Package ‘symbolicDA’

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Title Analysis of symbolic data

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Depends clusterSim,XML

Imports rgl,shapes,e1071,ade4

Description Symbolic Data Analysis Methods: importing/ exporting data from ASSO XML Files, distance calculation for symbolic data (Ichino-Yaguchi, de Carvalho measure), zoom star plot, 3d interval plot, multidimensional scaling for symbolic interval data, dynamic clustering based on distance matrix, HINoV method for symbolic data, Ichino's feature selection method, principal component analysis for symbolic interval data, decision trees for symbolic data based on optimal split with bagging, boosting and random forest approach (+visualization), kernel discriminant analysis for symbolic data, Kohonen's self-organizing maps for symbolic, replication and profiling, artificial symbolic data generation.

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R topics documented:

`bagging.SDA` *Bagging algorithm for optimal split based on decision tree for symbolic objects*

Description

Bagging algorithm for optimal split based on decision (classification) tree for symbolic objects

Usage

```
bagging.SDA(sdt,formula,testSet, mfinal = 20,rf=FALSE,...)
```

Arguments

`sdt`	Symbolic data table
`formula`	formula as in ln function
`testSet`	a vector of integers indicating classes to which each objects are allocated in learnig set
`mfinal`	number of partial models generated
`rf`	random forest like drawing of variables in partial models
`...`	arguments passed to decisionTree.SDA function

Details

The bagging, which stands for bootstrap aggregating, was introduced by Breiman in 1996. The diversity of classifiers in bagging is obtained by using bootstrapped replicas of the training data. Different training data subsets are randomly drawn with replacement from the entire training data set. Then each training data subset is used to train a decision tree (classifier). Individual classifiers are then combined by taking a simple majority vote of their decisions. For any given instance, the class chosen by most number of classifiers is the ensemble decision.

Value

An object of class bagging.SDA, which is a list with the following components:

`predclass`	the class predicted by the ensemble classifier
`confusion`	the confusion matrix for ensemble classifier
`error`	the classification error
`pred`	?
`classfinal`	final class memberships

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References

Billard L., Diday E. (red.) (2006), *Symbolic Data Analysis, Conceptual Statistics and Data Mining*, John Wiley & Sons, Chichester.

Bock H.H., Diday E. (eds.) (2000), *Analysis of symbolic data. Explanatory methods for extracting statistical information from complex data*, Springer-Verlag, Berlin.

Breiman L. (1996), *Bagging predictors*, Machine Learning, vol. 24, no. 2, pp. 123-140.

Diday E., Noirhomme-Fraiture M. (red.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester.

See Also

`boosting.SDA`,`random.forest.SDA`,`decisionTree.SDA`

Examples

```
#Example will be available in next version of package, thank You for your patience :-)
```

`boosting.SDA` *Boosting algorithm for optimal split based decision tree for symbolic objects*

Description

Boosting algorithm for optimal split based decision tree for symbolic objects, "symbolic" version of adabag.M1 algorithm

Usage

```
boosting.SDA(sdt,formula,testSet, mfinal = 20,...)
```

Arguments

`sdt`	Symbolic data table
`formula`	formula as in ln function
`testSet`	a vector of integers indicating classes to which each objects are allocated in learnig set
`mfinal`	number of partial models generated
`...`	arguments passed to decisionTree.SDA function

Details

Boosting, similar to bagging, also creates an ensemble of classifiers by resampling the data. The results are then combined by majority voting. Resampling in boosting provides the most informative training data for each consecutive classifier. In each iteration of boosting three weak classifiers are created: the first classifier C1 is trained with a random subset of the training data. The training data subset for the next classifier C2 is chosen as the most informative subset, given C1.C2 is trained on a training data only half of wich is correctly classified by C1 and the other half is misclassified. The third classifier C3 is trained with instances on which C1 and C2 disagree. Then the three classifiers are combined through a three-way majority vote.

Value

formula	a symbolic description of the model that was used
trees	trees built whlie making the ensemble
weights	weights for each object from test set
votes	final consensus clustering
class	predicted class memberships
error	error rate of the ensemble clustering

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References

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Bock H.H., Diday E. (eds.) (2000), *Analysis of symbolic data. Explanatory methods for extracting statistical information from complex data*, Springer-Verlag, Berlin.

Diday E., Noirhomme-Fraiture M. (red.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester.

See Also

bagging.SDA,random.forest.SDA,decisionTree.SDA

Examples

```
#Example will be available in next version of package, thank You for your patience :-)
```

---

cars — *real data set in symbolic form - selected car models described by a set of symbolic variables*

Description

symbolic data set: 30 observations on 12 symbolic variables - 9 interval-valued and 3 multinominal variables, third dimension represents the begining and the end of intervals for interval-valued variable's implementation or a set of categories for multinominal variable's implementation

Format

symbolic data table (see (link{symbolic.object})

Source

the original data on 30 selected car models and their prices, chasis and engine types were collected from the websites of authorized car dealers. Then the data were converted (aggregated) to symbolic format (second order symbolic objects). Each symbolic object - e.g. "Seat Leon", "Citroen C4" - represents all chasis, engine types and price range of this kind of car model available on the Polish market in 2010. For example the price range [54,900; 96,190] PLN, hatchback and saloon body style, petrol and diesel engine, acceleration 0-100 kph range [10.00; 11.90] seconds are, in general, the characteristics of "Toyota Corolla".

Examples

```
# LONG RUNNING - UNCOMMENT TO RUN
#data("cars",package="symbolicDA")
#sdt<-cars
#r<- HINoV.SDA(sdt, u=5, distance="U_3")
#print(r$stopri)
#plot(r$stopri[,2], xlab="Variable number", ylab="topri",
#xaxt="n", type="b")
#axis(1,at=c(1:max(r$stopri[,1])),labels=r$stopri[,1])
```

---

cluster.Description.SDA

description of clusters of symbolic objects

Description

description of clusters of symbolic objects is obtained by a generalisation operation using in most cases descriptive statistics calculated separately for each cluster and each symbolic variable.

Usage

```
cluster.Description.SDA(table.Symbolic, clusters, precission=3)
```

Arguments

`table.Symbolic`	Symbolic data table
`clusters`	a vector of integers indicating the cluster to which each object is allocated
`precission`	Number of digits to round the results

Value

A List of cluster numbers, variable number and labels.

The description of clusters of symbolic objects which differs according to the symbolic variable type:

- for interval-valued variable:

"min value" - minimum value of the lower-bounds of intervals observed for objects belonging to the cluster

"max value" - maximum value of the upper-bounds of intervals observed for objects belonging to the cluster

- for multinominal variable:

"categories" - list of all categories of the variable observed for symbolic belonging to the cluster

- for multinominal with weights variable:

"min probabilities" - minimum weight of each category of the variable observed for objects belonging to the cluster

"max probabilities" - maximum weight of each category of the variable observed for objects belonging to the cluster

"avg probabilities" - average weight of each category of the variable calculated for objects belonging to the cluster

"sum probabilities" - sum of weights of each category of the variable calculated for objects belonging to the cluster

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References

Billard, L., Diday, E. (2006), *Symbolic Data Analysis. Conceptual Statistics and Data Mining*, Wiley, Chichester.

Verde, R., Lechevallier, Y., Chavent, M. (2003), *Symbolic clustering interpretation and visualization*, "The Electronic Journal of Symbolic Data Analysis", Vol. 1, No 1.

Bock, H.H., Diday, E. (Eds.) (2000), *Analysis of symbolic data. Explanatory methods for extracting statistical information from complex data*, Springer-Verlag, Berlin.

