

# Package ‘symbolicDA’

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**Title** Analysis of Symbolic Data

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**Depends** R(>= 3.6.0), clusterSim,XML

**Imports** rgl, shapes, e1071, ade4, cluster, RSDA

**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 data, replication and profiling, artificial symbolic data generation.

(Milligan, G.W., Cooper, M.C. (1985) <doi:10.1007/BF02294245>,

Breiman, L. (1996), <doi:10.1007/BF00058655>,

Hubert, L., Arabie, P. (1985), <doi:10.1007%2FBF01908075>,

Ichino, M., & Yaguchi, H. (1994), <doi:10.1109/21.286391>,

Rand, W.M. (1971) <doi:10.1080/01621459.1971.10482356>,

Calinski, T., Harabasz, J. (1974) <doi:10.1080/03610927408827101>,

Breckenridge, J.N. (2000) <doi:10.1207/S15327906MBR3502\_5>,

Groenen, P.J.F, Winsberg, S., Rodriguez, O., Diday, E. (2006) <doi:10.1016/j.csda.2006.04.003>,

Walesiak, M., Dudek, A. (2008) <doi:10.1007/978-3-540-78246-9\_11>,

Dudek, A. (2007), <doi:10.1007/978-3-540-70981-7\_4>).

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bagging.SDA	<i>Bagging algorithm for optimal split based on decision tree for symbolic objects</i>
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**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 learning 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. (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.

Breiman L. (1996), *Bagging predictors*, Machine Learning, vol. 24, no. 2, pp. 123-140. Available at: [doi:10.1007/BF00058655](https://doi.org/10.1007/BF00058655).

Diday E., Noirhomme-Fraiture M. (eds.) (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	<i>Boosting algorithm for optimal split based decision tree for symbolic objects</i>
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---

### 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 while 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**

- Billard L., Diday E. (eds.) (2006), *Symbolic Data Analysis, Conceptual Statistics and Data Mining*, John Wiley & Sons, Chichester.
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- Diday E., Noirhomme-Fraiture M. (eds.) (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	<i>real data set in symbolic form - selected car models described by a set of symbolic variables</i>
------	--

---

**Description**

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

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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. (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)
```

---

data_symbolic	<i>Symbolic interval data</i>
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---

**Description**

Artificially generated symbolic interval data

**Format**

3-dimensional array: 125 objects, 6 variables, third dimension represents beginning and end of interval, 5-class structure

**Source**

Artificially generated data

---

DClust	<i>Dynamical clustering based on distance matrix</i>
--------	--

---

**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), *Classification 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	<i>Decision tree for symbolic data</i>
------------------	--

---

## 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 estimating conditional probabilities
multiNominalType	"ordinal" - functione treats multi-nominal data as ordered or "nominal" functione treats multi-nomial data as unordered (longer performance 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

### Author(s)

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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

[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 general information
#tree # summary information
```

---

dist_SDA	<i>distance measurement for symbolic data</i>
----------	---

---

## Description

calculates distances between symbolic objects described by interval-valued, multinomial and multinomial 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 multinomial 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 multinomial 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

NOTE !!!: In previous version of package this function has been called dist.SDA.

## Value

distance matrix of symbolic objects

## Author(s)

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**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	width 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.

**Author(s)**

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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. (eds.) (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	<i>generation of artificial symbolic data table with given cluster structure</i>
-------------	--

---

## Description

generation of artificial 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**

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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. (eds.) (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 <a href="#">dist_SDA</a>
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 <a href="#">dist_SDA</a> 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	$m \times m$ 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

**Author(s)**

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**References**

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analysis, machine learning and applications, Springer-Verlag, Berlin, Heidelberg, 85-92. Available at: [doi:1007/9783540782469\\_11](https://doi.org/10.1007/9783540782469_11)

### 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 identifying 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.

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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**

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**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 calculated. See details

## Details

Interscal is the adaptation of well-known classical multidimensional scaling for symbolic data. The input for Interscal is the interval-valued dissimilarity matrix. Such dissimilarity 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 calculated. 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 dissimilarity 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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**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 bandwidth size
...	argumets passed to dist_SDA functon

**Details**

Kernel discriminant analysis for symbolic data is based on the intensity estimator (that is based on dissimilarity 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

- Billard L., Diday E. (eds.) (2006), *Symbolic Data Analysis, Conceptual Statistics and Data Mining*, John Wiley & Sons, Chichester.
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- Diday E., Noirhomme-Fraiture M. (eds.) (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)
#print(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 <a href="#">S02Simple</a> )
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 belonginners in a test set  
 prot            prototypes

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**References**

Kohonen, T. (1995), *Self-Organizing Maps*, Springer, Berlin-Heidelberg.  
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 Diday, E., Noirhomme-Fraiture, M. (eds.) (2008), *Symbolic Data Analysis with SODAS Software*, John Wiley & Sons, Chichester, pp. 373-392.

