Package 'OptimClassifier'

April 9, 2018

Title Create the Best Train for Classification Models

Version 0.1.4

Description Patterns searching and binary classification in economic and financial data is a large field of research. There are a large part of the data that the target variable is binary. Nowadays, many methodologies are used, this package collects most popular and compare different configuration options for Linear Models (LM), Generalized Linear Models (GLM), Linear Mixed Models (LMM), Discriminant Analysis (DA), Classification And Regression Trees (CART), Neural Networks (NN) and Support Vector Machines (SVM).

Depends R (>= 3.2.3)

License GPL (>= 2)

BugReports https://github.com/economistgame/OptimClassifier/issues

URL https://economistgame.github.io/OptimClassifier

Imports crayon, dplyr, MASS, lme4, rpart, nnet, e1071, lmtest, nortest, clisymbols, ggplot2

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Author Agustín Pérez-Martín [aut] (<https://orcid.org/0000-0003-4994-3176>), Agustín Pérez-Torregrosa [cre, aut] (<https://orcid.org/0000-0001-5658-4795>), Marta Vaca-Lamata [aut] (<https://orcid.org/0000-0001-8496-5579>), Antonio José Verdú-Jover [aut] (<https://orcid.org/0000-0002-6201-7196>)

Maintainer Agustín Pérez-Torregrosa <agustin.perez01@goumh.umh.es>

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R topics documented:

`AustralianCredit` *A Credit Approval Dataset*

Description

This dataset concerns credit card applications and represent positive and negative instances of people who were and were not granted credit. It has served as an important test data set for several credit-scoring algorithms. This dataset was introduced by Quinlan (1987).

Usage

```
data("AustralianCredit")
```

Format

A data frame with 690 observations on the following 15 variables.

`X1` a factor with levels `0` and `1`

`X2` a numeric vector

`X3` a numeric vector

`X4` a factor with 3 levels

`X5` a factor with 14 levels

`X6` a factor with 9 levels

`X7` a numeric vector

`X8` a factor with levels `0` and `1`

`X9` a factor with levels `0` and `1`

`X10` a numeric vector

X11 a factor with levels 0 and 1

X12 a factor with 3 levels

X13 a numeric vector

X14 a numeric vector

Y a factor with levels 0 and 1

References

Lichman, M. (2013). UCI machine learning repository. Quinlan,R. (1987). "Simplifying decision trees", Int J Man-Machine Studies 27, pp. 221-234.

Examples

```
data(AustralianCredit)

## See a general view of a dataset
summary(AustralianCredit)

## Plot a response variable
plot(AustralianCredit$Y)
```

MC *Confusion Matrix*

Description

Confusion Matrix is a contingency table that gives a visualization of the performance of an algorithm

Usage

```
MC(yhat, y, metrics = FALSE)
```

Arguments

yhat	A predicted value vector.
y	A real value vector.
metrics	Calculate all metrics. See details for more information.

Details

Also it known as an error matrix. Normally, you can identify 4 elements, they known as true positive (TP), true negative (TN), false positive (FP) and false negative (FN). To understand it, a simple example is presented:

	Real Values	
Estimated	Class 1	Class 2
Class 1	TP	FP
Class 2	FN	TN

The problem arises that there is not always a clear relationship between which is the positive class or there may be different classes so it is also common to use the terms Type I error (FP), Type II error (FN) and unify the success or accuracy (TP+TN) in a single value.

Suppose a 3x3 table with notation

	Real Values		
Estimated	Class 1	Class 2	Class 3
Class 1	A	B	C
Class 2	D	E	F
Class 3	G	H	I

where N = A+B+C+D+E+F+G+H+I The formulas used here are:

$$Successrate = (A + E + I)/N$$

$$TypeIerror = (B + F + C)/N$$

$$TypeIIerror = (D + H + G)/N$$

Other indicators depends of one class and in the case choose Class 1

$$SensitivityClass1 = A/(A + D + G)$$

$$SpecificityClass1 = (E + I)/(B + E + H + C + F + I)$$

$$PrecisionClass1 = A/(A + E + I),$$

also it is called Positive Predictive Value (PPV)

$$PrevalenceClass1 = (A + D + G)/N$$

References

Stehman, Stephen V. (1997). "Selecting and interpreting measures of thematic classification accuracy". Remote Sensing of Environment. 62 (1): 77–89. doi:10.1016/S0034-4257(97)00083-7.