Diday E., Noirhomme-Fraiture, M. (Eds.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester.

See Also

SClust,DClust; hclust in stats library; pam in cluster library

Examples

```
# LONG RUNNING - UNCOMMENT TO RUN
#data("cars",package="symbolicDA")
#y<-cars
#cl<-SClust(y, 4, iter=150)
#print(cl)
#o<-cluster.Description.SDA(y, cl)
#print(o)
```

DClust *Dynamical clustering based on distance matrix*

Description

Dynamical clustering of objects described by symbolic and/or classic (metric, non-metric) variables based on distance matrix

Usage

```
DClust(dist, cl, iter=100)
```

Arguments

dist	distance matrix
cl	number of clusters or vector with initial prototypes of clusters
iter	maximum number of iterations

Details

See file ../doc/DClust_details.pdf for further details

Value

a vector of integers indicating the cluster to which each object is allocated

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References

Bock, H.H., Diday, E. (Eds.) (2000), *Analysis of Symbolic Data. Explanatory Methods for Extracting Statistical Information from Complex Data*, Springer-Verlag, Berlin.

Diday, E., Noirhomme-Fraiture, M. (Eds.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester, pp. 191-204.

Diday, E. (1971), *La methode des Nuees dynamiques*, Revue de Statistique Appliquee, Vol. 19-2, pp. 19-34.

Celeux, G., Diday, E., Govaert, G., Lechevallier, Y., Ralambondrainy, H. (1988), *Classifcation Automatique des Donnees*, Environnement Statistique et Informatique - Dunod, Gauthier-Villards, Paris.

See Also

SClust, dist.SDA; dist in stats library; dist.GDM in clusterSim library; pam in cluster library

Examples

```
# LONG RUNNING - UNCOMMENT TO RUN
#data("cars",package="symbolicDA")
#sdt<-cars
#dist<-dist.SDA(sdt, type="U_3")
#clust<-DClust(dist, cl=5, iter=100)
#print(clust)
```

---

decisionTree.SDA *Decison tree for symbolic data*

Description

Optimal split based decision tree for symbolic objects

Usage

```
decisionTree.SDA(sdt,formula,testSet,treshMin=0.0001,treshW=-1e10,
tNodes=NULL,minSize=2,epsilon=1e-4,useEM=FALSE,
multiNominalType="ordinal",rf=FALSE,rf.size,objectSelection)
```

Arguments

`sdt`	Symbolic data table
`formula`	formula as in ln function
`testSet`	a vector of integers indicating classes to which each objects are allocated in learnig set
`treshMin`	parameter for tree creation algorithm
`treshW`	parameter for tree creation algorithm
`tNodes`	parameter for tree creation algorithm
`minSize`	parameter for tree creation algorithm
`epsilon`	parameter for tree creation algorithm
`useEM`	use Expectation Optimalization algorithm for estinating conditional probabilities
`multiNominalType`	"ordinal" - functione treats multi-nominal data as ordered or "nominal" functione treats multi-nomianal data as unordered (longer perfomance times)
`rf`	if TRUE symbolic variables for tree creation are randomly chosen like in random forest algorithm
`rf.size`	the number of variables chosen for tree creation if rf is true
`objectSelection`	optional, vector with symbolic object numbers for tree creation

Details

For futher details see ../doc/decisionTree_SDA.pdf

Value

nodes	nodes in tree
nodeObjects	contribution of each objects nodes in tree
conditionalProbab	conditional probability of belonginess of nodes te classes
prediction	predicted classes for objects from testSet

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References

Billard L., Diday E. (red.) (2006), *Symbolic Data Analysis, Conceptual Statistics and Data Mining*, John Wiley & Sons, Chichester.

Bock H.H., Diday E. (eds.) (2000), *Analysis of symbolic data. Explanatory methods for extracting statistical information from complex data*, Springer-Verlag, Berlin.

Diday E., Noirhomme-Fraiture M. (red.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester.

See Also

bagging.SDA,boosting.SDA,random.forest.SDA,draw.decisionTree.SDA

Examples

```
# Example 1
# LONG RUNNING - UNCOMMENT TO RUN
# File samochody.xml needed in this example
# can be found in /inst/xml library of package
#sda<-parse.SO("samochody")
#tree<-decisionTree.SDA(sda, "Typ_samochodu~.", testSet=1:33)
#summary(tree) # a very gerneral information
#tree  # summary information
```

dist.SDA *distance measurement for symbolic data*

Description

calculates distances between symbolic objects described by interval-valued, multinominal and multinominal with weights variables

Usage

```
dist.SDA(table.Symbolic,type="U_2",subType=NULL,gamma=0.5,power=2,probType="J",
probAggregation="P_1",s=0.5,p=2,variableSelection=NULL,weights=NULL)
```

Arguments

`table.Symbolic`	symbolic data table
`type`	distance measure for boolean symbolic objects: H, U_2, U_3, U_4, C_1, SO_1, SO_2, SO_3, SO_4, SO_5; mixed symbolic objects: L_1, L_2
`subType`	comparison function for C_1 and SO_1: D_1, D_2, D_3, D_4, D_5
`gamma`	gamma parameter for U_2 and U_3, gamma [0, 0.5]
`power`	power parameter for U_2 and U_3; power [1, 2, 3, ..]
`probType`	distance measure for probabilistic symbolic objects: J, CHI, REN, CHER, LP
`probAggregation`	agregation function for J, CHI, REN, CHER, LP: P_1, P_2
`s`	parameter for Renyi (REN) and Chernoff (CHE) distance, s [0, 1)
`p`	parameter for Minkowski (LP) metric; p=1 - manhattan distance, p=2 - euclidean distance
`variableSelection`	numbers of variables used for calculation or NULL for all variables
`weights`	weights of variables for Minkowski (LP) metrics

Details

Distance measures for boolean symbolic objects:

H - Hausdorff's distance for objects described by interval-valued variables, U_2, U_3, U_4 - Ichino-Yaguchi's distance measures for objects described by interval-valued and/or multinominal variables, C_1, SO_1, SO_2, SO_3, SO_4, SO_5 - de Carvalho's distance measures for objects described by interval-valued and/or multinominal variables.

Distance measurement for probabilistic symbolic objects consists of two steps: 1. Calculation of distance between objects for each variable using componentwise distance measures: J (Kullback-Leibler divergence), CHI (Chi-2 divergence), REN (Renyi's divergence), CHER (Chernoff's distance), LP (modified Minkowski metrics). 2. Calculation of aggregative distance between objects based on componentwise distance measures using objectwise distance measure: P_1 (manhattan distance), P_2 (euclidean distance).

Distance measures for mixed symbolic objects - modified Minkowski metrics: L_1 (manhattan distance), L_2 (euclidean distance).

See file ../doc/dist_SDA.pdf for further details

Value

distance matrix of symbolic objects

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References

Billard L., Diday E. (Eds.) (2006), *Symbolic Data Analysis, Conceptual Statistics and Data Mining*, John Wiley & Sons, Chichester.

Bock H.H., Diday E. (Eds.) (2000), *Analysis of Symbolic Data. Explanatory methods for extracting statistical information from complex data*, Springer-Verlag, Berlin.

Diday E., Noirhomme-Fraiture M. (Eds.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester.

Malerba D., Espozito F, Giovalle V., Tamma V. (2001), *Comparing Dissimilarity Measures for Symbolic Data Analysis*, "New Techniques and Technologies for Statistcs" (ETK NTTS'01), pp. 473-481.

