Package: multiModTest (via r-universe)

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Type Package

Title Information Assessment for Individual Modalities in Multimodal Regression Models

Version 1.0

Description Provides methods for quantifying the information gain contributed by individual modalities in multimodal regression models. Information gain is measured using Expected Relative Entropy (ERE) or pseudo-R^2 metrics, with corresponding p-values and confidence intervals. Currently supports linear and logistic regression models with plans for extension to additional Generalized Linear Models and Cox proportional hazard model.

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Encoding UTF-8

RoxygenNote 7.3.2

Imports tidyverse, MASS, SIS, glmnet, ncvreg, MBESS, survival, dplyr

Depends R (>= 3.6.0)

NeedsCompilation no

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Contents

`data_linear_model` *Example Dataset*

Description

A toy dataset to demonstrate running this package on multimodal linear models.

Usage

```
data_linear_model
```

Format

A data object that contains

`y` A vector of 200 observations of continuous outcomes.

`X` A 200 $\times$ 600 matrix containing all training data.

`mod.idx` A list of modality indices.

`data_logistic_model` *Example Dataset*

Description

A toy dataset to demonstrate running this package on multimodal logistic models.

Usage

```
data_logistic_model
```

Format

A data object that contains

`y` A vector 200 observations of outcomes. (0 or 1)

`X` A 200 $\times$ 600 matrix containing all training data.

`mod.idx` A list of modality indices.

mglm.test *Modality Assessment in Multimodal Generalized Linear Models*

Description

Provides statistical inference for modality-specific information gain in multimodal GLMs. Estimates ERE and pseudo-R^2 with confidence intervals and p-values using Sure Independence Screening for variable selection and penalized likelihood for inference.

Usage

```
mglm.test(
  X,
  y,
  mod.idx,
  family = c("gaussian", "binomial"),
  iter = TRUE,
  penalty = c("SCAD", "MCP", "lasso"),
  tune = c("bic", "ebic", "aic"),
  lambda = NULL,
  nlambda = 100,
  conf.level = 0.95,
  CI.type = c("two.sided", "one.sided"),
  trace = FALSE
)
```

Arguments

X	The $n \times p$ data matrix consisting of features from all modalities.
y	The $n \times 1$ vector of response.
mod.idx	A list of column indices for all modalities in the concatenated data matrix X.
family	A description of the error distribution and link function to be used in the model. Currently, we allow the Binomial ("binomial") and Gaussian ("gaussian") families with canonical links only.
iter	Specifies whether to perform iterative SIS. The default is iter=TRUE.
penalty	Specifies the type of penalty to be used in the variable selection and inference procedure. Options include 'MCP', 'SCAD', and 'lasso'. The default is penalty='SCAD'.
tune	Specifies the method for selecting the optimal tuning parameters in (I)SIS and penalized likelihood procedure. Options include 'bic', 'ebic' and 'aic'. The default is tune='bic'.
lambda	A user-specified decreasing sequence of lambda values for penalized likelihood procedure. By default, a sequence of values of length nlambda is automatically computed and equally spaced on the log scale.
nlambda	The number of lambda values. The default is 100.

conf.level	Levels of the confidence interval. The default is conf.level=0.95.
CI.type	A string specifying the type of the confidence interval. Options include 'two.sided' and 'one.sided'. The default is CI.type='two.sided'.
trace	Specifies whether to print out logs of iterations in SIS procedure. The default is trace=FALSE.

Value

An object with S3 class "mglm.test" containing:

sel.idx	List of indices of selected features by (I)SIS in each modality.
num.nonzeros	Number of selected features by (I)SIS in each modality.
ERE	Point estimation of ERE for each modality.
ERE.CI.L	Lower bound of the confidence interval of ERE for each modality
ERE.CI.U	Upper bound of the confidence interval of ERE for each modality
R2	Point estimate of pseudo-R^2 for each modality.
R2.CI.L	Lower bound of the confidence interval of pseudo-R^2 for each modality
R2.CI.U	Upper bound of the confidence interval of pseudo-R^2 for each modality
conf.level	Level of confidence intervals.

Examples

```
## Example 1: Linear model
data(data_linear_model)
X <- data_linear_model$X
y <- data_linear_model$y
mod.idx <- data_linear_model$mod.idx
test <- mglm.test(X = X, y = y, mod.idx = mod.idx, family = "gaussian",
               iter = TRUE, penalty = "SCAD", tune = "bic",
               conf.level = 0.95, CI.type = "one.sided")
summary(test)


## Example 2: Logistic regression
data(data_logistic_model)
X <- data_logistic_model$X
y <- data_logistic_model$y
mod.idx <- data_logistic_model$mod.idx
test <- mglm.test(X = X, y = y, mod.idx = mod.idx, family = "binomial",
               iter = TRUE, penalty = "SCAD", tune = "bic",
               conf.level = 0.95, CI.type = "two.sided")
sum.test <- summary(test)
```

summary.mglm.test *Summary method for objects of class "mglm.test"*

Description

Summary method for objects of class "mglm.test"

Usage

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

## S3 method for class 'summary.mglm.test'
print(x, ...)
```

Arguments

object	An mglm.test object.
...	Additional arguments that could be passed to summary.mglm.test.
x	A summary.mglm.test object.

Value

An object with S3 class summary.mglm.test. The class has its own print method and contains the following list of elements.

sum.ERE	The summary table of point estimate and confidence interval of ERE for each modality.
sum.R2	The summary table of point estimate and confidence interval of pseudo-R^2 for each modality.
conf.level	Level of confidence intervals.
sel.mod	Index of the most informative modality.

Index