

# Package ‘DFP’

December 16, 2024

**Type** Package

**Title** Gene Selection

**Version** 1.65.0

**Date** 2009-07-22

**Author** R. Alvarez-Gonzalez, D. Glez-Pena, F. Diaz, F. Fdez-Riverola

**Maintainer** Rodrigo Alvarez-Glez <rodrigo.djv@uvigo.es>

**Depends** methods, Biobase (>= 2.5.5)

**Collate** AllClasses.R show-methods.R DFP.R

**LazyLoad** Yes

**Description** This package provides a supervised technique able to identify differentially expressed genes, based on the construction of *Fuzzy Patterns* (FPs). The Fuzzy Patterns are built by means of applying 3 Membership Functions to discretized gene expression values.

**License** GPL-2

**biocViews** Microarray, DifferentialExpression

**git\_url** <https://git.bioconductor.org/packages/DFP>

**git\_branch** devel

**git\_last\_commit** c67c641

**git\_last\_commit\_date** 2024-10-29

**Repository** Bioconductor 3.21

**Date/Publication** 2024-12-16

## Contents

|   |   |
|---|---|
| DFP-package . . . . .                       | 2 |
| calculateDiscriminantFuzzyPattern . . . . . | 3 |
| calculateFuzzyPatterns . . . . .            | 4 |
| calculateMembershipFunctions . . . . .      | 5 |
| DFP-internal . . . . .                      | 6 |

|  |    |
|--|----|
| discretizeExpressionValues . . . . .   | 7  |
| discriminantFuzzyPattern . . . . .     | 8  |
| ExpressionLevel-class . . . . .        | 10 |
| HighExpressionLevel-class . . . . .    | 11 |
| LowExpressionLevel-class . . . . .     | 12 |
| MediumExpressionLevel-class . . . . .  | 13 |
| plotDiscriminantFuzzyPattern . . . . . | 14 |
| plotMembershipFunctions . . . . .      | 15 |
| readCSV . . . . .                      | 16 |
| rmadataset . . . . .                   | 17 |
| show-methods . . . . .                 | 18 |
| showDiscreteValues . . . . .           | 18 |
| showFuzzyPatterns . . . . .            | 19 |

|              |           |
|--------------|-----------|
| <b>Index</b> | <b>20</b> |
|--------------|-----------|

---

DFP-package

*DFP Package Overview*

---

## Description

This package provides a supervised technique able to identify differentially expressed genes, based on the construction of *Fuzzy Patterns* (FPs). The *Fuzzy Patterns* are built by means of applying 3 *Membership Functions* to discretized gene expression values.

## Details

Package: DFP  
 Type: Package  
 Version: 1.0  
 Date: 2008-07-03  
 License: GPL-2

The main functionality of the package is provided by the `discriminantFuzzyPattern` function, which works in a 4-step process:

1. Calculates the *Membership Functions*. These functions are used in the next step to discretize gene expression data.
2. Discretizes the gene expression data (float values) into ‘Low’, ‘Medium’ or ‘High’ labels.
3. Calculates a *Fuzzy Pattern* for each category. To do this, a given percentage of the samples belonging to a category must have the same label (‘Low’, ‘Medium’ or ‘High’).
4. Calculates the *Discriminant Fuzzy Pattern* (DFP) that includes those genes present in two or more FPs with different assigned labels.

Additional data classes: `ExpressionSet`, `AnnotatedDataFrame`.

**Author(s)**

Rodrigo Alvarez-Gonzalez  
 Daniel Glez-Pena  
 Fernando Diaz  
 Florentino Fdez-Riverola  
 Maintainer: Rodrigo Alvarez-Gonzalez <<rodrigo.djv@uvigo.es>>

**References**

F. Diaz; F. Fdez-Riverola; D. Glez-Pena; J.M. Corchado. Using Fuzzy Patterns for Gene Selection and Data Reduction on Microarray Data. 7th International Conference on Intelligent Data Engineering and Automated Learning: IDEAL 2006, (2006) pp. 1095-1102

**Examples**

```
#####
##### Get sample data #####
#####
library(DFP)
data(rmadataset)

#####
# Filter the most representative genes #
#####
res <- discriminantFuzzyPattern(rmadataset)

#####
##### Different result displays #####
#####
plotMembershipFunctions(rmadataset, res$membership.functions, featureNames(rmadataset)[1:2])
showDiscreteValues(res$discrete.values, featureNames(rmadataset)[1:10], c("healthy", "AML-inv"))
showFuzzyPatterns(res$fuzzy.patterns, "healthy")[21:50]
plotDiscriminantFuzzyPattern(res$discriminant.fuzzy.pattern)
```

---

calculateDiscriminantFuzzyPattern

*Calculates the Discriminant Fuzzy Pattern to select significant genes*

---

**Description**

Calculates the *Discriminant Fuzzy Pattern* (DFP) that includes those genes present in two or more FPs with different assigned labels.

