Package 'gwer'

April 28, 2021

Type Package

Title Geographically Weighted Elliptical Regression

Version 3.0

Date 2021-04-25

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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 (>= 4.0.0), sp (> 1.4-0)

Imports maptools (>= 0.7-32), stats, Matrix, methods, spData (>= 0.2.6.2), spdep, GWmodel, spgwr, utils, assertthat, glogis, graphics

Suggests rgdal, parallel, testthat

NeedsCompilation no

License GPL (>= 2)

RoxygenNote 7.1.1

Encoding UTF-8

LazyData true

Repository CRAN

Date/Publication 2021-04-28 04:30:02 UTC

R topics documented:

`anova.elliptical` *Analysis of Deviance for Elliptical Regression Models*

Description

Compute an analysis of deviance table for the fitted elliptical regression model.

Usage

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

Arguments

`object`	an object with the result of the fitted elliptical regression model.
`...`	arguments to be used to form the default control argument if it is not supplied directly.
`dispersion`	the dispersion parameter for the fitting family. By default it is obtained from the object.
`test`	a character string indicating the hypothesis test considered. Only chi-square test is implemented at moment.

Value

Return an object of class "anova". This object contain the analysis of deviance table.

References

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

See Also

elliptical, summary.elliptical, family.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, test = "Chisq")
```

---

bw.gwer *Optimization of Bandwidth for Geographically Weighted Elliptical Regression Model*

Description

The function compute the optimal bandwidth for a given geographically weighted elliptical regression using three differents methods: cross-validation, AIC and spatial validation. This optimal bandwidth optimzing the selected function.

Usage

```
bw.gwer(
  formula,
  family = Normal(),
  data,
  approach = "CV",
  kernel = "bisquare",
  adaptive = F,
  spdisp = "local",
  dispersion,
  p = 2,
  theta = 0,
  longlat = F,
  dMat
)
```

Arguments

formula	regression model formula of a formula object.
family	a description of the error distribution to be used in the model (see family.elliptical for more details of family functions).

data	a SpatialPointsDataFrame or SpatialPolygonsDataFrame as defined in package **sp**.
approach	specified by CV for cross-validation approach, by AIC for corrected Akaike information criterion approach or by MI for spatial-validation approach.
kernel	function chosen as follows: gaussian: wgt = exp(-.5*(vdist/bw)^2); exponential: wgt = exp(-vdist/bw); bisquare: wgt = (1-(vdist/bw)^2)^2 if vdist < bw, wgt=0 otherwise; tricube: wgt = (1-(vdist/bw)^3)^3 if vdist < bw, wgt=0 otherwise; boxcar: wgt=1 if dist < bw, wgt=0 otherwise.
adaptive	if TRUE calculate an adaptive kernel where the bandwidth (bw) corresponds to the number of nearest neighbours (i.e. adaptive distance); default is FALSE, where a fixed kernel is found (bandwidth is a fixed distance).
spdisp	if TRUE, by default, the dispersion parameter vary geographically in estimation process.
dispersion	an optional fixed value for dispersion parameter.
p	the power of the Minkowski distance, default is 2 (Euclidean distance).
theta	an angle in radians to rotate the coordinate system, default is 0
longlat	if TRUE, great circle distances will be calculated.
dMat	a pre-specified distance matrix, it can be calculated by the function gw.dist.

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. doi: 10.1111/j.15384632.1996.tb00936.x

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

gwer, elliptical, family.elliptical

Examples

```
data(georgia, package="spgwr")
fit.formula <- PctBach ~ TotPop90 + PctRural + PctFB + PctPov
gwer.bw.n <- bw.gwer(fit.formula, data = gSRDF, family = Student(3),
                     longlat = TRUE, adapt = TRUE)
```

elliptical *Fitting Elliptical Regression Models*

Description

The function `elliptical` is used to fit linear elliptical regression models. This models is specified giving a symbolic description of the systematic and stochastic components.

Usage

```
elliptical(
  formula = formula(data),
  family = Normal,
  data,
  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 of a formula `object`.
`family`	a description of the error distribution to be used in the model (see `family.elliptical` for details of elliptical distribution).
`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 numeric vector of "prior weights" to be used in the fitting process.
`subset`	an optional numeric 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 model 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. This is passed by `glm.control`.

