# Package ‘SparseBiplots’

June 28, 2020

<table>
<thead>
<tr>
<th>Type</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title</td>
<td>'HJ-Biplot' using Different Ways of Penalization Plotting with 'ggplot2'</td>
</tr>
<tr>
<td>Version</td>
<td>4.0.0</td>
</tr>
<tr>
<td>Author</td>
<td>Mitzi Isabel Cubilla-Montilla <a href="mailto:mitzi@usal.es">mitzi@usal.es</a>, Carlos Alfredo Torres-Cubilla <a href="mailto:carlos_t22@usal.es">carlos_t22@usal.es</a>, Purificacion Galindo Villardon <a href="mailto:pgalindo@usal.es">pgalindo@usal.es</a> and Ana Belen Nieto-Librero <a href="mailto:ananieto@usal.es">ananieto@usal.es</a></td>
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<tr>
<td>Maintainer</td>
<td>Mitzi Isabel Cubilla-Montilla <a href="mailto:mitzi@usal.es">mitzi@usal.es</a></td>
</tr>
<tr>
<td>Description</td>
<td>'HJ-Biplot' is a multivariate method that allow represent multivariate data on a subspace of low dimension, in such a way that most of the variability of the information is captured in a few dimensions. This package implements three new techniques and constructs in each case the 'HJ-Biplot', adapting restrictions to reduce weights and / or produce zero weights in the dimensions, based on the regularization theories. It implements three methods of regularization: Ridge, LASSO and Elastic Net.</td>
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<tr>
<td>License</td>
<td>GPL (&gt;= 3)</td>
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<td>Encoding</td>
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<tr>
<td>Depends</td>
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<tr>
<td>Imports</td>
<td>ggrepel, gtable, rlang, stats, sparsepca, testthat</td>
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<tr>
<td>URL</td>
<td><a href="https://github.com/mitzicubillamontilla/SparseBiplots">https://github.com/mitzicubillamontilla/SparseBiplots</a></td>
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<tr>
<td>BugReports</td>
<td><a href="https://github.com/mitzicubillamontilla/SparseBiplots/issues">https://github.com/mitzicubillamontilla/SparseBiplots/issues</a></td>
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<td>NeedsCompilation</td>
<td>no</td>
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<td>Repository</td>
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ElasticNet_HJBiplot  Elastic Net HJ Biplot

Description

This function is a generalization of the Ridge regularization method and the LASSO penalty. Realizes the representation of the SPARSE HJ Biplot through a combination of LASSO and Ridge, on the data matrix. This means that with this function you can eliminate weak variables completely as with the LASSO regularization or contract them to zero as in Ridge.

Usage

ElasticNet_HJBiplot(X, Lambda = 1e-04, Alpha = 1e-04, Transform.Data = 'scale')

Arguments

X array_like;
A data frame with the information to be analyzed

Lambda float;
Tuning parameter of the LASSO penalty. Higher values lead to sparser components.

Alpha float;
Tuning parameter of the Ridge shrinkage

Transform.Data character;
A value indicating whether the columns of X (variables) should be centered or scaled. Options are: "center" that removes the columns means and "scale" that removes the columns means and divide by its standard deviation. Default is "scale".

Details

Algorithm used to perform automatic selection of variables and continuous contraction simultaneously. With this method, the model obtained is simpler and more interpretable. It is a particularly useful method when the number of variables is much greater than the number of observations.
ElasticNet_HJBiplot

Value

ElasticNet_HJBiplot returns a list containing the following components:

- **loadings** array_like; penalized loadings, the loadings of the sparse principal components.
- **n_ceros** array_like; number of loadings equal to cero in each component.
- **coord_ind** array_like; matrix with the coordinates of individuals.
- **coord_var** array_like; matrix with the coordinates of variables.
- **eigenvalues** array_like; vector with the eigenvalues penalized.
- **explvar** array_like; an vector containing the proportion of variance explained by the first 1, 2...k sparse principal components obtained.