**Usage**

```
calculateDiscriminantFuzzyPattern(rmadataset, fps)
```

**Arguments**

|            |   |
|------------|---|
| rmadataset | <a href="#">ExpressionSet</a> with numeric values containing gene expression values (rows) of samples belonging to different categories (columns).<br>The <a href="#">ExpressionSet</a> also contains an <a href="#">AnnotatedDataFrame</a> with metadata regarding the classes to which each sample belongs. |
| fps        | Genes belonging to each <i>Fuzzy Patterns</i> . There are one FP for each class.<br>Includes an attribute <i>ifs</i> with the <i>Impact Factor</i> for each category.   |

**Value**

Genes belonging to the final DFP.  
Includes an attribute *ifs* with the *Impact Factor* for each category.

**Author(s)**

Rodrigo Alvarez-Gonzalez  
Daniel Glez-Pena  
Fernando Diaz  
Florentino Fdez-Riverola  
Maintainer: Rodrigo Alvarez-Gonzalez <<rodrigo.djv@uvigo.es>>

**References**

F. Diaz; F. Fdez-Riverola; D. Glez-Pena; J.M. Corchado. Using Fuzzy Patterns for Gene Selection and Data Reduction on Microarray Data. 7th International Conference on Intelligent Data Engineering and Automated Learning: IDEAL 2006, (2006) pp. 1095-1102

---

calculateFuzzyPatterns

*Calculates a Fuzzy Pattern for each category of the samples*

---

**Description**

Calculates a *Fuzzy Pattern* for each category. To do this, a given percentage of the samples belonging to a category must have the same label ('Low', 'Medium' or 'High').

**Usage**

```
calculateFuzzyPatterns(rmadataset, dvs, piVal = 0.9, overlapping = 2)
```

**Arguments**

|            |   |
|------------|---|
| rmadataset | <a href="#">ExpressionSet</a> with numeric values containing gene expression values (rows) of samples belonging to different categories (columns).<br>The <a href="#">ExpressionSet</a> also contains an <a href="#">AnnotatedDataFrame</a> with metadata regarding the classes to which each sample belongs. |
|------------|---|

|             |   |
|-------------|---|
| dvs         | Matrix containing discrete values according to the overlapping parameter after discretizing the gene expression values.<br>Includes an attribute <i>types</i> which determines the category of each sample.   |
| piVal       | Controls the degree of exigency for selecting a gene as a member of a <i>Fuzzy Pattern</i> .<br>Default value = 0.9. Range[0, 1].   |
| overlapping | Modifies the number of membership functions used in the discretization process.<br>Possible values: <ol style="list-style-type: none"><li>1. 'Low', 'Medium', 'High'.</li><li>2. 'Low', 'Low-Medium', 'Medium', 'Medium-High', 'High'.</li><li>3. 'Low', 'Low-Medium', 'Low-Medium-High', 'Medium', 'Medium-High', 'High'.</li></ol> Default value = 2. |

**Value**

Genes belonging to each *Fuzzy Patterns*. There are one FP for each class.  
Includes an attribute *ifs* with the *Impact Factor* for each category.

**Author(s)**

Rodrigo Alvarez-Gonzalez  
Daniel Glez-Pena  
Fernando Diaz  
Florentino Fdez-Riverola  
Maintainer: Rodrigo Alvarez-Gonzalez <<rodrigo.djv@uvigo.es>>

**References**

F. Diaz; F. Fdez-Riverola; D. Glez-Pena; J.M. Corchado. Using Fuzzy Patterns for Gene Selection and Data Reduction on Microarray Data. 7th International Conference on Intelligent Data Engineering and Automated Learning: IDEAL 2006, (2006) pp. 1095-1102

---

calculateMembershipFunctions

*Calculates Membership Functions*

---

**Description**

Calculates the *Membership Functions*. These functions are used in the next step ([discretizeExpressionValues](#)) to discretize gene expression data.