Examples

```
if(interactive()){
 # You can create a confusion Matrix like a table

 RealValue <- c(1,0,1,0)
 Predicted <- c(1,1,1,0)

 MC(y = RealValue, yhat=Predicted ,metrics=TRUE)


}
```

`Microsoft` *Daily Information Data of Microsoft*

Description

Daily Information Data of Microsoft, 2007/01/03~2018-03-13

Usage

```
data("Microsoft")
```

Format

A data frame with 2817 observations on the following 6 variables.

`Date` a Date

`Y` a factor with levels `0` and `1`

`DayWeek` a factor, represent the day of the week

`Month` a factor, month

`LastDay` a numeric vector, difference of open price and close price

`PayDiv` a logical vector, represent when Microsoft was payed dividends

Source

Yahoo Finance.

Examples

```
data(Microsoft)

## See a general view of a dataset
summary(Microsoft)

## Plot a response variable
plot(Microsoft$Y)
```

`Optim.CART` *Tune CART for the optimal complexity parameter*

Description

The complexity parameter aims to save computing time by pruning off splits that are obviously not worthwhile. This function starting with null value of `cp` and ranks the different possibles levels of pruning trees find best CART for different levels of cost complexity. The main role of this parameter is to save computing time by pruning off splits that are obviously not worthwhile.

Usage

```
Optim.CART(formula, data, p, includedata = FALSE, seed = NULL, ...)
```

Arguments

`formula`	A formula of the form `y ~ x1 + x2 + ...`
`data`	Data frame from which variables specified in `formula` are preferentially to be taken.
`p`	A percentage of training elements
`includedata`	logicals. If TRUE the training and testing datasets are returned.
`seed`	a single value, interpreted as an integer, or `NULL`. The default value is `NULL`, but for future checks of the model or models generated it is advisable to set a random seed to be able to reproduce it.
`...`	arguments passed to `rpart`

Details

Classification And Regression Tree (CART) are a decision tree learning technique that produces either classification or regression trees, first introduced by Breiman et al.(1984). Trees used for regression and trees used for classification have some similarities - but also some differences, such as the procedure used to determine where to split.

Value

An object of class `Optim`. See `Optim.object`

References

Breiman L., Friedman J. H., Olshen R. A., and Stone, C. J. (1984) Classification and Regression Trees. Wadsworth.

Examples

```
if(interactive()){
## Load a Dataset
data(AustralianCredit)
## Generate a model
modelFit <- Optim.CART(Y~., AustralianCredit, p = 0.7, seed=2018)
modelFit
}
```

`Optim.DA` *Discover the best Discriminant Analysis for your data*

Description

This function search the best Discriminant Analysis (DA) between `LDA` and `QDA`.

Usage

```
Optim.DA(formula, data, p, criteria = c("rmse", "success_rate", "ti_error",
  "tii_error"), includedata = FALSE, seed = NULL, ...)
```

Arguments

`formula`	A formula of the form `y ~ x1 + x2 + ...`
`data`	Data frame from which variables specified in `formula` are preferentially to be taken.
`p`	A percentage of training elements
`criteria`	Select criterion to use.
`includedata`	logicals. If TRUE the training and testing datasets are returned.
`seed`	a single value, interpreted as an integer, or `NULL`. The default value is `NULL`, but for future checks of the model or models generated it is advisable to set a random seed to be able to reproduce it.
`...`	arguments passed to `lda` and `qda`

Details

LDA and QDA are distribution-based classifiers with the assumption that data follows a multivariate normal distribution. LDA differs from QDA in the assumption about the class variability. LDA assumes that all classes share the same within-class covariance matrix whereas QDA allows for distinct within-class covariance matrices.

Value

An object of class `Optim`. See `Optim.object`

Examples

```
if(interactive()){
## Load a Dataset
data(AustralianCredit)
## Generate a Model
modelFit <- Optim.DA(Y~., AustralianCredit, p = 0.7, seed=2018)
modelFit
}
```

`Optim.GLM` *Find out what is the error distribution and link function that best fits a classification generalized linear model to your data*

Description

`Optim.GLM` is used to fit the best classification `GLM` to a dataset. For this purpose, we examine the variation of the precision using the root mean square error (RMSE) when different error distribution and link function was used in the model. In addition, several thresholds are applied to check which is the most optimal cut for the indicators derived from the confusion matrix (success rate, type I error and type II error) according to a given criterion.