**See Also**

S02Simple; 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 symphobic 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. (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.

**See Also**

[save.S0](#), [generate.S0](#)

**Examples**

```
#cars<-parse.S0("cars")
```

---

PCA.centers.SDA	<i>principal component analysis for symbolic objects described by symbolic interval variables. Centers algorithm</i>
-----------------	--

---

**Description**

principal component analysis for symbolic objects described by symbolic interval 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. (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.

**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	<i>principal component analysis for symbolic objects described by symbolic interval variables. Midpoints and radii algorithm</i>
---------------	--

---

**Description**

principal component analysis for symbolic objects described by symbolic interval 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**

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.

**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 interval variables. Spaghetti algorithm*

---

**Description**

principal component analysis for symbolic objects described by symbolic interval 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**

- 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.

**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	<i>principal component analysis for symbolic objects described by symbolic interval variables. 'Symbolic' PCA algorithm</i>
--------------	---

---

### Description

principal component analysis for symbolic objects described by symbolic interval 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)

### Author(s)

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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.

### 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	<i>principal component analysis for symbolic objects described by symbolic interval variables. Vertices algorithm</i>
------------------	---

---

**Description**

principal component analysis for symbolic objects described by symbolic interval 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)

**Author(s)**

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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.

**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	<i>3D plot for symbolic interval-valued data</i>
----------------	--

---

**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 <a href="#">colors</a> ) 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

**Author(s)**

Andrzej Dudek <[andrzej.dudek@ue.wroc.pl](mailto:andrzej.dudek@ue.wroc.pl)>, Justyna Wilk <[justyna.wilk@ue.wroc.pl](mailto:justyna.wilk@ue.wroc.pl)> Department of Econometrics and Computer Science, Wroclaw University of Economics, Poland <http://keii.ue.wroc.pl/symbolicDA/>

**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	<i>Random forest algorithm for optimal split based decision tree for symbolic objects</i>
-------------------	---

---

**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 <code>lm</code> function
testSet	a vector of integers indicating classes to which each objects are allocated in learning set
mfinal	number of partial models generated
...	arguments passed to <code>decisionTree.SDA</code> function

**Details**

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

**Value**

Section details goes here

**Author(s)**

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<http://keii.ue.wroc.pl/symbolicDA/>

**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.

**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	<i>Modification of replication analysis for cluster validation of symbolic data</i>
-----------------	---

---

**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 <a href="#">dist_SDA</a> 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

**Author(s)**

Andrzej Dudek <[andrzej.dudek@ue.wroc.pl](mailto:andrzej.dudek@ue.wroc.pl)>, Justyna Wilk <[justyna.wilk@ue.wroc.pl](mailto:justyna.wilk@ue.wroc.pl)> Department of Econometrics and Computer Science, Wroclaw University of Economics, Poland <http://keii.ue.wroc.pl/symbolicDA/>

**References**

- Breckenridge, J.N. (2000), *Validating cluster analysis: consistent replication and symmetry*, "Multivariate Behavioral Research", 35 (2), 261-285. Available at: [doi:10.1207/S15327906MBR3502\\_5](https://doi.org/10.1207/S15327906MBR3502_5).
- Gordon, A.D. (1999), *Classification*, Chapman and Hall/CRC, London. ISBN 9781584880134.
- Hubert, L., Arabie, P. (1985), *Comparing partitions*, "Journal of Classification", no. 1, 193-218. Available at: [doi:10.1007/BF01908075](https://doi.org/10.1007/BF01908075).
- 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, 341-375. ISBN 9789810212872.
- 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)
```

---

RSDA2SymbolicDA

*Read a Symbolic Table from*


---

**Description**

It reads a symbolic data table from a CSV file or converts RSDA object to SymbolicDA "symbolic" class type object

**Usage**