**Usage**

```
calculateMembershipFunctions(rmadataSet, skipFactor = 3)
```

**Arguments**

|                         |  |
|-------------------------|--|
| <code>rmdatASET</code>  | <code>ExpressionSet</code> with numeric values containing gene expression values (rows) of samples belonging to different categories (columns).<br>The <code>ExpressionSet</code> also contains an <code>AnnotatedDataFrame</code> with metadata regarding the classes to which each sample belongs. |
| <code>skipFactor</code> | Numeric value to omit odd values (a way of normalization).<br>Higher values imply that less samples of a gene are considered as odd. If <code>skipFactor=0</code> do <b>NOT</b> skip.<br>Default value = 3. Range[0,).   |

**Value**

*Membership functions* to determine the discret value (linguistic label) corresponding to a given gene expression level.

**Author(s)**

Rodrigo Alvarez-Gonzalez  
Daniel Glez-Pena  
Fernando Diaz  
Florentino Fdez-Riverola  
Maintainer: Rodrigo Alvarez-Gonzalez <<rodrigo.djv@uvigo.es>>

**References**

F. Diaz; F. Fdez-Riverola; D. Glez-Pena; J.M. Corchado. Using Fuzzy Patterns for Gene Selection and Data Reduction on Microarray Data. 7th International Conference on Intelligent Data Engineering and Automated Learning: IDEAL 2006, (2006) pp. 1095-1102

---

DFP-internal

*Internal DFP objects*

---

**Description**

Internal DFP objects.

**Details**

These are not to be called by the user.

---

`discretizeExpressionValues`*Function to discretize gene expression data*

---

**Description**

Discretizes the gene expression data (float values) into 'Low', 'Medium' or 'High' labels.

**Usage**

```
discretizeExpressionValues(rmadataSet, mfs, zeta = 0.5, overlapping = 2)
```

**Arguments**

|                          |   |
|--------------------------|---|
| <code>rmadataSet</code>  | <a href="#">ExpressionSet</a> with numeric values containing gene expression values (rows) of samples belonging to different categories (columns).<br>The <a href="#">ExpressionSet</a> also contains an <a href="#">AnnotatedDataFrame</a> with metadata regarding the classes to which each sample belongs.   |
| <code>mfs</code>         | <i>Membership functions</i> to determine the discret value (linguistic label) corresponding to a given gene expression level.   |
| <code>zeta</code>        | Threshold value which controls the activation of a linguistic label ('Low', 'Medium' or 'High').<br>The lower, the less possibilities of having genes with more than one assigned linguistic label.<br>Default value = 0.5. Range[0, 1].  |
| <code>overlapping</code> | Modifies the number of membership functions used in the discretization process.<br>Possible values:<br><ol style="list-style-type: none"><li>1. 'Low', 'Medium', 'High'.</li><li>2. 'Low', 'Low-Medium', 'Medium', 'Medium-High', 'High'.</li><li>3. 'Low', 'Low-Medium', 'Low-Medium-High', 'Medium', 'Medium-High', 'High'.</li></ol><br>Default value = 2. |

**Value**

Matrix containing discrete values according to the overlapping parameter after discretizing the gene expression values.

Includes an attribute *types* which determines the category of each sample.

**Author(s)**

Rodrigo Alvarez-Gonzalez

Daniel Glez-Pena

Fernando Diaz

Florentino Fdez-Riverola

Maintainer: Rodrigo Alvarez-Gonzalez <<rodrigo.djv@uvigo.es>>

## References

F. Diaz; F. Fdez-Riverola; D. Glez-Pena; J.M. Corchado. Using Fuzzy Patterns for Gene Selection and Data Reduction on Microarray Data. 7th International Conference on Intelligent Data Engineering and Automated Learning: IDEAL 2006, (2006) pp. 1095-1102

---

discriminantFuzzyPattern

*Discriminant Fuzzy Pattern to filter genes*

---

## Description

*discriminantFuzzyPattern* discovers significant genes based on the construction of *Fuzzy Patterns* (FPs). The *Fuzzy Patterns* are built by means of applying 3 *Membership Functions* to the gene expression values in the matrix *rmadataset*.