model	a logical value indicating whether model frame should be included as a component of the return.
x	a logical value indicating whether the response vector used in the fitting process should be returned as components of the return.
y	a logical value indicating whether model matrix used in the fitting process should be returned as components of the return.
contrasts	an optional list. See the contrasts.arg of model.matrix.default.
offset	this can be used to specify a "prior 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

returns an object of class "elliptical", a list with follow components:

coefficients	coefficients of location parameters.
dispersion	coefficient of dispersion parameter.
residuals	standardized residuals.
fitted.values	the fitted mean values.
loglik	the likelihood logarithm value for the fitted model.
Wg	values of the function W_g(u).
Wgder	values for the function W^{(1)}_g(u).
v	values for the function V(u).
rank	the numeric rank for the fitted model.
R	the matrix of correlation for the estimated parameters.
inter	number of iterations of optimization process.
scale	values of the 4d_g for the specified distribution.
scaledispersion	values of the 4f_g for the specified distribution.
scalevariance	values of the scale variance for the specified distribution.
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,sigmap	dispersion parameters for contaminated normal distribution.
k	shape parameter for power exponential distribution.
Xmodel	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. doi: 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, summary.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.fitLII <- elliptical(y ~ x1+x2+x3, family = LogisII()
,data=luz)
```

---

elliptical.diag *Diagnostic Measures for Elliptical Regression Models*

Description

This function obtains the values of different residuals types and calculates the diagnostic measures for the fitted elliptical regression model.

Usage

```
elliptical.diag(object, ...)
```

Arguments

`object`	an object with the result of the fitted elliptical regression model.
`...`	arguments to be used to form the default control argument if it is not supplied directly.

Value

Returns a list of diagnostic arrays:

`ro`	ordinal residuals.
`rr`	response residuals.
`rp`	pearson residuals.
`rs`	studentized residuals.
`rd`	deviance residuals.
`dispersion`	coefficient of dispersion parameter.
`Hat`	the hat matrix.
`h`	main diagonal of the hat matrix.
`GL`	generalized leverage.
`GLbeta`	generalized leverage of location parameters estimation.
`GLphi`	generalized leverage of dispersion parameters estimation.
`DGbeta`	cook distance of location parameters estimation.
`DGphi`	cook distance of dispersion parameters estimation.
`Cic`	normal curvature for case-weight perturbation.
`Cih`	normal curvature for scale perturbation.
`Lmaxr`	local influence on response (additive perturbation in responce).
`Lmaxc`	local influence on coefficients (additive perturbation in predictors).

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. doi: 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 generate diagnostic measures plots for the fitted elliptical regression models.

Usage

```
elliptical.diag.plots(
  object,
  ellipticaldiag = NULL,
  which,
  subset = NULL,
  iden = FALSE,
  labels = NULL,
  ret = FALSE,
  ...
)
```

Arguments

`object`	an object with the result of the fitted elliptical regression model.
`ellipticaldiag`	object list containing the diagnostic measures. By default it is obtained from the object, but can be calculated using `elliptical.diag`.
`which`	an optional numeric value with the number of only plot that must be returned.
`subset`	an optional numeric 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 are identified by user in the graphic window.
`labels`	a optional string vector specifying a labels plots.
`ret`	a logical value used to return the diagnostic measures computing. If `TRUE` the diagnostic measures are returned (see `elliptical.diag` for more details).
`...`	graphics parameters to be passed to the plotting routines.

Value

Return an interactive menu with eleven options to make plots. This menu contains the follows graphics: 1: plot: All. 2: plot: Response residual against fitted values. 3: plot: Response residual against index. 4: plot: Standardized residual against fitted values. 5: plot: Standardized residual against index. 6: plot: QQ-plot of response residuals. 7: plot: QQ-plot of standardized residuals. 8: plot: Generalized leverage. 9: plot: Total local influence index plot for response perturbation. 10: plot: Total local influence index plot scale perturbation. 11: plot: Total local influence index plot case-weight perturbation.

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. doi: 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)
```

---

elliptical.envelope *Simulated Envelope of Residuals for Elliptical Regression Models*

Description

This function produces quantile-quantile residuals plot with simulated envelope for the specified error distribution in elliptical regression models.

Usage

```
elliptical.envelope(
  object,
  B = 100,
  arg,
  xlab = NULL,
  ylab = NULL,
  ident = NULL,
  ident.labels = NULL,
  ...
)
```

Arguments

object	an object with the result of the fitted elliptical regression model.
B	number of Monte Carlo simulations.
arg	a numerical or vector representing the distribution parameters used in fitted model.

xlab	a label for the x axis, defaults to a description of x.
ylab	a label for the y axis, defaults to a description of y.
ident	a numerical indicate the number of observation identified in plot.
ident.labels	an optional character vector giving labels for the identified points.
...	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. doi: 10.1016/j.spl.2005.04.033

See Also

glm, elliptical, family.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.envelope(elliptical.fitt, B=100, arg=5)
```

---

family.elliptical *Family Objects for Elliptical Models*

Description

The family object provide an specify details of the model used by functions such as elliptical, gwer and gwer.multiscale. The distribution functions are necessary to specify the random component of the regression models with elliptical errors.

Usage

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

Normal()

Cauchy()

LogisI()
```

```
LogisII()

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

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

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

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

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

Arguments

object	an object with the result of the fitted elliptical regression model.
...	arguments to be used to form the default control argument if it is not supplied directly.
df	degrees of freedom.
k	shape parameter.
parma	parameter vector (alpha, m).
parm	parameter vector (s, r) for this distribuition.
parmt	parameters vector (epsi, sigma).

Value

An object of class "family" specifying a list with the follows 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,sigmap	dispersion parameters 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)
```

---

gwer *Geographically Weighted Elliptical Regression*

Description

The function fit geographically weighted elliptical regression model to explore the non-stationarity for a certain bandwidth and weighting function.

