Package 'visualpred'

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Title Visualization 2D of Binary Classification Models

Version 0.1.3

Description Visual contour and 2D point and contour plots for binary classification modeling under algorithms such as 'glm', 'rf', 'gbm', 'nnet' and 'svm', presented over two dimensions generated by 'famd' and 'mca' methods. Package 'FactoMineR' for multivariate reduction functions and package 'MBA' for interpolation functions are used. The package can be used to visualize the discriminant power of input variables and algorithmic modeling, explore outliers, compare algorithm behaviour, etc. It has been created initially for teaching purposes, but it has also many practical uses under the 'XAI' paradigm.

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Encoding UTF-8

LazyData true

RoxygenNote 7.3.3

Imports gbm, randomForest, nnet (>= 7.3.12), e1071, MASS (>= 7.3.51.4), magrittr, FactoMineR (>= 2.3), ggplot2 (>= 3.3.0), dplyr, data.table, MBA, pROC, ggrepel, stats

Suggests knitr, markdown,egg

VignetteBuilder knitr

Depends R (>= 3.5.0)

NeedsCompilation no

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`breastwisconsin1` *Breast Cancer Winsconsin dataset*

Description

Breast Cancer Winsconsin dataset

Usage

```
data(breastwisconsin1)
```

Format

An object of class `data.frame` with 699 rows and 10 columns.

Source

https://archive.ics.uci.edu/ml/datasets/breast+cancer+wisconsin+(original)

`famdcontour` *Contour plots and FAMD function for classification modeling*

Description

This function presents visual graphics by means of FAMD. FAMD function is Factorial Analysis for Mixed Data (interval and categorical) Dependent classification variable is set as supplementary variable. Machine learning algorithm predictions are presented in a filled contour setting

Usage

```
famdcontour(dataf=dataf,listconti,listclass,vardep,proba="",
title="",title2="",depcol="",listacol="",alpha1=0.7,alpha2=0.7,alpha3=0.7,
classvar=1,intergrid=0,selec=0,
modelo="glm",nodos=3,maxit=200,decay=0.01,
sampsize=400,mtry=2,nodesize=10,ntree=400,
ntreegbm=500,shrink=0.01,
bag.fraction=1,n.minobsinnode=10,C=100,
gamma=10,Dime1="Dim.1",Dime2="Dim.2",
offsetx=0.1,offsety=0.1)
```

Arguments

dataf	data frame.
listconti	Interval variables to use, in format c("var1","var2",...).
listclass	Class variables to use, in format c("var1","var2",...).
vardep	Dependent binary classification variable.
proba	vector of probability predictions obtained externally (optional)
title	plot main title
title2	plot subtitle
depcol	vector of two colors for points
listacol	vector of colors for labels
alpha1	alpha transparency for majoritary class
alpha2	alpha transparency for minoritary class
alpha3	alpha transparency for fit probability plots
classvar	1 if dependent variable categories are plotted as supplementary
intergrid	scale of grid for contour:0 if automatic
selec	1 if stepwise logistic variable selection is required, 0 if not.
modelo	name of model: "glm","gbm","rf,","nnet","svm".
nodos	nnet: nodes
maxit	nnet: iterations
decay	nnet: decay
sampsize	rf: sampsize
mtry	rf: mtry
nodesize	rf: nodesize
ntree	rf: ntree
ntreegbm	gbm: ntree
shrink	gbm: shrink
bag.fraction	gbm: bag.fraction
n.minobsinnode	gbm:n.minobsinnode
C	svm Radial: C
gamma	svm Radial: gamma
Dime1, Dime2	FAMD Dimensions to consider. Dim.1 and Dim.2 by default.
offsetx	margin control for contour in percent of rangex, default=0.1
offsety	margin control for contour in percent of rangey, default=0.1

Details

FAMD algorithm from FactoMineR package is used to compute point coordinates on dimensions (Dim.1 and Dim.2 by default). Minority class on dependent variable category is represented as red, majority category as green. Color scheme can be altered using depcol and listacol, as well as alpha transparency values.