## Usage

```
discriminantFuzzyPattern(rmadataset, skipFactor = 3, zeta = 0.5, overlapping = 2, piVal = 0.9)
```

## Arguments

|             |  |
|-------------|--|
| rmadataset  | <a href="#">ExpressionSet</a> with numeric values containing gene expression values (rows) of samples belonging to different categories (columns).<br>The <a href="#">ExpressionSet</a> also contains an <a href="#">AnnotatedDataFrame</a> with metadata regarding the classes to which each sample belongs.                                      |
| skipFactor  | Numeric value to omit odd values (a way of normalization).<br>Higher values imply that less samples of a gene are considered as odd. If <i>skipFactor=0</i> do <b>NOT</b> skip.<br>Default value = 3. Range[0,).   |
| zeta        | Threshold value which controls the activation of a linguistic label ('Low', 'Medium' or 'High').<br>The lower, the less possibilities of having genes with more than one assigned linguistic label.<br>Default value = 0.5. Range[0, 1].   |
| overlapping | Modifies the number of membership functions used in the discretization process.<br>Possible values: <ol style="list-style-type: none"> <li>'Low', 'Medium', 'High'.</li> <li>'Low', 'Low-Medium', 'Medium', 'Medium-High', 'High'.</li> <li>'Low', 'Low-Medium', 'Low-Medium-High', 'Medium', 'Medium-High', 'High'.</li> </ol> Default value = 2. |
| piVal       | Controls the degree of exigency for selecting a gene as a member of a <i>Fuzzy Pattern</i> .<br>Default value = 0.9. Range[0, 1].  |



## Details

The `discriminantFuzzyPattern` function works in a 4-step process:

1. Calculates the *Membership Functions*. These functions are used in the next step to discretize gene expression data.
2. Discretizes the gene expression data (float values) into ‘Low’, ‘Medium’ or ‘High’ labels.
3. Calculates a *Fuzzy Pattern* for each category. To do this, a given percentage of the samples belonging to a category must have the same label (‘Low’, ‘Medium’ or ‘High’).
4. Calculates the *Discriminant Fuzzy Pattern* (DFP) that includes those genes present in two or more FPs with different assigned labels.

## Value

|   |   |
|---|---|
| <code>membership.functions</code>       | <i>Membership functions</i> to determine the discret value corresponding to a given gene expression level.  |
| <code>discrete.values</code>            | Discrete values according to the overlapping parameter after discretizing the gene expression values.<br>Includes an attribute <i>types</i> which determines the category of each sample. |
| <code>fuzzy.patterns</code>             | Genes belonging to each <i>Fuzzy Patterns</i> . There are one FP for each class.<br>Includes an attribute <i>ifs</i> with the <i>Impact Factor</i> for each category.                     |
| <code>discriminant.fuzzy.pattern</code> | Genes belonging to the final DFP.<br>Includes an attribute <i>ifs</i> with the <i>Impact Factor</i> for each category.  |
| <code>params</code>                     | The parameters used to tune the algorithm (as arguments in the function).   |

## Author(s)

Rodrigo Alvarez-Gonzalez  
 Daniel Glez-Pena  
 Fernando Diaz  
 Florentino Fdez-Riverola  
 Maintainer: Rodrigo Alvarez-Gonzalez <<rodrigo.djv@uvigo.es>>

## References

F. Diaz; F. Fdez-Riverola; D. Glez-Pena; J.M. Corchado. Using Fuzzy Patterns for Gene Selection and Data Reduction on Microarray Data. 7th International Conference on Intelligent Data Engineering and Automated Learning: IDEAL 2006, (2006) pp. 1095-1102

## Examples

```
#####
##### Get sample data #####
#####
library(DFP)
data(rmadataset)
```

```
#####
# Filters the most representative genes #
#####
res <- discriminantFuzzyPattern(rmadataset)
summary(res)
```

---

ExpressionLevel-class Class "ExpressionLevel"

---

### Description

A virtual class which represents a generic *Membership Function*.

### Objects from the Class

A virtual Class: No objects may be created from it.

### Slots

**center:** Object of class "numeric". Represents the peak point in the function curve.

**width:** Object of class "numeric". Represents the length of values lower than 1 and greater than 0 in the function curve.

### Methods

**show** signature(object = "ExpressionLevel"): Prints the ExpressionLevel subclass of the object.

**setValues** signature(object = "ExpressionLevel", values = "numeric"): Generic function to be implemented in the subclasses.

**computeMembership** signature(object = "ExpressionLevel", x = "numeric"): Generic function to be implemented in the subclasses.

### Author(s)

Rodrigo Alvarez-Gonzalez  
 Daniel Glez-Pena  
 Fernando Diaz  
 Florentino Fdez-Riverola  
 Maintainer: Rodrigo Alvarez-Gonzalez <<rodrigo.djv@uvigo.es>>

### References

F. Diaz; F. Fdez-Riverola; D. Glez-Pena; J.M. Corchado. Using Fuzzy Patterns for Gene Selection and Data Reduction on Microarray Data. 7th International Conference on Intelligent Data Engineering and Automated Learning: IDEAL 2006, (2006) pp. 1095-1102

**Examples**

```
showClass("ExpressionLevel")
```

---

```
HighExpressionLevel-class  
Class "HighExpressionLevel"
```

---

**Description**

A class which represents a *Membership Function* to determine the membership of a numeric value to the 'High' discrete label. The result depends on the 'center' and 'width' values.