Usage

```
gwer(
  formula,
  data,
  regression.points,
  bandwidth,
  kernel = "bisquare",
  p = 2,
  theta = 0,
  adapt = NULL,
  hatmatrix = FALSE,
  family = Normal,
  longlat = NULL,
  dMat,
  weights,
  dispersion = NULL,
  subset,
  na.action = "na.fail",
  method = "gwer.fit",
  control = glm.control(epsilon = 1e-04, maxit = 100, trace = F),
  model = FALSE,
  x = FALSE,
  y = TRUE,
  contrasts = NULL,
  offset,
  spdisp = TRUE,
  parplot = 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**.
regression.points	a Spatial*DataFrame object, i.e. SpatialPointsDataFrame or SpatialPolygonsDataFrame as defined in package sp; Note that no diagnostic information will returned if it is assigned.
bandwidth	value of the selected bandwidth used in the weighting function (see bw.gwer for bandwidth optimization).
kernel	function chosen as follows: gaussian: wgt = exp(-.5*(vdist/bw)^2); exponential: wgt = exp(-vdist/bw); bisquare: wgt = (1-(vdist/bw)^2)^2 if vdist < bw, wgt=0 otherwise; tricube: wgt = (1-(vdist/bw)^3)^3 if vdist < bw, wgt=0 otherwise; boxcar: wgt=1 if dist < bw, wgt=0 otherwise
p	the power of the Minkowski distance, default is 2, i.e. the Euclidean distance
theta	an angle in radians to rotate the coordinate system, default is 0
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).
hatmatrix	if TRUE, return the hatmatrix as a component of the result.
family	a description of the error distribution to be used in the model (see family.elliptical for details of family functions).
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.
dMat	a pre-specified distance matrix, it can be calculated by the function gw.dist
weights	an optional numeric vector of weights to be used in the fitting process.
dispersion	an optional fixed value for dispersion parameter.
subset	an optional numeric 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	the method to be used in fitting local models. The default method "bw.gwer" 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 elliptical this is passed by glm.control.
model	a logical value indicating whether model frame should be included as a component of the return.

x	a logical value indicating whether the response vector used in the fitting process should be returned as components of the return.
y	a logical value indicating whether model matrix used in the fitting process should be returned as components of the return.
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.
spdisp	if TRUE dispersion parameter varies geographically.
parplot	if TRUE the parameters boxplots are plotted.
...	arguments to be used to form the default control argument if it is not supplied directly.

Value

returns an object of class "gwer", a list with follow components:

SDF	a SpatialPointsDataFrame (may be gridded) or SpatialPolygonsDataFrame object (see package **sp**) with fit.points, weights, GWR coefficient estimates, dispersion and the residuals in its data slot.
coef	the matrices of coefficients, standard errors and significance values for parameters hypothesis test.
dispersion	either the supplied argument or the estimated dispersion with standard error.
hat	hat matrix of the geographically weighted elliptical model.
lm	elliptical global regression on the same model formula.
results	a list of results values for fitted geographically weighted elliptical model.
bandwidth	the bandwidth used in geographical weighting function.
fitted	the fitted mean values of the geographically weighted elliptical model.
hatmatrix	a logical value indicating if hatmatrix was considered
gweights	a matrix with the geographical weighting for all local elliptical models.
family	the family object used.
flm	a matrix with the fitted values for all local elliptical models.
adapt	the adapt object used.
kernel	the kernel object used.
spdisp	the spdisp object used.
this.call	the function call used.
longlat	the longlat object 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. doi: 10.1111/j.15384632.1996.tb00936.x

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

bw.gwer, elliptical, family.elliptical

Examples

```
data(georgia, package = "spgwr")
fit.formula <- PctBach ~ TotPop90 + PctRural + PctFB + PctPov
gwer.bw.t <- bw.gwer(fit.formula, data = gSRDF, family = Student(3), adapt = TRUE)
gwer.fit.t <- gwer(fit.formula, data = gSRDF, family = Student(3), bandwidth = gwer.bw.t,
                   adapt = TRUE, parplot = FALSE, hatmatrix = TRUE, spdisp = TRUE,
                   method = "gwer.fit")
print(gwer.fit.t)
```

`gwer.diag` *Diagnostic Measures for Geographically Weighted Elliptical Regression Models*

Description

This function obtains the values of different residuals types and calculates the diagnostic measures for the fitted geographically weighted elliptical regression model.

Usage

