, package="spData")
fit.lm <- lm(CRIME ~ INC, data=columbus)
summary(fit.lm)
gwer.bw <- gwer.sel(CRIME ~ INC, data=columbus, family = Student(df=4),
                coords=cbind(columbus$X, columbus$Y), method = 'aic')
gwer.fitt <- gwer(CRIME ~ INC, family = Student(df=4), bandwidth = gwer.bw,
                parplot = TRUE, data=columbus, method = "gwer.fit",
                coords=cbind(columbus$X, columbus$Y))
```

---

gwer.sel *Optimization of Bandwidth for Geographically Weighted Elliptical Regression*

Description

The function finds a bandwidth for a given geographically weighted elliptical regression by optimzing a selected function. For cross-validation, this scores the root mean square prediction error for the geographically weighted elliptical regressions, choosing the bandwidth minimizing this quantity.

Usage

```
gwer.sel(formula, data = list(), coords, adapt = FALSE,
  gweight = gwr.Gauss, method = "cv", verbose = TRUE,
  longlat = NULL, family, RMSE = FALSE, weights,
  tol = .Machine$double.eps^0.25, show.error.messages = FALSE, ...)
```

Arguments

formula	regression model formula as in glm.
data	model data frame, or may be a SpatialPointsDataFrame or SpatialPolygonsDataFrame as defined in package **sp**.
coords	matrix of coordinates of points representing the spatial positions of the observations.
adapt	defines the type of bandwidth used. Either TRUE: find the proportion between 0 and 1 of observations to include in weighting scheme (k-nearest neighbours) or FALSE: find global bandwidth.
gweight	geographical weighting function, at present gwr.Gauss() default, or gwr.bisquare().
method	default "cv" for drop-1 cross-validation, "aic" for AIC optimisation (depends on assumptions about AIC degrees of freedom) or "sv" for spatial validation.
verbose	if TRUE (default), reports the progress of search for bandwidth.
longlat	TRUE if point coordinates are longitude-latitude decimal degrees, in which case distances are measured in kilometers; if x is a SpatialPoints object, the value is taken from the object itself.
family	a description of the error distribution to be used in the model (see elliptical.family for details of family functions).
RMSE	default FALSE to correspond with CV scores in newer references (sum of squared CV errors), if TRUE the previous behaviour of scoring by LOO CV RMSE.
weights	case weights used as in weighted least squares, beware of scaling issues. Only used with the cross-validation method, probably unsafe.
tol	the desired accuracy to be passed to optimize.
show.error.messages	default FALSE. may be set to TRUE to see error messages if gwer.sel returns without a value.
...	arguments to be used to form the default control argument if it is not supplied directly.

Value

returns the bandwidth optimization value.

References

Brunsdon, C., Fotheringham, A. S. and Charlton, M. E. (1996). Geographically weighted regression: a method for exploring spatial nonstationarity. Geographical analysis, 28(4), 281-298. https://doi.org/10.1111/j.1538-4632.1996.tb00936.x

Fang, K. T., Kotz, S. and NG, K. W. (1990, ISBN:9781315897943). Symmetric Multivariate and Related Distributions. London: Chapman and Hall.

See Also

gwer, elliptical, family.elliptical

Examples

```
data(columbus, package="spData")
gwer.bw <- gwer.sel(CRIME ~ INC, data=columbus, family = Normal(),
                 coords=cbind(columbus$X, columbus$Y))

data(columbus, package="spData")
gwer.bw <- gwer.sel(CRIME ~ INC, data=columbus, family = Student(df=4),
                 coords=cbind(columbus$X, columbus$Y))
```

LogisI *Logistic Type I Distribution*

Description

Family objects for logistic type I distribution provide a convenient way to specify the details of the models used by functions such as `elliptical`.

Usage

```
LogisI()
```

Value

An object of class "family" for logistic type I distribution.

References

Fang, K. T., Kotz, S. and NG, K. W. (1990, ISBN:9781315897943). Symmetric Multivariate and Related Distributions. London: Chapman and Hall.

See Also

`family.elliptical`, `elliptical`, `gwer`

Examples