**Objects from the Class**

Objects can be created by calls of the form `new("HighExpressionLevel")`.

**Slots**

**center:** Object of class "numeric". Represents the peak point in the function curve.

**width:** Object of class "numeric". Represents the length of values lower than 1 and greater than 0 in the function curve.

**Extends**

Class "[ExpressionLevel](#)", directly.

**Methods**

**setValues** signature(object = "HighExpressionLevel", values = "numeric"): Establishes the 'center' and 'width' slots of the object, given a vector of numeric values.

**computeMembership** signature(object = "HighExpressionLevel", x = "numeric"): Returns a value in the [0,1] interval, which represents the membership to the 'High' discrete label.

**Author(s)**

Rodrigo Alvarez-Gonzalez

Daniel Glez-Pena

Fernando Diaz

Florentino Fdez-Riverola

Maintainer: Rodrigo Alvarez-Gonzalez <<rodrigo.djv@uvigo.es>>

**References**

F. Diaz; F. Fdez-Riverola; D. Glez-Pena; J.M. Corchado. Using Fuzzy Patterns for Gene Selection and Data Reduction on Microarray Data. 7th International Conference on Intelligent Data Engineering and Automated Learning: IDEAL 2006, (2006) pp. 1095-1102

**Examples**

```
showClass("HighExpressionLevel")
```

---

LowExpressionLevel-class

*Class "LowExpressionLevel"*

---

**Description**

A class which represents a *Membership Function* to determine the membership of a numeric value to the 'Low' discrete label. The result depends on the 'center' and 'width' values.

**Objects from the Class**

Objects can be created by calls of the form `new("LowExpressionLevel")`.

**Slots**

**center:** Object of class "numeric". Represents the peak point in the function curve.

**width:** Object of class "numeric". Represents the length of values lower than 1 and greater than 0 in the function curve.

**Extends**

Class "[ExpressionLevel](#)", directly.

**Methods**

**setValues** signature(object = "LowExpressionLevel", values = "numeric"): Establishes the 'center' and 'width' slots of the object, given a vector of numeric values.

**computeMembership** signature(object = "LowExpressionLevel", x = "numeric"): Returns a value in the [0,1] interval, which represents the membership to the 'Low' discrete label.

**Author(s)**

Rodrigo Alvarez-Gonzalez

Daniel Glez-Pena

Fernando Diaz

Florentino Fdez-Riverola

Maintainer: Rodrigo Alvarez-Gonzalez <<rodrigo.djv@uvigo.es>>

**References**

F. Diaz; F. Fdez-Riverola; D. Glez-Pena; J.M. Corchado. Using Fuzzy Patterns for Gene Selection and Data Reduction on Microarray Data. 7th International Conference on Intelligent Data Engineering and Automated Learning: IDEAL 2006, (2006) pp. 1095-1102

**Examples**

```
showClass("LowExpressionLevel")
```

---

```
MediumExpressionLevel-class  
Class "MediumExpressionLevel"
```

---

**Description**

A class which represents a *Membership Function* to determine the membership of a numeric value to the 'Medium' discrete label. The result depends on the 'center' and 'width' values.

**Objects from the Class**

Objects can be created by calls of the form `new("MediumExpressionLevel")`.

**Slots**

**center:** Object of class "numeric". Represents the peak point in the function curve.

**width:** Object of class "numeric". Represents the length of values lower than 1 and greater than 0 in the function curve.

**Extends**

Class "[ExpressionLevel](#)", directly.

**Methods**

**setValues** signature(object = "MediumExpressionLevel", values = "numeric"): Establishes the 'center' and 'width' slots of the object, given a vector of numeric values.

**computeMembership** signature(object = "MediumExpressionLevel", x = "numeric"): Returns a value in the [0,1] interval, which represents the membership to the 'Medium' discrete label.

**Author(s)**

Rodrigo Alvarez-Gonzalez

Daniel Glez-Pena

Fernando Diaz

Florentino Fdez-Riverola

Maintainer: Rodrigo Alvarez-Gonzalez <<rodrigo.djv@uvigo.es>>

**References**

F. Diaz; F. Fdez-Riverola; D. Glez-Pena; J.M. Corchado. Using Fuzzy Patterns for Gene Selection and Data Reduction on Microarray Data. 7th International Conference on Intelligent Data Engineering and Automated Learning: IDEAL 2006, (2006) pp. 1095-1102

**Examples**

```
showClass("MediumExpressionLevel")
```

---

```
plotDiscriminantFuzzyPattern
```

*Plots the Discriminant Fuzzy Pattern of the relevant genes*

---

**Description**

This function plots the *Discriminant Fuzzy Pattern* of the relevant genes (in rows) for the sample classes (in columns), as well as the impact factor which determines if a gene belongs to a *Fuzzy Pattern* in a class (if its value is higher than the *piVal*).