```
RSDA2SymbolicDA(rsda.object=NULL,from.csv=F,file=NULL
, header = TRUE, sep, dec, row.names = NULL)
```

**Arguments**

<code>rsda.object</code>	object of class "symb.data.table" from (former) RSDA package)
<code>from.csv</code>	object of class "symb.data.table" from (former) RSDA package)
<code>file</code>	optional, The name of the CSV file in RSDA format (see details)
<code>header</code>	As in R function <code>read.table</code>
<code>sep</code>	As in R function <code>read.table</code>
<code>dec</code>	As in R function <code>read.table</code>
<code>row.names</code>	As in R function <code>read.table</code>

**Details**

(as in (former) RSDA package) The labels \$C means that follows a continuous variable, \$I means an interval variable, \$H means a histogram variables and \$S means set variable. In the first row each labels should be follow of a name to variable and to the case of histogram a set variables types the names of the modalities (categories) . In data rows for continuous variables we have just one value, for interval variables we have the minimum and the maximum of the interval, for histogram variables we have the number of modalities and then the probability of each modality and for set variables we have the cardinality of the set and next the elements of the set.

The format is the CSV file should be like:

```
$C F1 $I F2 F2 $H F3 M1 M2 M3 $S F4 E1 E2 E3 E4
```

```
Case1 $C 2.8 $I 1 2 $H 3 0.1 0.7 0.2 $S 4 e g k i
```

```
Case2 $C 1.4 $I 3 9 $H 3 0.6 0.3 0.1 $S 4 a b c d
```

```
Case3 $C 3.2 $I -1 4 $H 3 0.2 0.2 0.6 $S 4 2 1 b c
```

```
Case4 $C -2.1 $I 0 2 $H 3 0.9 0.0 0.1 $S 4 3 4 c a
```

```
Case5 $C -3.0 $I -4 -2 $H 3 0.6 0.0 0.4 $S 4 e i g k
```

The internal format is:

```
$N
```

```
[1] 5
```

```
$M
```

```
[1] 4
```

```
$sym.obj.names
```

```
[1] 'Case1' 'Case2' 'Case3' 'Case4' 'Case5'
```

```
$sym.var.names
```

```
[1] 'F1' 'F2' 'F3' 'F4'
```

```
$sym.var.types
```

```
[1] '$C' '$I' '$H' '$S'
```

```
$sym.var.length
```

```
[1] 1 2 3 4
```

```
$sym.var.starts
```

```
[1] 2 4 8 13
```

```
$meta
```

```
$C F1 $I F2 F2 $H F3 M1 M2 M3 $S F4 E1 E2 E3 E4
```

```
Case1 $C 2.8 $I 1 2 $H 3 0.1 0.7 0.2 $S 4 e g k i
```

```
Case2 $C 1.4 $I 3 9 $H 3 0.6 0.3 0.1 $S 4 a b c d
```

```
Case3 $C 3.2 $I -1 4 $H 3 0.2 0.2 0.6 $S 4 2 1 b c
```

```
Case4 $C -2.1 $I 0 2 $H 3 0.9 0.0 0.1 $S 4 3 4 c a
```

```
Case5 $C -3.0 $I -4 -2 $H 3 0.6 0.0 0.4 $S 4 e i g k
```

```
$data
```

```
F1 F2 F2.1 M1 M2 M3 E1 E2 E3 E4
```

```
Case1 2.8 1 2 0.1 0.7 0.2 e g k i
```

```
Case2 1.4 3 9 0.6 0.3 0.1 a b c d
```

```
Case3 3.2 -1 4 0.2 0.2 0.6 2 1 b c
```

```
Case4 -2.1 0 2 0.9 0.0 0.1 3 4 c a
```

```
Case5 -3.0 -4 -2 0.6 0.0 0.4 e i g k
```

## Value

Return a symbolic data table in form of SymbolicDA "symbolic" class type object.

**Author(s)**

Andrzej Dudek

With ideas from RSDA package by Oldemar Rodriguez Rojas

**References**

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

**See Also**

display.sym.table

**Examples**

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

---

```
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

**Author(s)**

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<http://keii.ue.wroc.pl/symbolicDA/>

**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.

**See Also**

[generate.S0,subsdt.SDA,parse.S0](#)