```
gwer.diag(object, ...)
```

Arguments

`object`	an object with the result of the fitted geographically weighted elliptical regression model.
`...`	arguments to be used to form the default control argument if it is not supplied directly.

Value

Returns a list of diagnostic arrays:

`ro`	ordinal residuals.
`rr`	response residuals.
`rp`	pearson residuals.
`rs`	studentized residuals.
`rd`	deviance residuals.
`dispersion`	coefficient of dispersion parameter.
`Hat`	the hat matrix.
`h`	main diagonal of the hat matrix.
`GL`	generalized leverage.
`GLbeta`	generalized leverage of location parameters estimation.
`GLphi`	generalized leverage of dispersion parameters estimation.
`DGbeta`	cook distance of location parameters estimation.
`DGphi`	cook distance of dispersion parameters estimation.
`Cic`	normal curvature for case-weight perturbation.
`Cih`	normal curvature for scale perturbation.
`Lmaxr`	local influence on response (additive perturbation in responce).
`Lmaxc`	local influence on coefficients (additive perturbation in predictors).

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. doi: 10.1016/j.spl.2005.04.033

See Also

`elliptical`

Examples

```
data(georgia, package = "spgwr")
fit.formula <- PctBach ~ TotPop90 + PctRural + PctFB + PctPov
gwer.bw.t <- bw.gwer(fit.formula, data = gSRDF, family = Student(3), adapt = TRUE)
gwer.fit.t <- gwer(fit.formula, data = gSRDF, family = Student(3), bandwidth = gwer.bw.t,
                   adapt = TRUE, parplot = FALSE, hatmatrix = TRUE, spdisp = TRUE,
                   method = "gwer.fit")
gwer.diag(gwer.fit.t)
```

`gwer.diag.plots` *Diagnostic Plots for Geographically Weighted Elliptical Regression Models*

Description

This function generate diagnostic measures plots for the fitted geographically weighted elliptical regression models.

Usage

```
gwer.diag.plots(
  object,
  gwerdiag = NULL,
  which,
  subset = NULL,
  iden = F,
  labels = NULL,
  ret = F,
  ...
)
```

Arguments

`object`	an object with the result of the fitted geographically weighted elliptical regression models.
`gwerdiag`	object list containing the diagnostic measures. By default it is obtained from the object, but can be calculated using `gwer.diag`.
`which`	an optional numeric value with the number of only plot that must be returned.
`subset`	an optional numeric 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 are identified by user in the graphic window.
`labels`	a optional string vector specifying a labels plots.
`ret`	a logical value used to return the diagnostic measures computing. If `TRUE` the diagnostic measures are returned (see `gwer.diag` for more details).
`...`	graphics parameters to be passed to the plotting routines.

Value

Return an interactive menu with eleven options to make plots. This menu contains the follows graphics: 1: plot: All. 2: plot: Response residual against fitted values. 3: plot: Response residual against index. 4: plot: Standardized residual against fitted values. 5: plot: Standardized residual against index. 6: plot: QQ-plot of response residuals. 7: plot: QQ-plot of standardized residuals. 8: plot: Generalized leverage. 9: plot: Total local influence index plot for response perturbation. 10: plot: Total local influence index plot scale perturbation. 11: plot: Total local influence index plot case-weight perturbation.

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. doi: 10.1016/j.spl.2005.04.033

See Also

gwer, gwer.diag

Examples

```
data(georgia, package = "spgwr")
fit.formula <- PctBach ~ TotPop90 + PctRural + PctFB + PctPov
gwer.bw.t <- bw.gwer(fit.formula, data = gSRDF, family = Student(3), adapt = TRUE)
gwer.fit.t <- gwer(fit.formula, data = gSRDF, family = Student(3), bandwidth = gwer.bw.t,
                   adapt = TRUE, parplot = FALSE, hatmatrix = TRUE, spdisp = TRUE,
                   method = "gwer.fit")
gwer.diag.plots(gwer.fit.t, which=3)
```

---

gwer.envelope *Simulated Envelope of Residuals for Geographically Weighted Elliptical Regression Models*

Description

This function produces quantile-quantile residuals plot with simulated envelope for the specified error distribution in geographically weighted elliptical regression Models.

Usage

```
gwer.envelope(
  object,
  B = 100,
  arg,
  xlab = NULL,
  ylab = NULL,
  ident = NULL,
  ident.labels = NULL,
  ...
)
```

Arguments

object	an object with the result of the fitted geographically weighted elliptical regression Models.
B	number of Monte Carlo simulations.

arg	a numerical or vector representing the distribution parameters used in fitted model.
xlab	a label for the x axis, defaults to a description of x.
ylab	a label for the y axis, defaults to a description of y.
ident	a numerical indicate the number of observation identified in plot.
ident.labels	an optional character vector giving labels for the identified points.
...	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. doi: 10.1016/j.spl.2005.04.033

See Also

glm, elliptical, family.elliptical

Examples