The relevant genes are those which are present in almost two different *Fuzzy Patterns* with different linguistic labels.

The plotting is made in both graphical and text mode.

**Usage**

```
plotDiscriminantFuzzyPattern(dfp, overlapping = 2)
```

**Arguments**

|             |   |
|-------------|---|
| dfp         | A matrix with the fuzzy patterns and impact factors for the relevant genes.   |
| overlapping | Modifies the number of membership functions used in the discretization process.<br>Possible values: <ol style="list-style-type: none"> <li>1. 'Low', 'Medium', 'High'.</li> <li>2. 'Low', 'Low-Medium', 'Medium', 'Medium-High', 'High'.</li> <li>3. 'Low', 'Low-Medium', 'Low-Medium-High', 'Medium', 'Medium-High', 'High'.</li> </ol> Default value = 2. |

**Value**

A matrix with the discriminant genes in rows, along with the *Fuzzy Pattern* for each class (in columns).

This object contains an attribute (*ifs*) which stores the *Impact Factors* used to determine if a gene belongs to a *Fuzzy Pattern* in a class (if the value is higher than the *piVal*).

**Author(s)**

Rodrigo Alvarez-Gonzalez  
Daniel Glez-Pena  
Fernando Diaz  
Florentino Fdez-Riverola  
Maintainer: Rodrigo Alvarez-Gonzalez <<rodrigo.djv@uvigo.es>>

## References

F. Diaz; F. Fdez-Riverola; D. Glez-Pena; J.M. Corchado. Using Fuzzy Patterns for Gene Selection and Data Reduction on Microarray Data. 7th International Conference on Intelligent Data Engineering and Automated Learning: IDEAL 2006, (2006) pp. 1095-1102

---

plotMembershipFunctions

*Plots the Membership Functions (Low, Medium, High) used to discretize gene expression values*

---

## Description

Each gene has 3 *Membership Functions* ('Low', 'Medium' and 'High') which can be plotted as curves in graphical mode.

In the text mode a membership function is represented with its *center* and *width*.

This function receives one or more gene names and plots the results in both graphical and text mode.

If a set of genes containing more than 36 elements is provided, only the text mode is available.

## Usage

```
plotMembershipFunctions(rmadataset, mfs, genes)
```

## Arguments

|            |   |
|------------|---|
| rmadataset | An <a href="#">ExpressionSet</a> object with <a href="#">AnnotatedDataFrame</a> metadata.                         |
| mfs        | A list of 3 <a href="#">ExpressionLevel</a> objects ('Low', 'Medium' and 'High') for each gene (a list of lists). |
| genes      | The set of genes to plot (a vector).  |

## Value

A dataframe with the values of the membership functions ('Low', 'Medium' and 'High') for each gene (in rows) received as a parameter.

## Author(s)

Rodrigo Alvarez-Gonzalez  
Daniel Glez-Pena  
Fernando Diaz  
Florentino Fdez-Riverola  
Maintainer: Rodrigo Alvarez-Gonzalez <<rodrigo.djv@uvigo.es>>

## References

F. Diaz; F. Fdez-Riverola; D. Glez-Pena; J.M. Corchado. Using Fuzzy Patterns for Gene Selection and Data Reduction on Microarray Data. 7th International Conference on Intelligent Data Engineering and Automated Learning: IDEAL 2006, (2006) pp. 1095-1102

---

|         |   |
|---------|---|
| readCSV | <i>Creates an ExpressionSet with an AnnotatedDataFrame from CSV files</i> |
|---------|---|

---

### Description

This function creates an [ExpressionSet](#) with an [AnnotatedDataFrame](#). To do this, it requires two CSV files in a predefined format:

1. 'exprsData' with the expression values of genes (in rows) of different samples (in columns).
2. 'pData' with the samples (in columns) and the metadata 'class' (the most important for the algorithm [discriminantFuzzyPattern](#)), 'age' and 'sex'.

### Usage

```
readCSV(fileExprs, filePhenodata)
```

### Arguments

fileExprs        The path to the exprsData file.  
filePhenodata   The path to the pData file.

### Value

An [ExpressionSet](#) object with an [AnnotatedDataFrame](#) storing 'class', 'age' and 'sex' information.