**Examples**

```
#data("cars",package="symbolicDA")
#save.S0(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), *Classification 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

**Author(s)**

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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.

**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

**Author(s)**

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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.

**See Also**

[link{simple2S0}](#)

**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 second 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 second argument. The result is of 'symbolic' class

**Author(s)**

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Department of Econometrics and Computer Science, University of Economics, Wrocław, Poland  
<http://keii.ue.wroc.pl/symbolicDA/>

**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.

**See Also**

[generate.S0](#), [save.S0](#), [parse.S0](#)

**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 further details see [../doc/SDA.pdf](#)

**Value**

individuals	<p>data frame with one row for each row in symbolic data table with following columns:</p> <p>num - symbolic object (described by symbolic data table row) ordering number , usually from 1 to number of symbolic objects;</p> <p>name - short name of symbolic object with no spaces;</p> <p>label - full descriptive name of symbolic object.</p>
variables	<p>data frame with one row for each column in symbolic data table with following columns:</p> <p>num - symbolic variable (adequate to symbolic data table column) ordering number, usually from 1 to number of symbolic variables;</p> <p>name - short name of symbolic variable with no spaces;</p> <p>label - full descriptive name of symbolic variable;</p> <p>type - type of symbolic variable: IC (InterContinuous) - Symbolic interval variable type, every realization of symbolic variable of this type on symbolic object takes form of numerical interval; C (Continuous) - Symbolic interval variable type, every realization of symbolic variable of this type on symbolic object takes form of numerical interval for which beginning 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.)</p> <p>details - id of this variable in details table appropriate for this kind of variable (<i>detailsN</i> for nominal and multi nominal variables, <i>detailsIC</i> for symbolic interval variables, <i>detailsC</i> for continuous (metric single-valued) variables, <i>detailsNM</i> of multi nominal with weights variables).</p>
detailsC	<p>data frame describing symbolic continuous (metric, single-valued) variables details with following columns:</p> <p>na - number of N.A. (not available) variables realization;</p> <p>nu - not used, left for compatibility with ASSO-XML specification;</p> <p>min - beginning of interval representing symbolic interval variable domain (minimal value of all realizations of this variable on all symbolic objects);</p> <p>max - end of interval representing symbolic interval variable domain (maximal value of all realizations of this variable on all symbolic objects).</p>
detailsIC	<p>data frame describing symbolic inter-continuous (symbolic interval) variables details with following columns:</p> <p>na - number of N.A. (not available) variables realizations;</p> <p>nu - not used, left for compatibility with ASSO-XML specification;</p>

	<p>min - beginning of interval representing symbolic interval variable domain (minimal value of all beginnings of interval realizations of this variable on all symbolic objects);</p> <p>max - end of interval representing symbolic interval variable domain (maximal value of all ends of interval realizations of this variable on all symbolic objects).</p>
detailsN	<p>data frame describing symbolic nominal and multi nominal variables details with following columns:</p> <p>na - number of N.A. variables realizations;</p> <p>nu - not used, left for compatibility with ASSO-XML specification;</p> <p>modals - number of categories in symbolic variable domain. Each categorie is described in <i>detailsListNom</i>.</p>
detailsListNom	<p>data frame describing every category of symbolic nominal and multi nominal variables, with following columns:</p> <p>details_no - number of variable in <i>detailsN</i> to which domain belongs category;</p> <p>num - number of category within variable domain;</p> <p>name - category short name</p> <p>label - category full name</p>
detailsNM	<p>data frame describing symbolic multi nominal modiff (categories sets with weights) variables details with following columns:</p> <p>na number of N.A. (not available) variables realizations.</p> <p>nu not used, left for compatibility with ASSO-XML specification</p> <p>modals number of categories in symbolic variable domain. Each categorie is described in <i>detailsListNomModiff</i></p>
detailsListNomModif	<p>data frame describing every category of symbolic multi nominal modiff variables, with following columns</p> <p>details_no - number of variable in <i>detailsNM</i> to which domain belongs category</p> <p>num - number of category within variable domain</p> <p>name - category short name</p> <p>label - category full name</p>
indivIC	<p>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</p>
indivC	<p>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</p>
indivN	<p>data frame describing symbolic nominal and multi nonimal variables realizations with folowing columns:</p> <p>indiv - id of symbolic object from <i>individuals</i>;</p> <p>variable - id of symbolic object from <i>variables</i>;</p> <p>value - id of category object from <i>detailsListNom</i>;</p>

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 nominal modified variables realizations with following columns:  
`indiv` - id of symbolic object from *individuals*;  
`variable` - id of symbolic object from *variables*;  
`value` - id of category object from *detailsListNom*;  
`frequency` - weight 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](#).

---

<code>symscal.SDA</code>	<i>Multidimensional scaling for symbolic interval data - SymScal algorithm</i>
--------------------------	--

---

### Description

Multidimensional scaling for symbolic interval data - symScal algorithm

### Usage

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

### Arguments

<code>x</code>	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)
<code>d</code>	Dimensionality of reduced space
<code>calculateDist</code>	if TRUE <code>x</code> are treated as raw data and min-max dist matrix is calculated. See details

## Details

SymScal, which was proposed by Groenen et. al. (2005), is an adaptation of well-known non-metric 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 dissimilarity 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

## Author(s)

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## References

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## 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 length 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 height
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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**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, .medoid2(dist, classes, i))}
```

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