```
data(georgia, package = "spgwr")
fit.formula <- PctBach ~ TotPop90 + PctRural + PctFB + PctPov
gwer.bw.t <- bw.gwer(fit.formula, data = gSRDF, family = Student(3), adapt = TRUE)
gwer.fit.t <- gwer(fit.formula, data = gSRDF, family = Student(3), bandwidth = gwer.bw.t,
                   adapt = TRUE, parplot = FALSE, hatmatrix = TRUE, spdisp = TRUE,
                   method = "gwer.fit")
```

---

gwer.montecarlo *Monte Carlo (randomisation) Test for Significance of GWER Parameter Variability*

Description

This function implements a Monte Carlo (randomisation) test to test for significant (spatial) variability of a geographically weighted elliptical regression model's parameters or coefficients.

Usage

```
gwer.montecarlo(
  formula,
  family = Normal,
  data = list(),
  nsims = 99,
  kernel = "bisquare",
  adaptive = F,
```

```
  bw,
  p = 2,
  theta = 0,
  dispersion = NULL,
  longlat = F,
  dMat,
  control = glm.control(epsilon = 1e-04, maxit = 100, trace = F)
)
```

Arguments

formula	regression model formula of a formula object.
family	a description of the error distribution to be used in the model (see family.elliptical for details of elliptical distribution).
data	an optional data frame, list or environment containing the variables in the model.
nsims	the number of randomisations.
kernel	function chosen as follows: gaussian: wgt = exp(-.5*(vdist/bw)^2); exponential: wgt = exp(-vdist/bw); bisquare: wgt = (1-(vdist/bw)^2)^2 if vdist < bw, wgt=0 otherwise; tricube: wgt = (1-(vdist/bw)^3)^3 if vdist < bw, wgt=0 otherwise; boxcar: wgt=1 if dist < bw, wgt=0 otherwise.
adaptive	if TRUE calculate an adaptive kernel where the bandwidth (bw) corresponds to the number of nearest neighbours (i.e. adaptive distance); default is FALSE, where a fixed kernel is found (bandwidth is a fixed distance).
bw	value of the selected bandwidth used in the weighting function (see bw.gwer for bandwidth optimization).
p	the power of the Minkowski distance, default is 2 (Euclidean distance).
theta	an angle in radians to rotate the coordinate system, default is 0
dispersion	an optional fixed value for dispersion parameter.
longlat	if TRUE, great circle distances will be calculated.
dMat	a pre-specified distance matrix, it can be calculated by the function gw.dist.
control	a list of parameters for controlling the fitting process. This is passed by glm.control.

Value

A vector containing p-values for all parameters spatial variability tests

References

Brunsdon C, Fotheringham AS, Charlton ME (1998) Geographically weighted regression - modelling spatial non-stationarity. Journal of the Royal Statistical Society, Series D-The Statistician 47(3):431-443

See Also

bw.gwer, elliptical, family.elliptical

Examples

```
data(georgia, package = "spgwr")
fit.formula <- PctBach ~ TotPop90 + PctRural + PctFB + PctPov
gwer.bw.t <- bw.gwer(fit.formula, data = gSRDF, family = Student(4), adapt = TRUE)
gwer.fit.t <- gwer(fit.formula, data = gSRDF, family = Student(4), bandwidth = gwer.bw.t,
                   adapt = TRUE, parplot = FALSE, hatmatrix = TRUE, spdisp = TRUE,
                   method = "gwer.fit")
gwer.montecarlo(fit.formula, data = gSRDF, family = Student(3), bw = gwer.bw.t, adaptive = TRUE)
```

---

gwer.multiscale *Multiscale Geographically Weighted Elliptical Regression*

Description

The function fit geographically weighted elliptical regression model to explore the non-stationarity relationshps across differente spatial scales.

Usage

```
gwer.multiscale(
  formula,
  data,
  kernel = "bisquare",
  approach = "CV",
  adaptive = FALSE,
  criterion = "dCVR",
  family = Normal,
  threshold = 1e-05,
  dMats,
  p.vals,
  theta.vals,
  longlat = NULL,
  bws0,
  bw.seled = rep(F, length(bws0)),
  bws.thresholds = rep(0.1, length(dMats)),
  bws.reOpts = 5,
  spdisp = "local",
  verbose = F,
  weights,
  dispersion = NULL,
  na.action = "na.fail",
  hatmatrix = T,
  control = glm.control(epsilon = 1e-04, maxit = 100, trace = F),
  model = FALSE,
  x = FALSE,
```

