Package 'JointModeling'

April 17, 2009

Version 1.0-0

Date 2006-11-02

Title Joint Modelling of Mean and Dispersion

Author Mathieu Ribatet <ribatet@lyon.cemagref.fr> and Bertrand Iooss

Maintainer Bertrand Iooss <bertrand.iooss@cea.fr>

Depends R (>= 1.8.0), mgcv

Description Some functions usefull to perform joint modelling of Mean and Dispersion through two interlinked GLM's or GAM's.

License GPL (>= 2)

Repository CRAN

Date/Publication 2006-11-02 18:07:09

R topics documented:

`eql` *Compute the Extended Quasi-Likelihood and the Extended Quasi-Deviance*

Description

Compute the Extended Quasi-Likelihood and the Extended Quasi-Deviance for a Joint Model.

Usage

```
eql(mod.mean, mod.disp, df.adj = TRUE)
```

Arguments

`mod.mean, mod.disp`
: Two fitted GLMs/GAMs correponding to the mean and the dispersion components respectively.

`df.adj`
: Logical. If *TRUE* - the default, adjustment on degree of freedom is applied for the EQD.

Details

The Extended Quasi-Likelihood (EQL) generalizes the Quasi-Likelihood as it behaves as a likelihood function on both mean and dispersion parameters. The Extended Quasi-Deviance is defined as

$$\sum_i \frac{d_i}{\phi_i} + \sum_i \log(2\pi\phi_i V(y_i))$$

where d_i is the deviance contribution of the i-th observation, ϕ_i is the fitted values of dispersion parameter for the i-th observation, V is the variance function of the mean GLM and y_i is the i-th observation.

Value

This function returns the Extended Quasi-Likelihood and the Extended Quasi-Deviance for a joint model.

Author(s)

Mathieu Ribatet and Bertrand Iooss

References

McCullagh P. and Nelder J. A. (1987). *Generalized Linear Models Second Edition.* London: Chapman and Hall. ISBN 0-412-31760-5.

`fitjoint` *Joint Modelling Fitting*

Description

Fit two interlinked GLMs or GAMS to model dependently the Mean and the Dispersion.

Usage

```
fitjoint(model, form.mean, form.disp, data, family.mean =
gaussian, family.disp = Gamma(link='log'), eps = 10^(-6), iter.max =
100, maxit = 50, reml = TRUE)
```

Arguments

`model`	A character string. Must be one of "`glm`" and "`gam`" for GLMs and GAMs models respectively.
`form.mean, form.disp`	R *formula* put in a character type way which specifies the linear model for the mean and the dispersion respectively.
`data`	A *data.frame* for the data. The first column corresponds to the response observations, while others to the explicative variables.
`family.mean, family.disp`	The *family* for the mean and dispersion. See `family`.
`eps`	Optional numeric. The precision for the convergence test.
`iter.max, maxit`	Numerics. The maximum number of iteration in the Joint Modelling algorithm and `glm.fit` function respectively.
`reml`	Logical. If *TRUE* - the default, the Restricted Maximum Likelihood Estimation is used.

Details

The estimation procedure of the Joint Model is based on the *see-saw* algorithm. This procedure is explained in *McCullagh and Nelder, 1987*. The pair of models is fitting thanks to the Extended Quasi-Deviance criterion. We start by setting the dispersion parameter for the mean to 1 and fitting the model for the mean. We then form d the response variable for dispersion and fit the dispersion GLM/GAM. From the fitted values of the dispersion GLM/GAM, we form prior weights given by the inverse of these fitted values and refit the model for the mean. The alternation of fits continues until stability is reached. We say that stability is reached when the EQD variation - in percent - between two iteration in lower than an ϵ.

Value

This function returns an object of class `c("joint", mod)` where `mod` is either `"glm"` or `"gam"`. In particular this object is a list with four components. The first two are *glm/gam ocbjects* corresponding to the final estimate of the mean and dispersion GLMs/GAMs component. A component *iterations* corresponding to the number of iterations in the Joint Modelling fitting algorithm. And a component *eql* corresponding to the Extended Quasi-Likelihood for this Joint Model Object.

Author(s)

Mathieu Ribatet and Bertrand Iooss

References

Lee, Y and Nelder, J. A. (2003). *Robust Design via Generalized Linear Models.* Journal of Quality Technology, 35:2-12. McCullagh P. and Nelder J. A. (1987). *Generalized Linear Models Second Edition.* London: Chapman and Hall. ISBN 0-412-31760-5.