Malerba, D., Esposito, F., Monopoli, M. (2002), *Comparing dissimilarity measures for probabilistic symbolic objects*, In: A. Zanasi, C.A. Brebbia, N.F.F. Ebecken, P. Melli (Eds.), Data Mining III, "Series Management Information Systems", Vol. 6, WIT Press, Southampton, pp. 31-40.

See Also

DClust, index.G1d; dist.Symbolic in clusterSim library

Examples

```
# LONG RUNNING - UNCOMMENT TO RUN
#data("cars",package="symbolicDA")
#dist<-dist.SDA(cars, type="U_3", gamma=0.3, power=2)
#print(dist)
```

draw.decisionTree.SDA *Draws optimal split based decision tree for symbolic objects*

Description

Draws optimal split based decision tree for symbolic objects

Usage

```
draw.decisionTree.SDA(decisionTree.SDA,boxWidth=1,boxHeight=3)
```

Arguments

decisionTree.SDA	optimal split based decision tree for symbolic objects (result of decisionTree.SDA function)
boxWidth	witdh of single box in drawing
boxHeight	height of single box in drawing

Details

Draws optimal split based decision (classification) tree for symbolic objects.

Value

A draw of optimal split based decision (classification) tree for symbolic objects.

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References

Billard L., Diday E. (red.) (2006), *Symbolic Data Analysis, Conceptual Statistics and Data Mining*, John Wiley & Sons, Chichester.

Bock H.H., Diday E. (eds.) (2000), *Analysis of symbolic data. Explanatory methods for extracting statistical information from complex data*, Springer-Verlag, Berlin.

Diday E., Noirhomme-Fraiture M. (red.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester.

See Also

decisionTree.SDA

Examples

```
# LONG RUNNING - UNCOMMENT TO RUN
# Files samochody.xml and wave.xml needed in this example
# can be found in /inst/xml library of package

# Example 1
#sda<-parse.SO("samochody")
#tree<-decisionTree.SDA(sda, "Typ_samochodu~.", testSet=26:33)
#draw.decisionTree.SDA(tree,boxWidth=1,boxHeight=3)

# Example 2
#sda<-parse.SO("wave")
#tree<-decisionTree.SDA(sda, "WaveForm~.", testSet=1:30)
#draw.decisionTree.SDA(tree,boxWidth=2,boxHeight=3)
```

---

generate.SO *generation of artifficial symbolic data table with given cluster structure*

Description

generation of artifficial symbolic data table with given cluster structure

Usage

```
generate.SO(numObjects,numClusters,numIntervalVariables,numMultivaluedVariables)
```

Arguments

`numObjects`	number of objects in each cluster
`numClusters`	number of objects
`numIntervalVariables`	Number of symbolic interval variables in generated data table
`numMultivaluedVariables`	Number of symbolic multi-valued variables in generated data table

Value

`data`	symbolic data table with given cluster structure
`clusters`	vector with cluster numbers for each object

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References

Billard L., Diday E. (red.) (2006), *Symbolic Data Analysis, Conceptual Statistics and Data Mining*, John Wiley & Sons, Chichester.

Bock H.H., Diday E. (eds.) (2000), *Analysis of symbolic data. Explanatory methods for extracting statistical information from complex data*, Springer-Verlag, Berlin.

Diday E., Noirhomme-Fraiture M. (red.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester.

User manual for SODAS 2 software, Software Report, Analysis System of Symbolic Official Data, Project no. IST-2000-25161, Paris.

See Also

see `symbolic.object` for symbolic data table R structure representation

Examples

```
# Example will be available in next version of package, thank You for your patience :-)
```

`HINoV.SDA` *Modification of HINoV method for symbolic data*

Description

Carmone, Kara \& Maxwell's Heuristic Identification of Noisy Variables (HINoV) method for symbolic data

Usage

```
HINoV.SDA(table.Symbolic, u=NULL, distance="H", Index="cRAND",method="pam",...)
```

Arguments

`table.Symbolic`	symbolic data table
`u`	number of clusters
`distance`	symbolic distance measure as parameter type in `dist.SDA`
`method`	clustering method: "single", "ward", "complete", "average", "mcquitty", "median", "centroid", "pam" (default), "SClust", "DClust"
`Index`	"cRAND" - adjusted Rand index (default); "RAND" - Rand index
`...`	additional argument passed to `dist.SDA` function

Details

For HINoV in symbolic data analysis there can be used methods based on distance matrix such as hierarchical ("single", "ward", "complete", "average", "mcquitty", "median", "centroid") and optimization methods ("pam", "DClust") and also methods based on symbolic data table ("SClust").

See file `../doc/HINoVSDA_details.pdf` for further details

Value

parim	*m* x *m* symmetric matrix (*m* - number of variables). Matrix contains pairwise adjusted Rand (or Rand) indices for partitions formed by the *j*-th variable with partitions formed by the *l*-th variable
topri	sum of rows of parim
stopri	ranked values of topri in decreasing order

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References

Bock, H.H., Diday, E. (Eds.) (2000), *Analysis of Symbolic Data. Explanatory Methods for Extracting Statistical Information from Complex Data*, Springer-Verlag, Berlin.

Diday, E., Noirhomme-Fraiture, M. (Eds.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester.

Carmone, F.J., Kara, A., Maxwell, S. (1999), *HINoV: a New Method to Improve Market Segment Definition by Identifying Noisy Variables*, "Journal of Marketing Research", November, vol. 36, pp. 501-509.

Rand, W.M. (1971), *Objective Criteria for the Evaluation of Clustering Methods*, "Journal of the American Statistical Association", no. 336, pp. 846-850.

Walesiak, M., Dudek, A. (2008), *Identification of Noisy Variables for Nonmetric and Symbolic Data in Cluster Analysis*,In: C. Preisach, H. Burkhardt, L. Schmidt-Thieme, R. Decker (Eds.), Data Analysis, Machine Learning and Applications, Studies in Classification, Data Analysis, and Knowledge Organization, Springer-Verlag, Berlin-Heilderberg, pp. 85-92.

See Also

DClust, SClust, dist.SDA; HINoV.Symbolic, dist.Symbolic in clusterSim library; hclust in stats library; pam in cluster library

Examples

```
# LONG RUNNING - UNCOMMENT TO RUN
#data("cars",package="symbolicDA")
#r<- HINoV.SDA(cars, u=3, distance="U_2")
#print(r$stopri)
#plot(r$stopri[,2], xlab="Variable number", ylab="topri",
#xaxt="n", type="b")
#axis(1,at=c(1:max(r$stopri[,1])),labels=r$stopri[,1])
```

IchinoFS.SDA *Ichino's feature selection method for symbolic data*

Description

Ichino's method for identifiyng non-noisy variables in symbolic data set

Usage

```
IchinoFS.SDA(table.Symbolic)
```

Arguments

`table.Symbolic` symbolic data table

Details

See file `../doc/IchinoFSSDA_details.pdf` for further details

Value

`plot` plot of the gradient illustrating combinations of variables, in which the axis of ordinates (Y) represents the maximum number of mutual neighbor pairs and the axis of the abscissae (X) corresponds to the number of features (m)

`combination` the best combination of variables, i.e. the combination most differentiating the set of objects

`maximum results`
step-by-step combinations of variables up to m variables

`calculation results`
....

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References

Ichino, M. (1994), *Feature selection for symbolic data classification*, In: E. Diday, Y. Lechevallier, P.B. Schader, B. Burtschy (Eds.), New Approaches in Classification and data analysis, Springer-Verlag, pp. 423-429.

Bock, H.H., Diday, E. (Eds.) (2000), *Analysis of symbolic data. Explanatory methods for extracting statistical information from complex data*, Springer-Verlag, Berlin.