### Author(s)

Rodrigo Alvarez-Gonzalez  
Daniel Glez-Pena  
Fernando Diaz  
Florentino Fdez-Riverola  
Maintainer: Rodrigo Alvarez-Gonzalez <<rodrigo.djv@uvigo.es>>

### References

F. Diaz; F. Fdez-Riverola; D. Glez-Pena; J.M. Corchado. Using Fuzzy Patterns for Gene Selection and Data Reduction on Microarray Data. 7th International Conference on Intelligent Data Engineering and Automated Learning: IDEAL 2006, (2006) pp. 1095-1102

### Examples

```
dataDir <- system.file("extdata", package="DFP"); dataDir  
fileExprs <- file.path(dataDir, "exprsData.csv"); fileExprs  
filePhenodata <- file.path(dataDir, "pData.csv"); filePhenodata  
rmdatASET <- readCSV(fileExprs, filePhenodata); rmdatASET  
pData(phenoData(rmdatASET))  
exprs(rmdatASET)[1:10,1:5]
```



---

|           |                                      |
|-----------|--------------------------------------|
| rmdatASET | <i>A sample ExpressionSet object</i> |
|-----------|--------------------------------------|

---

### Description

This `ExpressionSet` object includes an `AnnotatedDataFrame` with metadata about 'Disease type' (the most important for the algorithm), 'Patient age' and 'Patient gender'. This data set gives the expression values of 500 genes in 35 samples.

### Usage

```
data(rmdatASET)
```

### Format

```
ExpressionSet      str(pData(phenoData(rmdatASET)))  
AnnotatedDataFrame str(exprs(rmdatASET))
```

### Author(s)

Rodrigo Alvarez-Gonzalez  
Daniel Glez-Pena  
Fernando Diaz  
Florentino Fdez-Riverola  
Maintainer: Rodrigo Alvarez-Gonzalez <<rodrigo.djv@uvigo.es>>

### References

F. Diaz; F. Fdez-Riverola; D. Glez-Pena; J.M. Corchado. Using Fuzzy Patterns for Gene Selection and Data Reduction on Microarray Data. 7th International Conference on Intelligent Data Engineering and Automated Learning: IDEAL 2006, (2006) pp. 1095-1102

### Examples

```
data(rmdatASET)  
featureNames(rmdatASET)[1:20]  
sampleNames(rmdatASET)  
varLabels(rmdatASET)  
pData(phenoData(rmdatASET))  
exprs(rmdatASET)[1:10, 1:5]
```

---

|              |   |
|--------------|---|
| show-methods | <i>Prints the slots (attributes) of an ExpressionLevel object</i> |
|--------------|---|

---

**Description**

Prints the slots (center and width) of an "ExpressionLevel" object.

**Methods**

**object** = "ExpressionLevel" See "ExpressionLevel".

---

|                    |   |
|--------------------|---|
| showDiscreteValues | <i>Prints the labels to which the algorithm converts the gene expression values</i> |
|--------------------|---|

---

**Description**

In an intermediate step, the algorithm `discriminantFuzzyPattern` converts the gene expression values into discrete labels (combining 'Low', 'Medium' and 'High', depending on the value of the param 'overlapping').

This function permits printing these labels, specifying a set of genes (a vector) and/or classes of samples.

**Usage**

```
showDiscreteValues(dvs, genes, classes)
```

**Arguments**

|         |   |
|---------|---|
| dvs     | A matrix with discrete labels for a set of genes (in rows) of several samples (in columns).   |
| genes   | [optional] The set of genes to plot.  |
| classes | [optional] A set of classes to which the samples belong. It must be one of the classes stored in the phenoData of the original <code>ExpressionSet</code> object. |

**Value**

A subset of the matrix dvs determined by the restrictions (genes and/or classes).

**Author(s)**

Rodrigo Alvarez-Gonzalez  
 Daniel Glez-Pena  
 Fernando Diaz  
 Florentino Fdez-Riverola  
 Maintainer: Rodrigo Alvarez-Gonzalez <<rodrigo.djv@uvigo.es>>

## References

F. Diaz; F. Fdez-Riverola; D. Glez-Pena; J.M. Corchado. Using Fuzzy Patterns for Gene Selection and Data Reduction on Microarray Data. 7th International Conference on Intelligent Data Engineering and Automated Learning: IDEAL 2006, (2006) pp. 1095-1102

---

showFuzzyPatterns      *Plots the Fuzzy Patterns corresponding to a class*

---

## Description

This functions prints (in text mode) the *Fuzzy Patterns* (discrete labels) calculated for a single class of samples.