Predictive modeling:

Logistic regression (glm) is used as default predictive model. Algorithms nnet, rf,gbm and svm-RBF can be used with basic parameter setting. A vector of fitted probabilities obtained externally from other algorithms can also be imported in parameter proba=nameofvector. Contour curves are in this particular case computed based on this vector. Before perfroming predictive modeling, selec=1 can be used to select variables with a stepwise BIC logistic regression. By default select=0 (all variables input are used). It is recommended to make variable selection process before using famdcontour, and use only useful variables as input.

Contour curves:

Contour curves are build by the following process: i) the chosen algorithm model is trained and all observations are predicted-fitted. ii) A grid of points on the two chosen FAMD dimensions is built iii) package MBA is used to interpol probability estimates over the grid, based on previously fitted observations.

Variable representation:

In order to represent interval variables, categories of class variables, and points in the same plot, a proportional projection of interval variables coordinates over the two dimensions range is applied. Since space of input variables is frequently larger than two dimensions, sometimes overlapping of points is produced; a frequency variable is used, and alpha values may be adjusted to avoid wrong interpretations of the presence of dependent variable category/color.

Troubleshooting:

- Check missings. Missing values are not allowed.
- By default selec=0. Setting selec=1 may sometimes imply that no variables are selected; an error message is shown in this case.
- Models with only two input variables could lead to plot generation problems.
- Be sure that variables named in listconti are all numeric.
- If some numeric variable is constant at one single value, process is stopped since numeric Min-max standarization is performed, and NaN values are generated.
- Dependent variable can not be named x,y,z,x1,x2.
- When there are only categorical variables as input use mcacontour instead

Value

A list with the following objects:

graph1 plot of points on FAMD first two dimensions

graph2 plot of points and contour curves

graph3 plot of points and variables

graph4 plot of points variable and contour curves

graph5 plot of points colored by fitted probability

graph6 plot of points colored by abs difference

df1 data frame used for graph1

df2 data frame used for contour curves

df3 data frame used for variable names

df4 data frame for use in famdcontourlabel

listconti interval variables used-selected

listclass class variables used-selected #'

... color schemes and other parameters

References

Pages J. (2004). Analyse factorielle de donnees mixtes. Revue Statistique Appliquee. LII (4). pp. 93-111.

Examples

```
data(breastwisconsin1)
dataf<-breastwisconsin1
listconti=c( "clump_thickness","uniformity_of_cell_shape","mitosis")
listclass=c("")
vardep="classes"
result<-famdcontour(dataf=dataf,listconti,listclass,vardep)
```

`famdcontourlabel` *Outliers in Contour plots and FAMD function for classification modeling*

Description

This function adds outlier marks to famdcontour using ggrepel package.

Usage

```
famdcontourlabel(
  dataf = dataf,
  Idt = "",
  inf = 0.1,
  sup = 0.9,
  cutprob = 0.5,
  sizerepel = 3,
  ...
)
```

Arguments

dataf	data frame.
Idt	Identification variable, default "", row number
inf, sup	Quantiles for x,y outliers
cutprob	cut point for outliers based on prob.estimation error
sizerepel	size for outliers label, default=3
...	options to be passed from famdcontour

Details

An identification variable can be set in Idt parameter. By default, number of row is used. There are two source of outliers: i) outliers in the two FAMD dimension space, where the cutpoints are set as quantiles given (inf=0.1 and sup=0.9 in both dimensions by default) and ii) outliers with respect to the fitted probability. The dependent variable is set to 1 for the minority class, and 0 for the majority class. Points considered outliers are those for which abs(vardep-fittedprob) excede parameter cutprob.