```
  y = TRUE,
  contrasts = NULL,
  parplot = FALSE,
  max.iterations = 2000,
  subset,
  offset,
  predictor.centered = rep(T, length(bws0) - 1),
  nlower = 10,
  ...
)
```

Arguments

formula	regression model formula as in glm.
data	model data frame, or may be a SpatialPointsDataFrame or SpatialPolygonsDataFrame as defined in package **sp**.
kernel	function chosen as follows: gaussian: wgt = exp(-.5*(vdist/bw)^2); exponential: wgt = exp(-vdist/bw); bisquare: wgt = (1-(vdist/bw)^2)^2 if vdist < bw, wgt=0 otherwise; tricube: wgt = (1-(vdist/bw)^3)^3 if vdist < bw, wgt=0 otherwise; boxcar: wgt=1 if dist < bw, wgt=0 otherwise
approach	specified by CV for cross-validation approach or by AIC corrected (AICc) approach
adaptive	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).
criterion	criterion for determining the convergence of the back-fitting procedure, could be "CVR" or "dCVR", which corespond to the changing value of RSS (CVR) and the differential version (dCVR), respectively; and "dCVR" is used as default.
family	a description of the error distribution to be used in the model (see family.elliptical for details of family functions).
threshold	threshold value to terminate the back-fitting iteration.
dMats	a list of distance matrices used for estimating each specific parameter
p.vals	a collection of positive numbers used as the power of the Minkowski distance
theta.vals	a collection of values used as angles in radians to rotate the coordinate system
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.
bws0	a vector of initializing bandwidths for the back-fitting procedure, of which the length should equal to the number of paramters if specified
bw.seled	a vector of boolean variables to determine whether the corresponding bandwidth should be re-selected or not: if TRUE, the corresponding bandwiths for the specific parameters are supposed to be given in bws0; otherwise, the bandwidths for the specific parameters will be selected within the back-fitting iterations.
bws.thresholds	threshold values to define whether the bandwidth for a specific parameter has converged or not

bws.reOpts	the number times of continually optimizing each parameter-specific bandwidth even though it meets the criterion of convergence, for avoiding sub-optimal choice due to illusion of convergence;
spdisp	if TRUE dispersion parameter varies geographically.
verbose	if TRUE (default) reports the progress of search for bandwidth.
weights	an optional numeric vector of weights to be used in the fitting process.
dispersion	an optional fixed value for dispersion parameter.
na.action	a function which indicates what should happen when the data contain NAs (see glm).
hatmatrix	if TRUE, return the hatmatrix as a component of the result.
control	a list of parameters for controlling the fitting process. For elliptical this is passed by glm.control.
model	a logical value indicating whether model frame should be included as a component of the return.
x	a logical value indicating whether the response vector used in the fitting process should be returned as components of the return.
y	a logical value indicating whether model matrix used in the fitting process should be returned as components of the return.
contrasts	an optional list. See the contrasts.arg of model.matrix.default.
parplot	if TRUE the parameters boxplots are plotted.
max.iterations	maximum number of iterations in the back-fitting procedure.
subset	an optional numeric vector specifying a subset of observations to be used in the fitting process.
offset	this can be used to specify an a priori known component to be included in the linear predictor during fitting as in glm.
predictor.centered	a logical vector of length equalling to the number of predictors, and note intercept is not included; if the element is TRUE, the corresponding predictor will be centered.
nlower	the minmum number of nearest neighbours if an adaptive kernel is used
...	arguments to be used to form the default control argument if it is not supplied directly.

Value

returns an object of class "gwer", a list with follow components:

SDF	a SpatialPointsDataFrame (may be gridded) or SpatialPolygonsDataFrame object (see package **sp**) with fit.points, weights, GWR coefficient estimates, dispersion and the residuals in its data slot.
coef	the matrices of coefficients, standard errors and significance values for parameters hypothesis test.
dispersion	either the supplied argument or the estimated dispersion with standard error.

hat	hat matrix of the geographically weighted elliptical model.
lm	elliptical global regression on the same model formula.
results	a list of results values for fitted geographically weighted elliptical model.
bandwidth	the bandwidth used in geographical weighting function.
fitted	the fitted mean values of the geographically weighted elliptical model.
hatmatrix	a logical value indicating if hatmatrix was considered
gweights	a matrix with the geographical weighting for all local elliptical models.
family	the family object used.
flm	a matrix with the fitted values for all local elliptical models.
adapt	the adapt object used.
gweight	the gweights object used.
spdisp	the spdisp object used.
this.call	the function call used.
fp.given	the fp.given object used.
longlat	the longlat object 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. doi: 10.1111/j.15384632.1996.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

bw.gwer, elliptical, family.elliptical

Examples

```
data(georgia, package = "spgwr")
fit.formula <- PctBach ~ TotPop90 + PctRural + PctFB + PctPov
gwer.bw.t <- bw.gwer(fit.formula, data = gSRDF, family = Student(3), adapt = TRUE)
msgwr.fit.t <- gwer.multiscale(fit.formula, family = Student(3), data = gSRDF,
                               bws0 = rep(gwer.bw.t, 5), hatmatrix = TRUE,
                               adaptive = TRUE)
```

`gwer.multiscale.diag` *Diagnostic for Geographically Weighted Elliptical Regression Models*

Description

This function obtains the values of different residuals types and calculates the diagnostic measures for the fitted geographically weighted elliptical regression model.

Usage