Usage

```
Optim.GLM(formula, data, p, criteria = c("success_rate", "ti_error",
  "tii_error"), includedata = FALSE, seed = NULL, ...)
```

Arguments

`formula`	A formula of the form `y ~ x1 + x2 + ...`
`data`	Data frame from which variables specified in `formula` are preferentially to be taken.
`p`	A percentage of training elements
`criteria`	This variable selects the criteria to select the best threshold. The default value is `success_rate`
`includedata`	logicals. If TRUE the training and testing datasets are returned.
`seed`	a single value, interpreted as an integer, or `NULL`. The default value is `NULL`, but for future checks of the model or models generated it is advisable to set a random seed to be able to reproduce it.
`...`	arguments passed to `glm`

Value

An object of class `Optim`. See `Optim.object`

Examples

```
if(interactive()){
## Load a Dataset
data(AustralianCredit)

## Create the model
creditscoring <- Optim.GLM(Y~., AustralianCredit, p = 0.7, seed=2018)

#See a ranking of the models tested
print(creditscoring)

#Access to summary of the best model
summary(creditscoring)

#not sure of like the best model, you can access to the all model, for example the 2nd model
summary(creditscoring,2)
}
```

`Optim.LM` *Find out what is the transformation of the response variable that best fits a classification linear model to your data*

Description

`Optim.LM` is used to fit the best classification linear model to a dataset. For this purpose, we examine the variation of the precision using the root mean square error (RMSE) when transformations are applied on the response variable. In addition, several thresholds are applied to check which is the most optimal cut for the indicators derived from the confusion matrix (success rate, type I error and type II error) according to a given criterion.

Usage

```
Optim.LM(formula, data, p, seqthreshold = 0.05, criteria = c("success_rate",
  "error_ti", "error_tii"), includedata = FALSE, seed = NULL, ...)
```

Arguments

`formula`	A formula of the form `y ~ x1 + x2 + ...`
`data`	Data frame from which variables specified in `formula` are preferentially to be taken.
`p`	A percentage of training elements
`seqthreshold`	Linear models doesn't return a class, it returns probability because of he must cut by levels. This parameter allows you to select the percentage between one threshold and next evaluated.

criteria	This variable selects the criteria to select the best threshold. The default value is success_rate
includedata	logicals. If TRUE the training and testing datasets are returned.
seed	a single value, interpreted as an integer, or NULL. The default value is NULL, but for future checks of the model or models generated it is advisable to set a random seed to be able to reproduce it.
...	arguments passed to lm

Value

An object of class Optim. See Optim.object

Examples

```
if(interactive()){
## Load a Dataset
data(AustralianCredit)

## Create the model
linearcreditscoring <- Optim.LM(Y~., AustralianCredit, p = 0.7, seed=2018)

#See a ranking of the models tested
print(linearcreditscoring)

#Access to summary of the best model
summary(linearcreditscoring)

#not sure of like the best model, you can access to the all model, for example the 2nd model
summary(linearcreditscoring,2)
}
```

Optim.LMM *Discover what is the best random variable for your data set*

Description

This function allows to find best LMM for a specific data.

Usage

```
Optim.LMM(response, data, p, criteria = c("success_rate", "error_ti",
  "error_tii"), randomatributtecandidate = NULL, includedata = FALSE,
  seed = NULL, ...)
```

Arguments

response	A character object that contain the name of response variable about which a researcher is asking a question. "Y"
data	Data frame from which variables specified in formula are preferentially to be taken.
p	A percentage of training elements
criteria	This variable selects the criteria to select the best threshold. The default value is success_rate
randomatributtecandidate	a character vector, or NULL. The default value is NULL,the function tests with all those categorical variables in the data. The default option is nor recommended. Because the decision must be made according to the objective of statistical modeling. But it can serve as orientation.
includedata	logicals. If TRUE the training and testing datasets are returned.
seed	a single value, interpreted as an integer, or NULL. The default value is NULL, but for future checks of the model or models generated it is advisable to set a random seed to be able to reproduce it.
...	arguments passed to lmer

Value

An object of class Optim. See Optim.object

Examples

```
if(interactive()){
## Load a Dataset
data(AustralianCredit)
## Generate a model
modelFit <- Optim.LMM("Y", AustralianCredit, p = 0.7, seed=2018)
modelFit
}
```

Optim.NN *Discover the best Neural Network for your data*

Description

Optim.NN function allows to find the best NN.