## Usage

```
showFuzzyPatterns(fps, class)
```

## Arguments

`fps`                    A matrix with the *Fuzzy Patterns* (discrete labels) for all the samples and genes.  
`class`                  A class to which the samples belong. It must be one of the classes stored in the `phenoData` of the original [ExpressionSet](#) *rmadataset* object.

## Value

A vector of *Fuzzy Patterns* (discrete labels) for a single class of samples, with the genes associated.

## Author(s)

Rodrigo Alvarez-Gonzalez  
Daniel Glez-Pena  
Fernando Diaz  
Florentino Fdez-Riverola  
Maintainer: Rodrigo Alvarez-Gonzalez <<rodrigo.djv@uvigo.es>>

## References

F. Diaz; F. Fdez-Riverola; D. Glez-Pena; J.M. Corchado. Using Fuzzy Patterns for Gene Selection and Data Reduction on Microarray Data. 7th International Conference on Intelligent Data Engineering and Automated Learning: IDEAL 2006, (2006) pp. 1095-1102

# Index

- \* **classes**
  - ExpressionLevel-class, [10](#)
  - HighExpressionLevel-class, [11](#)
  - LowExpressionLevel-class, [12](#)
  - MediumExpressionLevel-class, [13](#)
- \* **datasets**
  - rmadataset, [17](#)
- \* **internal**
  - DFP-internal, [6](#)
- \* **manip**
  - calculateDiscriminantFuzzyPattern, [3](#)
  - calculateFuzzyPatterns, [4](#)
  - calculateMembershipFunctions, [5](#)
  - discretizeExpressionValues, [7](#)
  - discriminantFuzzyPattern, [8](#)
  - plotDiscriminantFuzzyPattern, [14](#)
  - plotMembershipFunctions, [15](#)
  - readCSV, [16](#)
  - showDiscreteValues, [18](#)
  - showFuzzyPatterns, [19](#)
- \* **methods**
  - show-methods, [18](#)
- \* **package**
  - DFP-package, [2](#)
  - .calculateDiscriminantFuzzyPattern (DFP-internal), [6](#)
  - .calculateFuzzyPatterns (DFP-internal), [6](#)
  - .calculateMembershipFunctions (DFP-internal), [6](#)
  - .computeMembershipHigh (DFP-internal), [6](#)
  - .computeMembershipLow (DFP-internal), [6](#)
  - .computeMembershipMedium (DFP-internal), [6](#)
  - .discretizeExpressionValues (DFP-internal), [6](#)
  - .fuzzyDiscretization (DFP-internal), [6](#)
  - .fuzzyPatterns (DFP-internal), [6](#)
  - .plotGeneMF (DFP-internal), [6](#)
  - .setValuesHigh (DFP-internal), [6](#)
  - .setValuesLow (DFP-internal), [6](#)
  - .setValuesMedium (DFP-internal), [6](#)
  - .skipOddValues (DFP-internal), [6](#)
- AnnotatedDataFrame, [2, 4, 6–8, 15–17](#)
- calculateDiscriminantFuzzyPattern, [3](#)
- calculateFuzzyPatterns, [4](#)
- calculateMembershipFunctions, [5](#)
- computeMembership, HighExpressionLevel-method (HighExpressionLevel-class), [11](#)
- computeMembership, LowExpressionLevel-method (LowExpressionLevel-class), [12](#)
- computeMembership, MediumExpressionLevel-method (MediumExpressionLevel-class), [13](#)
- DFP (DFP-package), [2](#)
- DFP-internal, [6](#)
- DFP-package, [2](#)
- discretizeExpressionValues, [5, 7](#)
- discriminantFuzzyPattern, [2, 8, 9, 16, 18](#)
- ExpressionLevel, [11–13, 18](#)
- ExpressionLevel-class, [10](#)
- ExpressionSet, [2, 4, 6–8, 15–19](#)
- HighExpressionLevel-class, [11](#)
- LowExpressionLevel-class, [12](#)
- MediumExpressionLevel-class, [13](#)
- plotDiscriminantFuzzyPattern, [14](#)
- plotMembershipFunctions, [15](#)
- readCSV, [16](#)
- rmadataset, [17](#)

setValues,HighExpressionLevel-method  
(HighExpressionLevel-class), [11](#)  
setValues,LowExpressionLevel-method  
(LowExpressionLevel-class), [12](#)  
setValues,MediumExpressionLevel-method  
(MediumExpressionLevel-class),  
[13](#)  
show,ExpressionLevel-method  
(ExpressionLevel-class), [10](#)  
show-methods, [18](#)  
showDiscreteValues, [18](#)  
showFuzzyPatterns, [19](#)