Diday, E., Noirhomme-Fraiture, M. (Eds.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester.

See Also

HINoV.SDA; HINoV.Symbolic in clusterSim library

Examples

```
# LONG RUNNING - UNCOMMENT TO RUN
#data("cars",package="symbolicDA")
#sdt<-cars
#ichino<-IchinoFS.SDA(sdt)
#print(ichino)
```

---

index.G1d — *Calinski-Harabasz pseudo F-statistic based on distance matrix*

Description

Calculates Calinski-Harabasz pseudo F-statistic based on distance matrix

Usage

```
index.G1d (d,cl)
```

Arguments

d	distance matrix (see dist.SDA)
cl	a vector of integers indicating the cluster to which each object is allocated

Details

See file ../doc/indexG1d_details.pdf for further details

Value

value of Calinski-Harabasz pseudo F-statistic based on distance matrix

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References

Calinski, R.B., Harabasz, J. (1974), *A Dendrite Method for Cluster Analysis*, "Communications in Statistics", Vol. 3, pp. 1-27.

Everitt, B.S., Landau, E., Leese, M. (2001), *Cluster Analysis*, Arnold, London, p. 103.

Gordon, A.D. (1999), *Classification*, Chapman & Hall/CRC, London, p. 62.

Milligan, G.W., Cooper, M.C. (1985), *An Examination of Procedures of Determining the Number of Clusters in a Data Set*, "Psychometrika", Vol. 50, No. 2, pp. 159-179.

Diday, E., Noirhomme-Fraiture, M. (Eds.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester, pp. 236-262.

Dudek, A. (2007), *Cluster Quality Indexes for Symbolic Classification. An Examination*, In: H.H.-J. Lenz, R. Decker (Eds.), Advances in Data Analysis, Springer-Verlag, Berlin, pp. 31-38.

See Also

`DClust`, `SClust`; `index.G2`, `index.G3`, `index.S`, `index.H`,`index.KL`,`index.Gap`, `index.DB` in `clusterSim` library

Examples

```
# LONG RUNNING - UNCOMMENT TO RUN
# Example 1
#library(stats)
#data("cars",package="symbolicDA")
#x<-cars
#d<-dist.SDA(x, type="U_2")
#wynik<-hclust(d, method="ward", members=NULL)
#clusters<-cutree(wynik, 4)
#G1d<-index.G1d(d, clusters)
#print(G1d)

# Example 2


#data("cars",package="symbolicDA")
#md <- dist.SDA(cars, type="U_3", gamma=0.5, power=2)
# nc - number_of_clusters
#min_nc=2
#max_nc=10
#res <- array(0,c(max_nc-min_nc+1,2))
#res[,1] <- min_nc:max_nc
#clusters <- NULL
#for (nc in min_nc:max_nc)
#{
#cl2 <- pam(md, nc, diss=TRUE)
#res[nc-min_nc+1,2] <- G1d <- index.G1d(md,cl2$clustering)
#clusters <- rbind(clusters, cl2$clustering)
#}
#print(paste("max G1d for",(min_nc:max_nc)[which.max(res[,2])],"clusters=",max(res[,2])))
#print("clustering for max G1d")
```

```
#print(clusters[which.max(res[,2]),])
#write.table(res,file="G1d_res.csv",sep=";",dec=",",row.names=TRUE,col.names=FALSE)
#plot(res, type="p", pch=0, xlab="Number of clusters", ylab="G1d", xaxt="n")
#axis(1, c(min_nc:max_nc))
```

`interscal.SDA` *Multidimensional scaling for symbolic interval data - InterScal algorithm*

Description

Multidimensional scaling for symbolic interval data - InterScal algorithm

Usage

```
interscal.SDA(x,d=2,calculateDist=FALSE)
```

Arguments

`x`	symbolic interval data: a 3-dimensional table, first dimension represents object number, second dimension - variable number, and third dimension contains lower- and upper-bounds of intervals (Simple form of symbolic data table)
`d`	Dimensionality of reduced space
`calculateDist`	if TRUE x are treated as raw data and min-max dist matrix is calulated. See details

Details

Interscal is the adaptation of well-known classical multidimensional scaling for symbolic data. The input for Interscal is the interval-valued dissmilirarity matrix. Such dissmilarity matrix can be obtained from symbolic data matrix (that contains only interval-valued variables), judgements obtained from experts, respondents. See Lechevallier Y. (2001) for details on calculating interval-valued distance. See file `../doc/Symbolic_MDS.pdf` for further details

Value

`xprim`	coordinates of rectangles
`stress.sym`	final STRESSSym value

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References

Billard L., Diday E. (eds.) (2006), *Symbolic Data Analysis, Conceptual Statistics and Data Mining*, John Wiley & Sons, Chichester.

Bock H.H., Diday E. (eds.) (2000), *Analysis of symbolic data. Explanatory methods for extracting statistical information from complex data*, Springer-Verlag, Berlin.

Diday E., Noirhomme-Fraiture M. (eds.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester.

Lechevallier Y. (ed.), *Scientific report for unsupervised classification, validation and cluster analysis*, Analysis System of Symbolic Official Data - Project Number IST-2000-25161, project report.

See Also

`iscal.SDA`,`symscal.SDA`

Examples

```
# LONG RUNNING - UNCOMMENT TO RUN
#sda<-parse.SO("samochody")
#data<-sda$indivIC
#mds<-interscal.SDA(data, d=2, calculateDist=TRUE)
```

---

iscal.SDA *Multidimensional scaling for symbolic interval data - IScal algorithm*

Description

Multidimensional scaling for symbolic interval data - IScal algorithm

Usage

```
iscal.SDA(x,d=2,calculateDist=FALSE)
```

Arguments

`x`	symbolic interval data: a 3-dimensional table, first dimension represents object number, second dimension - variable number, and third dimension contains lower- and upper-bounds of intervals (Simple form of symbolic data table)
`d`	Dimensionality of reduced space
`calculateDist`	if TRUE x are treated as raw data and min-max dist matrix is calulated. See details

Details

IScal, which was proposed by Groenen et. al. (2006), is an adaptation of well-known nonmetric multidimensional scaling for symbolic data. It is an iterative algorithm that uses I-STRESS objective function. This function is normalized within the range [0; 1] and can be interpreted like classical STRESS values. IScal, like Interscal and SymScal, requires interval-valued dissimilarity matrix. Such dissmilarity matrix can be obtained from symbolic data matrix (that contains only interval-valued variables), judgements obtained from experts, respondents. See Lechevallier Y. (2001) for details on calculating interval-valued distance. See file `../doc/Symbolic_MDS.pdf` for further details

Value

`xprim`	coordinates of rectangles
`STRESSSym`	final STRESSSym value

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References

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Bock H.H., Diday E. (eds.) (2000), *Analysis of symbolic data. Explanatory methods for extracting statistical information from complex data*, Springer-Verlag, Berlin.

Diday E., Noirhomme-Fraiture M. (red.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester.

Groenen P.J.F, Winsberg S., Rodriguez O., Diday E. (2006), I-Scal: multidimensional scaling of interval dissimilarities, *Computational Statistics and Data Analysis*, 51, pp. 360-378.

Lechevallier Y. (ed.), *Scientific report for unsupervised classification, validation and cluster analysis*, Analysis System of Symbolic Official Data - Project Number IST-2000-25161, project report.