Usage

```
Optim.NN(formula, data, p, criteria = c("success_rate", "ti_error",
  "tii_error"), includedata = FALSE, seed = NULL, maxhiddenlayers = 10,
  maxit = 500, MaxNWts = 2000, ...)
```

Arguments

formula	A formula of the form y ~ x1 + x2 + ...
data	data frame from which variables specified in formula are preferentially to be taken.
p	a percentage of training elements
criteria	this variable selects the criteria to select the best threshold. The default value is success_rate
includedata	logicals. If TRUE the training and testing datasets are returned.
seed	a single value, interpreted as an integer, or NULL. The default value is NULL, but for future checks of the model or models generated it is advisable to set a random seed to be able to reproduce it.
maxhiddenlayers	the high number of hidden layers for the neural network considers.
maxit	the maximum allowable number of weights. There is no intrinsic limit in the code, but increasing MaxNWts will probably allow fits that are very slow and time-consuming.
MaxNWts	maximum number of iterations. Default 500.
...	arguments passed to nnet

Value

An object of class Optim. See Optim.object

Examples

```
if(interactive()){
## Load a Dataset
data(AustralianCredit)
## Generate a model
modelFit <- Optim.NN(Y~., AustralianCredit, p = 0.7, seed=2018)
modelFit
}
```

Optim.object *Optimized Classifier Object*

Description

These are objects representing different fitted models.

Value

Type	character string: the method used to fit the model. At the moment the following models are implemented: "LM" (lm), "GLM" (glm), "LMM" (lmer), "CART" (rpart), "DA" (lda and qda), "NN" (nnet) and "SVM" (svm).
Models	a data.frame whose content summarize the different models generated, ordered for selected criterion
Model	a list of the models generated
Predict	a list of the predicts generated
Thresholds	a list whose content data.frames that summarize the different thresholds tested. This component is only available in LM, GLM, NN and SVM
Confussion_Matrixs	a data.frame whose content summarize the different models generated
Data	a list which training and testing datasets
Inference Tests	a data.frame with different diagnostics for models generated. It is only available in LM

Structure

The following components must be included in a legitimate Optim object.

Optim.SVM *Discover the best SVM for your data*

Description

This function allows to find the best kernel for tune your support vector machine (SVM).

Usage

```
Optim.SVM(formula, data, p, criteria = c("rmse", "success", "ti_error",
  "tii_error"), includedata = FALSE, seed = NULL, ...)
```

Arguments

formula	A formula of the form y ~ x1 + x2 + ...
data	Data frame from which variables specified in formula are preferentially to be taken.
p	A percentage of training elements
criteria	This variable selects the criteria to select the best threshold. The default value is success_rate.
includedata	logicals. If TRUE the training and testing datasets are returned.
seed	a single value, interpreted as an integer, or NULL. The default value is NULL, but for future checks of the model or models generated it is advisable to set a random seed to be able to reproduce it.
...	arguments passed to svm

Value

An object of class `Optim`. See `Optim.object`

Examples

```
if(interactive()){

## Load a Dataset
data(AustralianCredit)

## Generate a model
modelFit <- Optim.SVM(Y~., AustralianCredit, p = 0.7, seed=2018)
modelFit

}
```

`print.Optim` *Print an Optim Object*

Description

This function prints an Optim object. It is a method for the generic function print of class "Optim".

Usage

```
## S3 method for class 'Optim'
print(x, plain = FALSE, digits = getOption("digits"), ...)
```

Arguments

`x`	object of class "Optim"
`plain`	select if you want enriched output mode (with colors and bold) or a plain output mode.
`digits`	minimal number of significant digits.
`...`	further arguments passed to or from other methods.

RMSE *Root Mean Square Error*

Description

RMSE is a commonly used error metric to measure the performance of regression models, but it is also possible to use it in a classification system. The RMSE measures the standard deviation of the predictions from the ground-truth. This is the relationship between RMSE and classification.

Usage

```
RMSE(yhat, y, type.of = c("numeric", "text", "scalable"))
```

Arguments

yhat	A predicted value vector
y	A real value vector
type.of	Type of response variable, either: `numeric` for the numerical response variables, `text` for the class response variables without growing relationship or `scalable` for the class response variables without growing relationship.

sampler *Splitting your dataset in training and testing*

Description

A training/test partition are created by `sampler` function.

Usage

```
sampler(data, p, seed = NULL)
```

Arguments

data	Data frame from which all variables
p	The percentage of data that goes to training, It can be expressed in either decimal fraction (such as 0.7) or percent (such as 72.12).
seed	a single value, interpreted as an integer, or `NULL`. The default value is `NULL`, but for future checks of the model or models generated it is advisable to set a random seed to be able to reproduce it.

Examples

```
if(interactive()){
# The best way to demostrate the functionality is test the function


Sampling <- sampler(AustralianCredit,p=0.7)

}
```

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