Author(s)

Mitzi Cubilla-Montilla, Carlos Torres-Cubilla, Ana Belen Nieto Librero and Purificacion Galindo Villardon

References


See Also

- spca, Plot_Biplot

Examples

ElasticNet_HJBiplot(mtcars, Lambda = 0.2, Alpha = 0.1)
Description

This function performs the representation of HJ Biplot (Galindo, 1986).

Usage

HJBiplot (X, Transform.Data = 'scale')

Arguments

X array_like;
A data frame which provides the data to be analyzed. All the variables must be numeric.

Transform.Data character;
A value indicating whether the columns of X (variables) should be centered or scaled. Options are: "center" that removes the columns means and "scale" that removes the columns means and divide by its standard deviation. Default is "scale".

Details

Algorithm used to construct the HJ Biplot. The Biplot is obtained as result of the configuration of markers for individuals and markers for variables in a reference system defined by the factorial axes resulting from the Decomposition in Singular Values (DVS).

Value

HJBiplot returns a list containing the following components:

eigenvalues array_like;
vector with the eigenvalues.

explvar array_like;
an vector containing the proportion of variance explained by the first 1, 2,...k principal components obtained.

loadings array_like;
the loadings of the principal components.

coord_ind array_like;
matrix with the coordinates of individuals.

coord_var array_like;
matrix with the coordinates of variables.
Author(s)
Mitzi Cubilla-Montilla, Carlos Torres-Cubilla, Ana Belen Nieto Librero and Purificacion Galindo Villardon

References

See Also
Plot_Biplot

Examples
HJBiplot(mtcars)

LASSO_HJBiplot

LASSO_HJBiplot

Description
This function performs the representation of the SPARSE HJ Biplot applying the LASSO regularization, on the original data matrix, implementing the norm L1.

Usage
LASSO_HJBiplot(X, Lambda, Transform.Data = 'scale', Operator = 'Hard-Thresholding')

Arguments
- X: array_like; A data frame which provides the data to be analyzed. All the variables must be numeric.
- Lambda: float; Tuning parameter for the LASSO penalty
- Transform.Data: character; A value indicating whether the columns of X (variables) should be centered or scaled. Options are: "center" that removes the columns means and "scale" that removes the columns means and divide by its standard deviation. Default is "scale".
- Operator: character; The operator used to solve the norm L1. Allowed values are "Soft-Thresholding" and "Hard-Thresholding".
Details

Algorithm that performs a procedure of contraction and selection of variables. LASSO imposes
a penalty that causes the charges of some components to be reduced to zero. By producing zero
loadings for some components and not zero for others, the Lasso technique performs selection of
variables. As the value of the penalty approaches one, the loadings approach zero.

Value

LASSO_HJBiplot returns a list containing the following components:

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>loadings</td>
<td>array_like; penalized loadings, the loadings of the sparse principal components.</td>
</tr>
<tr>
<td>n_ceros</td>
<td>array_like; number of loadings equal to cero in each component.</td>
</tr>
<tr>
<td>coord_ind</td>
<td>array_like; matrix with the coordinates of individuals.</td>
</tr>
<tr>
<td>coord_var</td>
<td>array_like; matrix with the coordinates of variables.</td>
</tr>
<tr>
<td>eigenvalues</td>
<td>array_like; vector with the eigenvalues penalized.</td>
</tr>
<tr>
<td>explvar</td>
<td>array_like; an vector containing the proportion of variance explained by the first 1, 2,... k sparse principal components obtained.</td>
</tr>
</tbody>
</table>

Author(s)

Mitzi Cubilla-Montilla, Carlos Torres-Cubilla, Ana Belen Nieto Librero and Purificacion Galindo Villardon

References

• Galindo, M. P. (1986). Una alternativa de representacion simultanea: HJ-Biplot. Questio,
  10(1), 13-23.