See Also

`interscal.SDA`,`symscal.SDA`

Examples

```
# Example will be available in next version of package, thank You for your patience :-)
```

kernel.SDA *Kernel discriminant analysis for symbolic data*

Description

Kernel discriminant analysis for symbolic data

Usage

```
kernel.SDA(sdt,formula,testSet,h,...)
```

Arguments

`sdt`	symbolic data table
`formula`	a formula, as in the `lm` function
`testSet`	vector with numbers objects ij test set
`h`	kernel bandwith size
`...`	argumets passed to dist.SDA functon

Details

Kernel discriminant analysis for symbolic data is based on the intensity estimatior (that is based on dissimiliarity measure for symbolic data) due to the fact that classical well-known density estimator can not be applied. Density estimator can not be applied due to the fact that symbolic objects are not object of euclidean space and the integral operator for symbolic data is not applicable.

For futher details see `../doc/Kernel_SDA.pdf.pdf`

Value

vector of class belongines of each object in test set

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References

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Bock H.H., Diday E. (eds.) (2000), *Analysis of symbolic data. Explanatory methods for extracting statistical information from complex data*, Springer-Verlag, Berlin.

Diday E., Noirhomme-Fraiture M. (red.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester.

See Also

dist.SDA

Examples

```
# Example 1
# LONG RUNNING - UNCOMMENT TO RUN
#sda<-parse.SO("samochody")
#model<-kernel.SDA(sda, "Typ_samochodu~.", testSet=6:16, h=0.75)
#model
```

---

kohonen.SDA *Kohonen's self-organizing maps for symbolic interval-valued data*

Description

Kohonen's self-organizing maps for a set of symbolic objects described by interval-valued variables

Usage

```
kohonen.SDA(data, rlen=100, alpha=c(0.05,0.01))
```

Arguments

data	symbolic data table in simple form (see SO2Simple)
rlen	number of iterations (the number of times the complete data set will be presented to the network)
alpha	learning rate, determining the size of the adjustments during training. Default is to decline linearly from 0.05 to 0.01 over rlen updates

Details

See file ../doc/kohonenSDA_details.pdf for further details

Value

clas	vector of mini-class belonginers in a test set
prot	prototypes

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References

Kohonen, T. (1995), *Self-Organizing Maps*, Springer, Berlin-Heidelberg.

Bock, H.H. (2001), *Clustering Algorithms and Kohonen Maps for Symbolic Data*, International Conference on New Trends in Computational Statistics with Biomedical Applications, ICNCB Proceedings, Osaka, pp. 203-215.

Bock, H.H., Diday, E. (Eds.) (2000), *Analysis of Symbolic Data. Explanatory Methods for Extracting Statistical Information from Complex Data*, Springer-Verlag, Berlin.

Diday, E., Noirhomme-Fraiture, M. (Eds.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester, pp. 373-392.

See Also

`SO2Simple`; `som` in `kohonen` library

Examples

```
# Example will be available in next version of package, thank You for your patience :-)
```

`parse.SO` *Reading symbolic data table from ASSO-format XML file*

Description

Kohonen self organizing maps for sympbolic data with interval variables

Usage

```
parse.SO(file)
```

Arguments

`file`	file name without xml extension

Details

see `symbolic.object` for symbolic data table R structure representation

Value

Symbolic data table parsed from XML file

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References

Billard L., Diday E. (red.) (2006), *Symbolic Data Analysis, Conceptual Statistics and Data Mining*, John Wiley & Sons, Chichester.

Bock H.H., Diday E. (eds.) (2000), *Analysis of symbolic data. Explanatory methods for extracting statistical information from complex data*, Springer-Verlag, Berlin.

Diday E., Noirhomme-Fraiture M. (red.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester.

See Also

save.SO,generate.SO

Examples

```
#cars<-parse.SO("cars")
```

PCA.centers.SDA — *principal component analysis for symbolic objects described by symbolic interavl variables.* Centers *algorithm*

Description

principal component analysis for symbolic objects described by symbolic interavl variables. *Centers* algorithm

Usage

```
PCA.centers.SDA(t,pc.number=2)
```

Arguments

t	symbolic interval data: a 3-dimensional table, first dimension represents object number, second dimension - variable number, and third dimension contains lower- and upper-bounds of intervals (Simple form of symbolic data table)
pc.number	number of principal components

Details

See file ../doc/PCA_SDA.pdf for further details

Value

Data in reduced space (symbolic interval data: a 3-dimensional table)

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References

Billard L., Diday E. (red.) (2006), *Symbolic Data Analysis, Conceptual Statistics and Data Mining*, John Wiley & Sons, Chichester.

Bock H.H., Diday E. (eds.) (2000), *Analysis of symbolic data. Explanatory methods for extracting statistical information from complex data*, Springer-Verlag, Berlin.

Diday E., Noirhomme-Fraiture M. (red.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester.

See Also

PCA.mrpca.SDA, PCA.spaghetti.SDA, PCA.spca.SDA, PCA.vertices.SDA

Examples

```
# Example will be available in next version of package, thank You for your patience :-)
```

PCA.mrpca.SDA — *principal component analysis for symbolic objects described by symbolic interavl variables.* Midpoints and radii *algorithm*

Description

principal component analysis for symbolic objects described by symbolic interavl variables. *Midpoints and radii* algorithm

Usage

```
PCA.mrpca.SDA(t,pc.number=2)
```

Arguments

`t`	symbolic interval data: a 3-dimensional table, first dimension represents object number, second dimension - variable number, and third dimension contains lower- and upper-bounds of intervals (Simple form of symbolic data table)
`pc.number`	number of principal components

Details

See file ../doc/PCA_SDA.pdf for further details

Value

Data in reduced space (symbolic interval data: a 3-dimensional table)

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References

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Bock H.H., Diday E. (eds.) (2000), *Analysis of symbolic data. Explanatory methods for extracting statistical information from complex data*, Springer-Verlag, Berlin.

Diday E., Noirhomme-Fraiture M. (red.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester.

See Also

PCA.centers.SDA, PCA.spaghetti.SDA, PCA.spca.SDA, PCA.vertices.SDA

Examples

```
# Example will be available in next version of package, thank You for your patience :-)
```

PCA.spaghetti.SDA — *principal component analysis for symbolic objects described by symbolic interavl variables.* Spaghetti *algorithm*

Description

principal component analysis for symbolic objects described by symbolic interavl variables. *Spaghetti* algorithm

Usage

```
PCA.spaghetti.SDA(t,pc.number=2)
```

Arguments

t	symbolic interval data: a 3-dimensional table, first dimension represents object number, second dimension - variable number, and third dimension contains lower- and upper-bounds of intervals (Simple form of symbolic data table)
pc.number	number of principal components

Details

See file ../doc/PCA_SDA.pdf for further details

Value

Data in reduced space (symbolic interval data: a 3-dimensional table)

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References

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Bock H.H., Diday E. (eds.) (2000), *Analysis of symbolic data. Explanatory methods for extracting statistical information from complex data*, Springer-Verlag, Berlin.

Diday E., Noirhomme-Fraiture M. (red.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester.

See Also

PCA.centers.SDA, PCA.mrpca.SDA, PCA.spca.SDA, PCA.vertices.SDA

Examples

```
# Example will be available in next version of package, thank You for your patience :-)
```

PCA.spca.SDA — *principal component analysis for symbolic objects described by symbolic interavl variables.* 'Symbolic' PCA *algorithm*

Description

principal component analysis for symbolic objects described by symbolic interavl variables. *'Symbolic' PCA* algorithm

Usage

```
PCA.spca.SDA(t,pc.number=2)
```

Arguments

`t`	symbolic interval data: a 3-dimensional table, first dimension represents object number, second dimension - variable number, and third dimension contains lower- and upper-bounds of intervals (Simple form of symbolic data table)
`pc.number`	number of principal components

Details

See file `../doc/PCA_SDA.pdf` for further details

Value

Data in reduced space (symbolic interval data: a 3-dimensional table)

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References

Billard L., Diday E. (red.) (2006), *Symbolic Data Analysis, Conceptual Statistics and Data Mining*, John Wiley & Sons, Chichester.