```
gwer.multiscale.diag(object, ...)
```

Arguments

`object`	an object with the result of the fitted multiscale geographically weighted elliptical regression model.
`...`	arguments to be used to form the default control argument if it is not supplied directly.

Value

Returns a list of diagnostic arrays:

`ro`	ordinal residuals.
`rr`	response residuals.
`rp`	pearson residuals.
`rs`	studentized residuals.
`rd`	deviance residuals.
`dispersion`	coefficient of dispersion parameter.
`Hat`	the hat matrix.
`h`	main diagonal of the hat matrix.
`GL`	generalized leverage.
`GLbeta`	generalized leverage of location parameters estimation.
`GLphi`	generalized leverage of dispersion parameters estimation.
`DGbeta`	cook distance of location parameters estimation.
`DGphi`	cook distance of dispersion parameters estimation.
`Cic`	normal curvature for case-weight perturbation.
`Cih`	normal curvature for scale perturbation.
`Lmaxr`	local influence on response (additive perturbation in responce).
`Lmaxc`	local influence on coefficients (additive perturbation in predictors).

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. doi: 10.1111/j.15384632.1996.tb00936.x

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

See Also

elliptical

Examples

```
data(georgia, package = "spgwr")
fit.formula <- PctBach ~ TotPop90 + PctRural + PctFB + PctPov
gwer.bw.t <- bw.gwer(fit.formula, data = gSRDF, family = Student(3), adapt = TRUE)
msgwr.fit.t <- gwer.multiscale(fit.formula, family = Student(3), data = gSRDF,
                               bws0 = rep(gwer.bw.t, 5), hatmatrix = TRUE,
                               adaptive = TRUE)
gwer.multiscale.diag(msgwr.fit.t)
```

---

gwer.multiscale.diag.plots

Diagnostic Plots for Multiscale Geographically Weighted Elliptical Regression Models

---

Description

This function generate diagnostic measures plots for the fitted multiscale geographically weighted elliptical regression models.

Usage

```
gwer.multiscale.diag.plots(
  object,
  mgwerdiag = NULL,
  which,
  subset = NULL,
  iden = F,
  labels = NULL,
  ret = F,
  ...
)
```

Arguments

object	an object with the result of the fitted multiscale geographically weighted elliptical regression models.
mgwerdiag	object list containing the diagnostic measures. By default it is obtained from the object, but can be calculated using gwer.multiscale.diag.
which	an optional numeric value with the number of only plot that must be returned.
subset	an optional numeric 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 are identified by user in the graphic window.
labels	a optional string vector specifying a labels plots.
ret	a logical value used to return the diagnostic measures computing. If TRUE the diagnostic measures are returned (see gwer.multiscale.diag for more details).
...	graphics parameters to be passed to the plotting routines.

Value

Return an interactive menu with eleven options to make plots. This menu contains the follows graphics: 1: plot: All. 2: plot: Response residual against fitted values. 3: plot: Response residual against index. 4: plot: Quantile residual against fitted values. 5: plot: Quantile residual against index. 6: plot: QQ-plot of response residuals. 7: plot: QQ-plot of Quantile residuals. 8: plot: Generalized leverage. 9: plot: Total local influence index plot for response perturbation. 10: plot: Total local influence index plot scale perturbation. 11: plot: Total local influence index plot case-weight perturbation.

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. doi: 10.1111/j.15384632.1996.tb00936.x

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

See Also

gwer.multiscale, gwer.multiscale.diag

Examples

```
data(georgia, package = "spgwr")
fit.formula <- PctBach ~ TotPop90 + PctRural + PctFB + PctPov
gwer.bw.t <- bw.gwer(fit.formula, data = gSRDF, family = Student(3), adapt = TRUE)
msgwr.fit.t <- gwer.multiscale(fit.formula, family = Student(3), data = gSRDF,
                               bws0 = rep(gwer.bw.t, 5), hatmatrix = TRUE,
                               adaptive = TRUE)
gwer.multiscale.diag.plots(msgwr.fit.t, which=3)
```

luzdat *Brightness of Snacks Dataset*

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)
```

`residuals.elliptical` *Extract Residuals for Elliptical Regression Model Fits*

Description

This function compute different types of residuals to the fitted elliptical regression model.

Usage

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

Arguments

`object`	an object with the result of the fitted elliptical regression model.
`type`	a character string that indicates the type of residuals. If is `stand` will be computed the standard residuals. If is `ordinal` will be computed the ordinal residuals. If is `response` will be computed the response residuals. If is `pearson` will be computed the Pearson residuals. If is `desvio` will be computed the desviance residuals.
`...`	arguments to be used to form the default control argument if it is not supplied directly.