```
data(luzdat)
y <- luzdat$y
x1 <- luzdat$x1 ; x1 <- factor(x1) ; x1 <- C(x1,treatment)
x2 <- luzdat$x2
x3 <- (luzdat$x2)^2
luz <- data.frame(y,x1,x2,x3)
elliptical.fitLI <- elliptical(y ~ x1+x2+x3, family = LogisI()
,data=luz)
family(elliptical.fitLI)
```

LogisII *Logistic Type II Distribution*

Description

Family objects for logistic type II distribution provide a convenient way to specify the details of the models used by functions such as `elliptical`.

Usage

```
LogisII()
```

Value

An object of class "family" for logistic type II distribution.

References

Fang, K. T., Kotz, S. and NG, K. W. (1990, ISBN:9781315897943). Symmetric Multivariate and Related Distributions. London: Chapman and Hall.

See Also

`family.elliptical`, `elliptical`, `gwer`

Examples

```
data(luzdat)
y <- luzdat$y
x1 <- luzdat$x1 ; x1 <- factor(x1) ; x1 <- C(x1,treatment)
x2 <- luzdat$x2
x3 <- (luzdat$x2)^2
luz <- data.frame(y,x1,x2,x3)
elliptical.fitLII <- elliptical(y ~ x1+x2+x3, family = LogisII()
,data=luz)
family(elliptical.fitLII)
```

luzdat *Brightness of Snacks*

Description

This dataset its a part of a study development by the nutritional department of USP (S\~ao Paulo University) such that is compared five new type composition of the snack with low saturated fat and fatty acids.

Usage

```
data(luzdat)
```

Format

The "data" slot is a data frame with 150 observations on the following 4 variables.

y the brightness of the product on a scale of 0 to 100 (the higher the value the product lighter).

x1 its the type compositions for the news snacks.

x2 its the time (in weeks) when was measurements the brightness of the product.

rot a characters vector that indicate the group-week-measurement for each snack.

References

Paula, G. A., de Moura, A. S. and Yamaguchi, A. M. (2004). Relat\'orio de an\'alise estat\'istica sobre o projeto: estabilidade sensorial de snacks aromatizados com \'oleo de canola e gordura vegetal hidrogenada. RAE-CEA 04105, IME-USP.

Examples

```
data(luzdat)
y <- luzdat$y
x1 <- luzdat$x1 ; x1 <- factor(x1) ; x1 <- C(x1,treatment)
x2 <- luzdat$x2
x3 <- (luzdat$x2)^2
luz <- data.frame(y,x1,x2,x3)
elliptical.fitt <- elliptical(y ~ x1+x2+x3, family = Student(df=5)
,data=luz)
```

Normal *Normal Distribution*

Description

Family objects for normal distribution provide a convenient way to specify the details of the models used by functions such as `elliptical`.

Usage

```
Normal()
```

Value

An object of class "family" for normal distribution.

References

Fang, K. T., Kotz, S. and NG, K. W. (1990, ISBN:9781315897943). Symmetric Multivariate and Related Distributions. London: Chapman and Hall.

See Also

family.elliptical, elliptical, gwer

Examples

```
data(luzdat)
y <- luzdat$y
x1 <- luzdat$x1 ; x1 <- factor(x1) ; x1 <- C(x1,treatment)
x2 <- luzdat$x2
x3 <- (luzdat$x2)^2
luz <- data.frame(y,x1,x2,x3)
elliptical.fitN <- elliptical(y ~ x1+x2+x3, family = Normal()
,data=luz)
family(elliptical.fitN)
```

Powerexp *Power Exponential Distribution*

Description

Family objects for power exponential distribution provide a convenient way to specify the details of the models used by functions such as elliptical.

Usage

```
Powerexp(k = stop("no k argument"))
```

Arguments

k	shape parameter.

Value

An object of class "family" for power exponential distribution.

References

Fang, K. T., Kotz, S. and NG, K. W. (1990, ISBN:9781315897943). Symmetric Multivariate and Related Distributions. London: Chapman and Hall.

See Also

family.elliptical, elliptical, gwer

Examples

```
data(luzdat)
y <- luzdat$y
x1 <- luzdat$x1 ; x1 <- factor(x1) ; x1 <- C(x1,treatment)
x2 <- luzdat$x2
x3 <- (luzdat$x2)^2
luz <- data.frame(y,x1,x2,x3)
elliptical.fitPe <- elliptical(y ~ x1+x2+x3, family = Powerexp(1)
,data=luz)
family(elliptical.fitPe)
```

---

residuals.elliptical *Extract Model Residuals*

Description

residuals is a generic function which extracts model residuals from objects returned by modeling functions.

Usage