Examples

```
X <- rnorm(500, 5)
mu <- 2*X + 1
sigma2 <- exp(-X)
Y <- rnorm(500, mu, sqrt(sigma2))
data.frm <- data.frame(Y=Y, X=X)
ajust <- fitjoint("glm", 'Y~X', 'd~X', data = data.frm)
ajust
```

`Joint Modelling` *Hat values for the Joint model*

Description

Computes hat values for the joint model.

Usage

```
hat.glm(glm)
```

Arguments

`glm`	A object of the class *glm*.

Details

The expression of the genralized form for the *hat matrix* is given by

$$H = W^{1/2} X \left(X^T W X\right)^{-1} X^T W^{1/2}$$

where W is diagonal matrix representing the weigths, X a matrix corresponding to explicative variables realisations.

Value

This function returns the *hat values* i.e. the diagonal of the *hat matrix*.

Author(s)

Mathieu Ribatet and Bertrand Iooss

`plot.joint` *Model Checking*

Description

Graphicals representation to help in model checking.

Usage

```
## S3 method for class 'joint':
plot(x, comp = "mean", var = NULL, res = 'standard',
which = 1:5, ask = nb.fig < length(which) && dev.interactive(), smooth =
TRUE, ...)
obs.vs.model(x.joint, plot.disp = FALSE, ...)
rstand.vs.linpred(x, smooth = TRUE, ...)
res.vs.explvar(x, var, res = 'standard', smooth = TRUE, ...)
absres.vs.fitted(x, res = 'standard', smooth = TRUE, ...)
adjvar.vs.linpred(x, smooth = TRUE, ...)
qqglm(x, ...)
```

Arguments

`x,x.joint`	A fitted GLM/GAM object or a fitted joint model.
`comp`	The component for the joint model. Must be one of `"mean"` or `"disp"`.
`var`	Character. The name of the explanatory variable selected.
`res`	Character. Should be *standard*, *student* of *brut*. The residual type considered.
`which`	Numeric vector. Which plot must be produced.
`ask`	Logical. If `TRUE`, user is asked before a new plot is produced.
`smooth`	Logical. If `TRUE` - the default, a smoothing curve is plotted thanks to the `lowess` fucntion.
`...`	Optional parameters to be passed to `plot`, `abline` and `qqnorm` functions.
`plot.disp`	Logical. Should the +/- standard deviation error bar be plottted around the point selected by the `identify` function.

Details

The function `plot.joint` is a special function to compute all the checking plots. Checking plots implemented are :

1. Observations functions of Fitted values
2. Standardized Residuals functions of Linear predictor
3. Residuals functions of an explanatory variable
4. Absolute Residuals functions of Fitted values
5. Adjusted Dependent Variable functions of Linear predictor
6. *QQ-plot* of the residuals

Several conclusions can be established thanks to these plots. One can refer to *McCullagh and Nelder, 1987* for interpretation.

Value

Return a (several) graphic window(s).

Author(s)

Mathieu Ribatet and Bertrand Iooss

References

McCullagh P. and Nelder J. A. (1987). *Generalized Linear Models Second Edition.* London: Chapman and Hall. ISBN 0-412-31760-5.

Examples

```
X <- rnorm(500, 5)
mu <- 2*X + 1
sigma2 <- exp(-X)
Y <- rnorm(500, mu, sqrt(sigma2))
data.frm <- data.frame(Y=Y, X=X)
ajust <- fitjoint("glm", 'Y~X', 'd~X', data = data.frm)
layout(matrix(c(1,1,2,2,3,3,4,4,0,5,5,0),3,byrow=TRUE))
plot(ajust, var = 'X')
```

---

print.joint *Printing joint object*

Description

Printing joint oject

Usage

```
## S3 method for class 'joint':
print(x, ...)
```

Arguments

x	An object of class "joint". Most often the return of the fitjoint function.
...	Other option to be passed to the plot function.

Author(s)

Mathieu Ribatet and Bertrand Iooss

See Also

fitjoint

---

summary.joint *Summary for objects of class joint*

Description

Summary for joint objects

Usage

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

Arguments

object	An object of class "joint". Most often this object is returned by the fitjoint function.
...	Other options to be passed to the summary function.

Value

Several useful informations about the fitted "joint" object.

Author(s)

Mathieu Ribatet and Bertrand Iooss

See Also

fitjoint, \joint{summary}

Index