Troubleshooting:

- Check missings. Missing values are not allowed.
- By default selec=0. Setting selec=1 may sometimes imply that no variables are selected; an error message is shown in this case.
- Models with only two input variables could lead to plot generation problems.
- Be sure that variables named in listconti are all numeric.
- If some numeric variable is constant at one single value, process is stopped since numeric Min-max standarization is performed, and NaN values are generated.
- Dependent variable can not be named x,y,z,x1,x2.
- When there are only categorical variables as input use mcacontour instead

Value

A list with the following objects:

graph1_graph6 plots for dimension outliers

graph7_graph12 plots for fit outliers

Examples

```
data(breastwisconsin1)
dataf<-breastwisconsin1
listconti=c( "clump_thickness","uniformity_of_cell_shape","mitosis")
listclass=c("")
vardep="classes"
result<-famdcontourlabel(dataf=dataf,listconti=listconti,
listclass=listclass,vardep=vardep)
```

Hmda *Home Mortgage Disclosure Act dataset*

Description

Home Mortgage Disclosure Act dataset

Usage

```
data(Hmda)
```

Format

An object of class `data.frame` with 2380 rows and 13 columns.

Source

Stock, J. H. and Watson, M. W. (2007). Introduction to Econometrics, 2nd ed. Boston: Addison Wesley.

mcacontour *Contour plots and MCA function for classification modeling*

Description

This function presents visual graphics by means of Multiple correspondence Analysis projection. Interval variables are categorized to bins. Dependent classification variable is set as supplementary variable. Machine learning algorithm predictions are presented in a filled contour setting.

Usage

```
mcacontour(dataf=dataf,listconti,listclass,vardep,proba="",bins=8,
Dime1="Dim.1",Dime2="Dim.2",classvar=1,intergrid=0,selec=0,
title="",title2="",listacol="",depcol="",alpha1=0.8,alpha2=0.8,alpha3=0.7,modelo="glm",
nodos=3,maxit=200,decay=0.01,sampsize=400,mtry=2,nodesize=5,
ntree=400,ntreegbm=500,shrink=0.01,bag.fraction=1,n.minobsinnode=10,C=100,gamma=10)
```

Arguments

`dataf`	data frame.
`listconti`	Interval variables to use, in format c("var1","var2",...).
`listclass`	Class variables to use, in format c("var1","var2",...).
`vardep`	Dependent binary classification variable.
`proba`	vector of probability predictions obtained externally (optional)

bins	Number of bins for categorize interval variables .
Dime1, Dime2	FAMD Dimensions to consider. Dim.1 and Dim.2 by default.
classvar	1 if dependent variable categories are plotted as supplementary
intergrid	scale of grid for contour:0 if automatic
selec	1 if stepwise logistic variable selection is required, 0 if not.
title	plot main title
title2	plot subtitle
listacol	vector of colors for labels
depcol	vector of two colors for points
alpha1	alpha transparency for majoritary class
alpha2	alpha transparency for minoritary class
alpha3	alpha transparency for fit probability plots
modelo	name of model: "glm","gbm","rf,","nnet","svm".
nodos	nnet: nodes
maxit	nnet: iterations
decay	nnet: decay
sampsize	rf: sampsize
mtry	rf: mtry
nodesize	rf: nodesize
ntree	rf: ntree
ntreegbm	gbm: ntree
shrink	gbm: shrink
bag.fraction	gbm: bag.fraction
n.minobsinnode	gbm:n.minobsinnode
C	svm Radial: C
gamma	svm Radial: gamma

Details

This function applies MCA (Multiple Correspondence Analysis) in order to project points and categories of class variables in the same plot. In addition, interval variables listed in listconti are categorized to the number given in bins parameter (by default 8 bins). Further explanation about machine learning classification and contour curves, see the famdcontour function documentation.

Troubleshooting:

- Check missings. Missing values are not allowed.
- By default selec=0. Setting selec=1 may sometimes imply that no variables are selected; an error message is shown in this case.
- Models with only two input variables could lead to plot generation problems.
- Be sure that variables named in listconti are all numeric.
- If some numeric variable is constant at one single value, process is stopped since numeric Min-max standarization is performed, and NaN values are generated.
- Dependent variable can not be named x,y,z,x1,x2.