```
## S3 method for class 'elliptical'
residuals(object, type = c("stand", "pearson",
  "response"), ...)
```

Arguments

object	fit object for elliptical regression model.
type	an character string that indicates the type of residuals.
...	arguments to be used to form the default control argument if it is not supplied directly.

Value

Residuals extracted from the object.

References

Galea, M., Paula, G. A., and Cysneiros, F. J. A. (2005). On diagnostics in symmetrical nonlinear models. Statistics & Probability Letters, 73(4), 459-467. https://doi.org/10.1016/j.spl.2005.04.033

See Also

elliptical

Examples

```
data(luzdat)
y <- luzdat$y
x1 <- luzdat$x1 ; x1 <- factor(x1) ; x1 <- C(x1,treatment)
x2 <- luzdat$x2
x3 <- (luzdat$x2)^2
luz <- data.frame(y,x1,x2,x3)
elliptical.fitt <- elliptical(y ~ x1+x2+x3, family = Student(df=5)
,data=luz)
residuals(elliptical.fitt)
```

`Student` *t-Student Distribution*

Description

Family objects for t-Student distribution provide a convenient way to specify the details of the models used by functions such as `elliptical`.

Usage

```
Student(df = stop("no df argument"))
```

Arguments

`df`	degrees of freedom.

Value

An object of class "family" for student distribution.

References

Fang, K. T., Kotz, S. and NG, K. W. (1990, ISBN:9781315897943). Symmetric Multivariate and Related Distributions. London: Chapman and Hall.

See Also

`family.elliptical`, `elliptical`, `gwer`

Examples

```
data(luzdat)
y <- luzdat$y
x1 <- luzdat$x1 ; x1 <- factor(x1) ; x1 <- C(x1,treatment)
x2 <- luzdat$x2
x3 <- (luzdat$x2)^2
luz <- data.frame(y,x1,x2,x3)
elliptical.fitt <- elliptical(y ~ x1+x2+x3, family = Student(df=5)
```

```
,data=luz)
family(elliptical.fitt)
```

`summary.elliptical` *Summarizing Elliptical Model Fits.*

Description

These functions are all methods for class `glm` or `summary.glm` objects.

Usage

```
## S3 method for class 'elliptical'
summary(object, correlation = TRUE, ...)
```

Arguments

`object`	fit object for elliptical regression model.
`correlation`	if TRUE, the correlation matrix of the estimated parameters is returned and printed.
`...`	arguments to be used to form the default control argument if it is not supplied directly.

Value

returns an object of class `summary.elliptical`, a list with components:

`coefficients`	the matrix of coefficients, standard errors and significance values for hypothesis test.
`dispersion`	either the supplied argument or the estimated dispersion with standard error.
`residuals`	residuals from `object`.
`cov.unscaled`	the unscaled (dispersion = 1) estimated covariance matrix of the estimated coefficients.
`corrrelation`	the likelihood logarithm value of the adjusted model's.
`family`	family from `object`.
`loglik`	logarithmic likelihood from `object`.
`terms`	the `terms` object used.
`df`	degrees of fredom from `object`.
`inter`	the number of iterations of optimization process from `object`.
`nas`	a logical vector indicating if there is `na` in estimation of coefficients.
`call`	the matched call from `object`.
`scale`	the values of the 4d_g for the specified distribution from `object`.
`scaledispersion`	the values of the 4f_g for the specified distribution from `object`.

References

Cysneiros, F. J. A., Paula, G. A., and Galea, M. (2007). Heteroscedastic symmetrical linear models. Statistics & probability letters, 77(11), 1084-1090. https://doi.org/10.1016/j.spl.2007.01.012

See Also

glm, elliptical, elliptical.diag

Examples

```
data(luzdat)
y <- luzdat$y
x1 <- luzdat$x1 ; x1 <- factor(x1) ; x1 <- C(x1,treatment)
x2 <- luzdat$x2
x3 <- (luzdat$x2)^2
luz <- data.frame(y,x1,x2,x3)
elliptical.fitt <- elliptical(y ~ x1+x2+x3, family = Student(df=5)
,data=luz)
summary(elliptical.fitt)
```

Index