• Tibshirani, R. (1996). Regression shrinkage and selection via the lasso. Journal of the Royal


See Also

Plot_Biplot

Examples

LASSO_HJBiplot(mtcars, Lambda = 0.2, Operator = 'Hard-Thresholding')
Plot_Biplot

Plot_Biplot initializes a ggplot2-based visualization of the characteristics presented in the data analyzed by the Biplot selected.

Usage

Plot_Biplot(X, axis = c(1,2), hide = "none",
labels = "auto", ind.shape = 19,
ind.color = "red", ind.size = 2,
ind.label = FALSE, ind.label.size = 4,
var.color = "black", var.size = 0.5,
var.label = TRUE, var.label.size = 4, var.label.angle = FALSE)

Arguments

X
List containing the output of one of the functions of the package.
axis
Vector with length 2 which contains the axis plotted in x and y axis.
hide
Vector specifying the elements to be hidden on the plot. Default value is “none”.
labels
It indicates the label for points. If it is "auto" the labels are the row names of the coordinates of individuals. If it isn’t auto it would be a vector containing the labels.
ind.shape
Points shape. It can be a number to indicate the shape of all the points or a factor to indicate different shapes.
ind.color
Points colors. It can be a character indicating the color of all the points or a factor to use different colors.
ind.size
Size of points.
ind.label
Logical value, if it is TRUE it prints the name for each row of X. If it is FALSE (default) does not print the names.
ind.label.size
Numeric value indicating the size of the labels of points.
var.color
Character indicating the color of the arrows.
var.size
Size of arrow.
var.label
Logical value, if it is TRUE (default) it prints the name for each column of X. If it is FALSE does not print the names.
var.label.size
Numeric value indicating the size of the labels of variables.
var.label.angle
Logical value, if it is TRUE (default) it print the vector names with orientation of the angle of the vector. If it is FALSE the angle of all tags is 0.
Ridge_HJBiplot

Value

Return a ggplot2 object.

Author(s)

Mitzi Cubilla-Montilla, Carlos Torres-Cubilla, Ana Belen Nieto Librero and Purificacion Galindo Villardon

See Also

HJBiplot, Ridge_HJBiplot, ElasticNet_HJBiplot

Examples

hj.biplot <- HJBiplot(mtcars)
Plot_Biplot(hj.biplot, ind.label = TRUE)

Ridge_HJBiplot

Ridge HJ Biplot

Description

This function performs the representation of the HJ Biplot applying the Ridge regularization, on the original data matrix, implementing the norm L2.

Usage

Ridge_HJBiplot (X, Lambda, Transform.Data = 'scale')

Arguments

X array_like;
A data frame which provides the data to be analyzed. All the variables must be numeric.

Lambda float;
Tuning parameter for the Ridge penalty

Transform.Data character;
A value indicating whether the columns of X (variables) should be centered or scaled. Options are: "center" that removes the columns means and "scale" that removes the columns means and divide by its standard deviation. Default is "scale".

Details

Algorithm used to contract the loads of the main components towards zero, but without achieving the nullity of any. If the penalty parameter is less than or equal to 1e-4 the result is like Galindo’s HJ Biplot (1986).
Ridge_HJBiplot returns a list containing the following components:

- **eigenvalues**: array_like; vector with the eigenvalues penalized.
- **explvar**: array_like; a vector containing the proportion of variance explained by the first 1, 2,...,k sparse principal components obtained.
- **loadings**: array_like; penalized loadings, the loadings of the sparse principal components.
- **coord_ind**: array_like; matrix with the coordinates of individuals.
- **coord_var**: array_like; matrix with the coordinates of variables.

**Author(s)**

Mitzi Cubilla-Montilla, Carlos Torres-Cubilla, Ana Belen Nieto Librero and Purificacion Galindo Villardon

**References**


**See Also**

Plot_Biplot

**Examples**

Ridge_HJBiplot(mtcars, Lambda = 0.2)
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