Value

A list with the following objects:

graph1 plot of points on MCA two dimensions

graph2 plot of points and variables

graph3 plot of points and contour curves

graph4 plot of points, contour curves and variables

graph5 plot of points colored by fitted probability

graph6 plot of points colored by abs difference

df1 dataset used for graph1

df2 dataset used for graph2

df3 dataset used for graph3

df4 dataset used for graph4

listconti interval variables used

listclass class variables used

... color schemes and other parameters

Examples

```
data(breastwisconsin1)
dataf<-breastwisconsin1
listconti=c( "clump_thickness","uniformity_of_cell_shape","mitosis")
listclass=c("")
vardep="classes"
result<-mcacontour(dataf=dataf,listconti,listclass,vardep)
```

---

mcacontourjit *Contour plots and MCA function for classification modeling*

Description

This function is similar to mcacontour but points are jittered in every plot

Usage

```
mcacontourjit(dataf=dataf,jit=0.1,alpha1=0.8,alpha2=0.8,alpha3=0.7,title="",...)
```

Arguments

dataf	data frame.
jit	jit distance. Default 0.1.
alpha1	alpha transparency for majoritary class
alpha2	alpha transparency for minoritary class
alpha3	alpha transparency for fit probability plots
title	plot main title
...	options to be passed from mcacontour

Value

A list with the following objects:

graph1 plot of points on MCA two dimensions

graph2 plot of points and variables

graph3 plot of points and contour curves

graph4 plot of points, contour curves and variables

graph5 plot of points colored by fitted probability

graph6 plot of points colored by abs difference

Examples

```
data(breastwisconsin1)
dataf<-breastwisconsin1
listconti=c( "clump_thickness","uniformity_of_cell_shape","mitosis")
listclass=c("")
vardep="classes"
result<-mcacontourjit(dataf=dataf,listconti=listconti,listclass=listclass,vardep=vardep,jit=0.1)
```

---

mcamodelobis *Basic MCA function for clasification*

Description

This function presents visual graphics by means of Multiple correspondence Analysis projection. Interval variables are categorized to bins. Dependent classification variable is set as supplementary variable. It is used as base for mcacontour function.

Usage

```
mcamodelobis(dataf=dataf,listconti,listclass, vardep,bins=8,selec=0,
Dime1="Dim.1",Dime2="Dim.2")
```

Arguments

dataf	data frame.
listconti	Interval variables to use, in format c("var1","var2",...).
listclass	Class variables to use, in format c("var1","var2",...).
vardep	Dependent binary classification variable.
bins	Number of bins for categorize interval variables .
selec	1 if stepwise logistic variable selection is required, 0 if not.
Dime1, Dime2	MCA Dimensions to consider. Dim.1 and Dim.2 by default.

Value

A list with the following objects:

df1 dataset used for graph1

df2 dataset used for graph2

df3 dataset used for graph2

listconti interval variables used

listclass class variables used

axisx axis definition in plot

axisy axis definition in plot

Examples

```
data(breastwisconsin1)
dataf<-breastwisconsin1
listconti=c( "clump_thickness","uniformity_of_cell_shape","mitosis")
listclass=c("")
vardep="classes"
result<-mcamodelobis(dataf=dataf,listconti,listclass,vardep,bins=8,selec=1)
```

---

nba *nba dataset*

Description

nba dataset

Usage

```
data(nba)
```

Format

An object of class `data.frame` with 1340 rows and 21 columns.

Source

https://data.world/exercises/logistic-regression-exercise-1

pima *Pima indian diabetes dataset*

Description

Pima indian diabetes dataset

Usage

```
data(pima)
```

Format

An object of class `data.frame` with 768 rows and 9 columns.

Source

https://sci2s.ugr.es/keel/dataset.php?cod=21

spiral *spiral sample data*

Description

spiral sample data

Usage

```
data(spiral)
```

Format

An object of class `data.frame` with 803 rows and 3 columns.

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