Bock H.H., Diday E. (eds.) (2000), *Analysis of symbolic data. Explanatory methods for extracting statistical information from complex data*, Springer-Verlag, Berlin.

Diday E., Noirhomme-Fraiture M. (red.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester.

See Also

`PCA.centers.SDA`, `PCA.mrpca.SDA`, `PCA.spaghetti.SDA`, `PCA.vertices.SDA`

Examples

```
# Example will be available in next version of package, thank You for your patience :-)
```

PCA.vertices.SDA — *principal component analysis for symbolic objects described by symbolic interavl variables.* Vertices *algorithm*

Description

principal component analysis for symbolic objects described by symbolic interavl variables. *Vertices* algorithm

Usage

```
PCA.vertices.SDA(t,pc.number=2)
```

Arguments

`t`	symbolic interval data: a 3-dimensional table, first dimension represents object number, second dimension - variable number, and third dimension contains lower- and upper-bounds of intervals (Simple form of symbolic data table)
`pc.number`	number of principal components

Details

See file `../doc/PCA_SDA.pdf` for further details

Value

Data in reduced space (symbolic interval data: a 3-dimensional table)

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References

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Bock H.H., Diday E. (eds.) (2000), *Analysis of symbolic data. Explanatory methods for extracting statistical information from complex data*, Springer-Verlag, Berlin.

Diday E., Noirhomme-Fraiture M. (red.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester.

See Also

`PCA.centers.SDA`, `PCA.mrpca.SDA`, `PCA.spaghetti.SDA`, `PCA.spca.SDA`

Examples

```
# Example will be available in next version of package, thank You for your patience :-)
```

plot3dInterval — *3D plot for symbolic interval-valued data*

Description

3-dimensional plot for symbolic objects described by interval-valued variables

Usage

```
plot3dInterval(data, colors)
```

Arguments

`data`	symbolic data table consists of a set of symbolic objects described by interval-valued variables
`colors`	set of colors (see `colors`) to mark symbolic objects

Value

3-dimensional plot for symbolic interval-valued data in which each axis represents a symbolic interval-valued variable and each cuboid represents a symbolic object

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References

Bock, H.H., Diday, E. (Eds.) (2000), *Analysis of symbolic data. Explanatory methods for extracting statistical information from complex data*, Springer-Verlag, Berlin.

Diday, E., Noirhomme-Fraiture, M. (Eds.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester.

See Also

`SClust`; `plotInterval` in `clusterSim` library

Examples

```
# LONG RUNNING - UNCOMMENT TO RUN
#means <- matrix(c(0,0,0,
#0,0,6,
#0,6,0,
#0,6,6,
#6,0,0,
```

```
#6,0,6,
#6,6,0,
#6,6,6),8,3,byrow=TRUE)
#means<-means*1.5
#means[5:8,1]<-means[5:8,1]-2
#means[5:8,3]<-means[5:8,3]-2
#cov <- matrix(c(1,0,0,0,1,0,0,0,1),3,3)
#t<-cluster.Gen(model=2, means=means, cov=cov, dataType="s", numObjects=10)
#plot3dInterval(t$data, colors=rainbow(8)[t$clusters])
#rgl.viewpoint(15,20,30)
#rgl.snapshot("8_clusters_3d.jpg")
```

---

random.forest.SDA *Random forest algorithm for optimal split based decision tree for symbolic objects*

Description

Random forest algorithm for optimal split based decision tree for symbolic objects

Usage

```
random.forest.SDA(sdt,formula,testSet, mfinal = 100,...)
```

Arguments

sdt	Symbolic data table
formula	formula as in ln function
testSet	a vector of integers indicating classes to which each objects are allocated in learnig set
mfinal	number of partial models generated
...	arguments passed to decisionTree.SDA function

Details

random.forest.SDA implements Breiman's random forest algorithm for classification of symbolic data set.

Value

Section details goes here

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References

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Bock H.H., Diday E. (eds.) (2000), *Analysis of symbolic data. Explanatory methods for extracting statistical information from complex data*, Springer-Verlag, Berlin.

Diday E., Noirhomme-Fraiture M. (red.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester.

See Also

bagging.SDA,boosting.SDA,decisionTree.SDA

Examples

```
# Example will be available in next version of package, thank You for your patience :-)
```

---

replication.SDA *Modification of replication analysis for cluster validation of symbolic data*

Description

Replication analysis for cluster validation of symbolic data

Usage

```
replication.SDA(table.Symbolic, u=2, method="SClust", S=10, fixedAsample=NULL, ...)
```

Arguments

table.Symbolic	symbolic data table
u	number of clusters given arbitrarily
method	clustering method: "SClust" (default), "DClust", "single", "complete", "average", "mcquitty", "median", "centroid", "ward", "pam", "diana"
S	the number of simulations used to compute average adjusted Rand index
fixedAsample	if NULL *A* sample is generated randomly, otherwise this parameter contains object numbers arbitrarily assigned to *A* sample
...	additional argument passed to dist.SDA function

Details

See file ../doc/replicationSDA_details.pdf for further details

Value

A	3-dimensional array containing data matrices for A sample of objects in each simulation (first dimension represents simulation number, second - object number, third - variable number)
B	3-dimensional array containing data matrices for B sample of objects in each simulation (first dimension represents simulation number, second - object number, third - variable number)
medoids	3-dimensional array containing matrices of observations on u representative objects (medoids) for A sample of objects in each simulation (first dimension represents simulation number, second - cluster number, third - variable number)
clusteringA	2-dimensional array containing cluster numbers for A sample of objects in each simulation (first dimension represents simulation number, second - object number)
clusteringB	2-dimensional array containing cluster numbers for B sample of objects in each simulation (first dimension represents simulation number, second - object number)
clusteringBB	2-dimensional array containing cluster numbers for B sample of objects in each simulation according to 4 step of replication analysis procedure (first dimension represents simulation number, second - object number)
cRand	value of average adjusted Rand index for S simulations

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References

Breckenridge, J.N. (2000), *Validating cluster analysis: consistent replication and symmetry*, "Multivariate Behavioral Research", 35 (2), pp. 261-285.

Gordon, A.D. (1999), *Classification*, Chapman and Hall/CRC, London.

Hubert, L., Arabie, P. (1985), *Comparing Partitions*, "Journal of Classification", no. 1, pp. 193-218.

Milligan, G.W. (1996), *Clustering Validation: Results and Implications for Applied Analyses*, In P. Arabie, L.J. Hubert, G. de Soete (Eds.), *Clustering and classification*, World Scientific, Singapore, pp. 341-375.

Bock H.H., Diday E. (Eds.) (2000), *Analysis of Symbolic Data. Explanatory methods for extracting statistical information from complex data*, Springer-Verlag, Berlin.

Diday E., Noirhomme-Fraiture M. (Eds.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester.