Value

Residuals of the specific `type` 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. doi: 10.1016/j.spl.2005.04.033

See Also

`residuals`, `elliptical`, `family.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, type = "stand")
```

`residuals.gwer` *Extract Residuals for Geographically Weighted Elliptical Regression Model Fits*

Description

This function compute different types of residuals to the fitted geographically weighted elliptical regression model.

Usage

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

Arguments

`object`	an object with the result of the fitted geographically weighted elliptical regression model.
`type`	a character string that indicates the type of residuals. If is `stand` will be computed the standar residuals. If is `ordinal` will be computed the ordinal residuals. If is `response` will be computed the response residuals. If is `pearson` will be computed the pearson residuals. If is `desvio` will be computed the desviance residuals.
`...`	arguments to be used to form the default control argument if it is not supplied directly.

Value

Residuals of the specific `type` extracted from the `object`.

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. doi: 10.1111/j.15384632.1996.tb00936.x

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

See Also

residuals, gwer, family.elliptical

Examples

```
data(georgia, package = "spgwr")
fit.formula <- PctBach ~ TotPop90 + PctRural + PctFB + PctPov
gwer.bw.t <- bw.gwer(fit.formula, data = gSRDF, family = Student(3), adapt = TRUE)
gwer.fit.t <- gwer(fit.formula, data = gSRDF, family = Student(3), bandwidth = gwer.bw.t,
                   adapt = TRUE, parplot = FALSE, hatmatrix = TRUE, spdisp = TRUE,
                   method = "gwer.fit")
summary(gwer.fit.t)
residuals(gwer.fit.t, type = "stand")
```

---

summary.elliptical *Summarizing Elliptical Model Fits.*

Description

This function produce summary for the result of the fitted elliptical regression model.

Usage

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

Arguments

object	an object with the result of the fitted elliptical regression model.
correlation	a logical value to return the correlation for the estimated parameters. If TRUE (by default) return the correlation matrix.
...	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 follow components:

coefficients	the matrix of coefficients, standard errors and significance values for parameters hypothesis test.
dispersion	either the supplied argument or the estimated dispersion with standard error.
residuals	the residuals from object.
cov.unscaled	the unscaled (dispersion = 1) estimated covariance matrix of the estimated coefficients.

corrrelation	the matrix of correlation for the estimated parameters.
family	family from object.
loglik	the likelihood logarithm value from object.
df	degrees of freedom from object.
terms	the terms object used.
inter	number of iterations of optimization process.
nas	a logical vector indicating if there is na in estimation of coefficients.
type	a character string indicating the type of residuals was obtained from object
call	the matched call from object.
scale	values of the 4d_g for the specified distribution from object.
scaledispersion	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. doi: 10.1016/j.spl.2007.01.012

See Also

summary, elliptical, family.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)
summary(elliptical.fitt)
```

---

summary.gwer *Summarizing Geographically Weighted Elliptical Regression Model Fits.*

Description

This function produce summary for the result of the fitted geographically weighted elliptical regression model.

Usage

```
## S3 method for class 'gwer'
summary(object, ...)
```

Arguments

object	an object with the result of the fitted geographically weighted elliptical regression model.
...	arguments to be used to form the default control argument if it is not supplied directly.

Value

returns an object of class "summary.gwer", a list with follow components:

coefficients	the matrix of summarizing coefficients, standard errors and significance values for parameters hypothesis test.
dispersion	either the supplied argument or the estimated dispersion with standard error.
residuals	the residuals from object.
family	family from object.
results	a list of results values for fitted geographically weighted elliptical model.
spdisp	a logical value indicating whether the dispersion varies geographically from object.
df	degrees of freedom from object.
terms	the terms object used.
inter	number of iterations of optimization process.
nas	a logical vector indicating if there is na in estimation of coefficients.
type	a character string indicating the type of residuals was obtained from object
hatmatrix	a logical value indicating if hat matrix was obtained from object
call	the matched call from object.
scale	values of the 4d_g for the specified distribution from object.
scaledispersion	values of the 4f_g for the specified distribution from object.
scalevariance	values of the scale variance for the specified distribution from object.

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. doi: 10.1111/j.15384632.1996.tb00936.x

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

See Also

summary, gwer, family.elliptical

Examples

```
data(georgia, package = "spgwr")
fit.formula <- PctBach ~ TotPop90 + PctRural + PctFB + PctPov
gwer.bw.t <- bw.gwer(fit.formula, data = gSRDF, family = Student(3), adapt = TRUE)
gwer.fit.t <- gwer(fit.formula, data = gSRDF, family = Student(3), bandwidth = gwer.bw.t,
                   adapt = TRUE, parplot = FALSE, hatmatrix = TRUE, spdisp = TRUE,
                   method = "gwer.fit")
summary(gwer.fit.t)
```

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