See Also

dist.SDA, SClust, DClust; hclust in stats library; pam in cluster library; replication.Mod in clusterSim library

Examples

```
#data("cars",package="symbolicDA")
#set.seed(123)
#w<-replication.SDA(cars, u=3, method="SClust", S=10)
#print(w)
```

---

save.SO *saves symbolic data table of 'symbolic' class to xml file*

Description

saves symbolic data table of 'symbolic' class to xml file (ASSO format)

Usage

```
save.SO(sdt,file)
```

Arguments

sdt	Symbolic data table
file	file name with extension

Details

see `symbolic.object` for symbolic data table R structure representation

Value

No value returned

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References

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Bock H.H., Diday E. (eds.) (2000), *Analysis of symbolic data. Explanatory methods for extracting statistical information from complex data*, Springer-Verlag, Berlin.

Diday E., Noirhomme-Fraiture M. (red.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester.

See Also

generate.SO,subsdt.SDA,parse.SO

Examples

```
#data("cars",package="symbolicDA")
#save.SO(cars,file="cars_backup.xml")
```

SClust *Dynamical clustering of symbolic data*

Description

Dynamical clustering of symbolic data based on symbolic data table

Usage

```
SClust(table.Symbolic, cl, iter=100, variableSelection=NULL, objectSelection=NULL)
```

Arguments

table.Symbolic	symbolic data table
cl	number of clusters or vector with initial prototypes of clusters
iter	maximum number of iterations
variableSelection	vector of numbers of variables to use in clustering procedure or NULL for all variables
objectSelection	vector of numbers of objects to use in clustering procedure or NULL for all objects

Details

See file ../doc/SClust_details.pdf for further details

Value

a vector of integers indicating the cluster to which each object is allocated

Author(s)

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References

Bock, H.H., Diday, E. (Eds.) (2000), *Analysis of Symbolic Data. Explanatory Methods for Extracting Statistical Information from Complex Data*, Springer-Verlag, Berlin.

Diday, E., Noirhomme-Fraiture, M. (Eds.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester, pp. 185-191.

Verde, R. (2004), *Clustering Methods in Symbolic Data Analysis*, In: D. Banks, L. House, E. R. McMorris, P. Arabie, W. Gaul (Eds.), Classification, clustering and Data mining applications, Springer-Verlag, Heidelberg, pp. 299-317.

Diday, E. (1971), *La methode des Nuees dynamiques*, Revue de Statistique Appliquee, Vol. 19-2, pp. 19-34.

Celeux, G., Diday, E., Govaert, G., Lechevallier, Y., Ralambondrainy, H. (1988), *Classifcation Automatique des Donnees*, Environnement Statistique et Informatique - Dunod, Gauthier-Villards, Paris.

See Also

`DClust`; `kmeans` in `stats` library

Examples

```
# LONG RUNNING - UNCOMMENT TO RUN
#data("cars",package="symbolicDA")
#sdt<-cars
#clust<-SClust(sdt, cl=3, iter=50)
#print(clust)
```

`simple2SO` *Change of representation of symbolic data from simple form to symbolic data table*

Description

Change of representation of symbolic data from simple form to symbolic data table

Usage

```
simple2SO(x)
```

Arguments

`x`	symbolic interval data: a 3-dimensional table, first dimension represents object number, second dimension - variable number, and third dimension contains lower- and upper-bounds of intervals

Details

see `symbolic.object` for symbolic data table R structure representation

Value

Symbolic data table in full form

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References

Billard L., Diday E. (red.) (2006), *Symbolic Data Analysis, Conceptual Statistics and Data Mining*, John Wiley & Sons, Chichester.

Bock H.H., Diday E. (eds.) (2000), *Analysis of symbolic data. Explanatory methods for extracting statistical information from complex data*, Springer-Verlag, Berlin.

Diday E., Noirhomme-Fraiture M. (red.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester.

See Also

`link{SO2Simple}`

Examples

```
# Example will be available in next version of package, thank You for your patience :-)
```

SO2Simple — *Change of representation of symbolic data from symbolic data table to simple form*

Description

Change of representation of symbolic data from symbolic data table to simple form

Usage

```
SO2Simple(sd)
```

Arguments

`sd`	Symbolic data table in full form

Details

see `symbolic.object` for symbolic data table R structure representation

Value

symbolic interval data: a 3-dimensional table, first dimension represents object number, second dimension - variable number, and third dimension contains lower- and upper-bounds of intervals

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References

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Bock H.H., Diday E. (eds.) (2000), *Analysis of symbolic data. Explanatory methods for extracting statistical information from complex data*, Springer-Verlag, Berlin.

Diday E., Noirhomme-Fraiture M. (red.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester.

See Also

`link{simple2SO}`

Examples

```
# Example will be available in next version of package, thank You for your patience :-)
```

---

subsdt.SDA   *Subset of symbolic data table*

Description

This method creates symbolic data table containing only objects, whose indices are given in secong argument

Usage

```
subsdt.SDA(sdt,objectSelection)
```

Arguments

`sdt`	Symbolic data table
`objectSelection`	vector containing symbolic object numbers, default value - all objects from sdt

Details

see `symbolic.object` for symbolic data table R structure representation

Value

Symbolic data table containing only objects, whose indices are given in secong argument. The result is of 'symbolic' class

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References

Billard L., Diday E. (red.) (2006), *Symbolic Data Analysis, Conceptual Statistics and Data Mining*, John Wiley & Sons, Chichester.

Bock H.H., Diday E. (eds.) (2000), *Analysis of symbolic data. Explanatory methods for extracting statistical information from complex data*, Springer-Verlag, Berlin.

Diday E., Noirhomme-Fraiture M. (red.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester.

See Also

`generate.SO`,`save.SO`,`parse.SO`

Examples

```
# Example will be available in next version of package, thank You for your patience :-)
```

---

summary.symbolic — *Short description of summary data table*

Description

Short description of summary data table

Usage

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

Arguments

`object`	Symbolic data table
`...`	...

Details

Section details goes here

Value

Section details goes here

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Billard L., Diday E. (red.) (2006), *Symbolic Data Analysis, Conceptual Statistics and Data Mining*, John Wiley & Sons, Chichester.

Bock H.H., Diday E. (eds.) (2000), *Analysis of symbolic data. Explanatory methods for extracting statistical information from complex data*, Springer-Verlag, Berlin.

Diday E., Noirhomme-Fraiture M. (red.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester.

See Also

symbolic.object

Examples

```
#Example will be available in next version of package, thank You for your patience :-)
```

---

symbolic.object *Symbolic data table Object*

Description

These are objects representing symbolic data table structure

Details

For all fields symbol N.A. means not available value.

For futher details see ../doc/SDA.pdf

Value

`individuals` data frame with one row for each row in symbolic data table with following columns:

`num` - symbolic object (described by symbolic data table row) ordering number , usually from 1 to numebr of symbolic objects;

`name` - short name of symbolic object with no spaces;

`label` - full descriptive name of symbolic object.

`variables` data frame with one row for each column in symbolic data table with following columns:

`num` - symbolic variable (adequate to symbolic data table column) ordering number, usually from 1 to number of symbolic variables;

`name` - short name of symbolic variable with no spaces;

`label` - full descriptive name of symbolic variable;

`type` - type of symbolic variable: `IC` (InterContinous) - Symbolic interval variable type, every realization of symbolic variable of this type on symbolic object takes form of numerical interval; `C` (Continous) - Symbolic interval variable type, every realization of symbolic variable of this type on symbolic object takes form of numerical interval for which begging is equal to end (equivalent to simple "numeric" value); `MN` (MultiNominal) - every realization of multi nominal symbolic variable on symbolic objects takes form of set of nominal values; `NM` ((Multi) Nominal Modif) - every realization of nominal symbolic variable on symbolic objects takes form of distribution of probabilities (set of nominal values with weights summing to one) `N` (Nominal) - every realization of nominal symbolic variable on symbolic objects is one value (or N.A.)

`details` - id of this variable in details table apropriate for this kind of variable (*detailsN* for nominal and multi nominal variables, *detailsIC* for symbolic interval variables, *detailsC* for continous (metric single-valued) variables, *detailsNM* of multi nominal with weights variables).

`detailsC` data frame describing symbolic continous (metric, single-valued) variables details with following columns:

`na` - number of N.A. (not available) variables realization;

`nu` - not used, left for compatibility with ASSO-XML specification;

`min` - beginning of interval representing symbolic interval variable domain (minimal value of all realizations of this variable on all symbolic objects);

`max` - end of interval representing symbolic interval variable domain (maximal value of all realizations of this variable on all symbolic objects).

`detailsIC` data frame describing symbolic inter-continous (symbolic interval) variables details with following columns:

`na` - number of N.A. (not available) variables realizations;

`nu` - not used, left for compatibility with ASSO-XML specification;

`min` - beginning of interval representing symbolic interval variable domain (minimal value of all beginnings of interval realizations of this variable on all symbolic objects);

`max` - end of interval representing symbolic interval variable domain (maximal value of all ends of interval realizations of this variable on all symbolic objects).

`detailsN` data frame describing symbolic nominal and multi nominal variables details with following columns:

`na` - number of N.A. variables realizations;

`nu` - not used, left for compatibility with ASSO-XML specification;

`modals` - number of categories in symbolic variable domain. Each categorie is described in *detailsListNom*.

`detailsListNom` data frame describing every category of symbolic nominal and multi nominal variables, with following columns:

`details_no` - number of variable in *detailsN* to which domain belongs category;

`num` - number of category within variable domain;

`name` - category short name

`label` - category full name

`detailsNM` data frame describing symbolic multi nominal modiff (categories sets with weights) variables details with following columns:

`na` number of N.A. (not available) variables realizations.

`nu` not used, left for compatibility with ASSO-XML specification

`modals` number of categories in symbolic variable domain. Each categorie is described in *detailsListNomModiff*

`detailsListNomModif`

data frame describing every category of symbolic multi nominal modiff variables, with following columns

`details_no` - number of variable in *detailsNM* to which domain belongs category

`num` - number of category within variable domain

`name` - category short name

`label` - category full name

`indivIC` array of symbolic interval variables realizations, with dimensions nr_of_objects X nr_of_variables X 2 containing beginnings and ends of intervals for given object and variable. For values different type than symbolic interval array contains zeros

`indivC` array of symbolic continues variables realizations, with dimensions nr_of_objects X nr_of_variables X 1 containing single values - realizations of variable on symbolic object. For values different type than symbolic continous array contains zeros

`indivN` data frame describing symbolic nominal and multi nonimal variables realizations with folowing columns:

`indiv` - id of symbolic object from *individuals*;

`variable` - id of symbolic object from *variables*;

`value` - id of category object from *detailsListNom*;

When this data frame contains line *i,j,k* it means that category *k* belongs to set that is realization of *j*-th symbolic variable on *i*-th symbolic object.

`indivNM` data frame describing symbolic multi nonimal modiff variables realizations with folowing columns:

`indiv` - id of symbolic object from *individuals*;

`variable` - id of symbolic object from *variables*;

`value` - id of category object from *detailsListNom*;

`frequency` - wiught of category;

When this data frame contains line *i,j,k,w* it means that category *k* belongs to set that is realization of *j*-th symbolic variable on *i*-th symbolic object with weight(probability) *w*.

Structure

The following components must be included in a legitimate `symbolic` object.

See Also

`dist.SDA`, `summary.symbolic`.

`symscal.SDA` *Multidimensional scaling for symbolic interval data - SymScal algorithm*

Description

Multidimensional scaling for symbolic interval data - SymScal algorithm

Usage

```
symscal.SDA(x,d=2,calculateDist=FALSE)
```

Arguments

`x`	symbolic interval data: a 3-dimensional table, first dimension represents object number, second dimension - variable number, and third dimension contains lower- and upper-bounds of intervals (Simple form of symbolic data table)
`d`	Dimensionality of reduced space
`calculateDist`	if TRUE x are treated as raw data and min-max dist matrix is calulated. See details

Details

SymScal, which was proposed by Groenen et. al. (2005), is an adaptation of well-known nonmetric multidimensional scaling for symbolic data. It is an iterative algorithm that uses STRESS objective function. This function is unnormalized. IScal, like Interscal and SymScal, requires interval-valued dissimilarity matrix. Such dissmilarity matrix can be obtained from symbolic data matrix (that contains only interval-valued variables), judgements obtained from experts, respondents. See Lechevallier Y. (2001) for details on calculating interval-valued distance. See file `../doc/Symbolic_MDS.pdf` for further details

Value

xprim	coordinates of rectangles
STRESSSym	final STRESSSym value

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References

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Bock H.H., Diday E. (eds.) (2000), *Analysis of symbolic data. Explanatory methods for extracting statistical information from complex data*, Springer-Verlag, Berlin.

Diday E., Noirhomme-Fraiture M. (red.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester.

Groenen P.J.F., Winsberg S., Rodriguez O., Diday E. (2005), Multidimensional scaling of interval dissimilarities, *Econometric Report* 2005-15, Rotterdam: Erasmus University.

See Also

iscal.SDA,interscal.SDA

Examples

```
# Example will be available in next version of package, thank You for your patience :-)
```

---

zoomStar *zoom star chart for symbolic data*

Description

plot in a form of zoom star chart for symbolic object described by interval-valued, multivalued and modal variables

Usage

```
zoomStar(table.Symbolic, j, variableSelection=NULL, offset=0.2,
firstTick=0.2, labelCex=.8, labelOffset=.7, tickLength=.3, histWidth=0.04,
histHeight=2, rotateLabels=TRUE, variableCex=NULL)
```

Arguments

table.Symbolic	symbolic data table
j	symbolic object number in symbolic data table used to create the chart
variableSelection	numbers of symbolic variables describing symbolic object used to create the chart, if NULL all variables are used
offset	relational offset of chart (margin size)
firstTick	place of first tick (relational to lenght of axis)
labelCex	labels cex parameter of labels
labelOffset	relational offset of labels
tickLength	relational length of single tick of axis
histWidth	histogram (for modal variables) relational width
histHeight	histogram (for modal variables) relational heigth
rotateLabels	if TRUE labels are rotated due to rotation of axes
variableCex	cex parameter of names of variables

Value

zoom star chart for selected symbolic object in which each axis represents a symbolic variable. Depending on the type of symbolic variable their implementations are presented as:

a) rectangle - interval range of interval-valued variable),

b) circles - categories of multinominal (or multinominal with weights) variable from among coloured circles means categories of the variable observed for the selected symbolic object

bar chart - additional chart for multinominal with weights variable in which each bar represents a weight (percentage share) of a category of the variable

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References

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Diday, E., Noirhomme-Fraiture, M. (Eds.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester.

See Also

plot3dInterval; plotInterval in clusterSim

Examples

```
# LONG RUNNING - UNCOMMENT TO RUN
# Example 1
#data("cars",package="symbolicDA")
#sdt<-cars
#zoomStar(sdt, j=12)

# Example 2
#data("cars",package="symbolicDA")
#sdt<-cars
#variables<-as.matrix(sdt$variables)
#indivN<-as.matrix(sdt$indivN)
#dist<-as.matrix(dist.SDA(sdt))
#classes<-DClust(dist, cl=5, iter=100)
#for(i in 1:max(classes)){
  #getOption("device")()
  #zoomStar(sdt, .medoid(dist, classes, i))}
```

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