Package 'apca'

May 7, 2026

Type Package

Title Advanced Principal Component Analysis

Version 1.0.0

Date 2026-04-19

Description Provides nine computational algorithms for dimensionality reduction via Principal Component Analysis (PCA), built using an object-oriented (S3) architecture. The package includes classical and modern methods: Singular Value Decomposition (SVD) based on Eckart and Young (1936) <doi:10.1007/BF02288367>, Power Iteration based on Hotelling (1933) <doi:10.1037/h0071325>, QR Algorithm based on Francis (1961) <doi:10.1093/comjnl/4.3.265>, Jacobi Algorithm based on Jacobi (1846) <doi:10.1515/crll.1846.30.51>, Arnoldi Iteration based on Arnoldi (1951) <doi:10.1090/qam/42792>, 'NIPALS' based on Wold (1975) <doi:10.1017/S0021900200047604>, Alternating Least Squares (ALS) based on Kolda and Bader (2009) <doi:10.1137/07070111X>, Probabilistic PCA (PPCA) with EM Algorithm based on Tipping and Bishop (1999) <doi:10.1111/1467-9868.00196>, and Generalized Hebbian Algorithm (GHA) based on Sanger (1989) <doi:10.1016/0893-6080(89)90044-0>.

License MIT + file LICENSE

Encoding UTF-8

Language en-US

RoxygenNote 7.3.3

Imports stats

NeedsCompilation no

Author Angga Dwi Mulyanto [aut, cre] (Institut Teknologi Sepuluh Nopember, Universitas Islam Negeri Maulana Malik Ibrahim Malang), Bambang Widjanarko Otok [aut] (Institut Teknologi Sepuluh Nopember), Jerry Dwi Trijoyo Purnomo [aut] (Institut Teknologi Sepuluh Nopember)

Maintainer Angga Dwi Mulyanto <angga.dwi.m@gmail.com>

Repository CRAN

Date/Publication 2026-04-28 18:40:24 UTC

Contents

---

apca *Advanced Principal Component Analysis (APCA)*

Description

Performs PCA using one of nine different computational algorithms. This is the main wrapper function for the apca package.

Usage

```
apca(data, n_components = 2, method = "svd", center = TRUE, scale = FALSE)
```

Arguments

`data`	A numeric matrix or data frame.
`n_components`	Integer. Number of principal components to extract.
`method`	Character. The algorithm to use: "svd", "power", "qr", "nipals", "jacobi", "arnoldi", "als", "ppca", or "gha".
`center`	Logical. Whether to mean-center the data. Default is TRUE.
`scale`	Logical. Whether to scale variables to unit variance. Default is FALSE.

Value

An object of class "apca" containing scores, loadings, and variance metrics.

Examples

```
# Run PCA using the classical SVD algorithm
data(mtcars)
res_svd <- apca(mtcars, n_components = 2, method = "svd", scale = TRUE)

# Print basic information
print(res_svd)

# ------------------------------------------------------------
# Extracting specific mathematical components
# ------------------------------------------------------------
# 1. Extract the PCA scores (useful for clustering/regression)
my_scores <- res_svd$scores
head(my_scores)
```

```
# 2. Extract the loadings matrix (variable weights)
my_loadings <- res_svd$loadings
print(my_loadings)

# 3. Extract the eigenvalues
my_eigen <- res_svd$eigenvalues
print(my_eigen)

# Run PCA using the NIPALS algorithm
res_nipals <- apca(mtcars, n_components = 2, method = "nipals", scale = TRUE)
```

`plot.apca` *Plot Method for APCA Objects*

Description

Generates a scatter plot of the principal component scores.

Usage

```
## S3 method for class 'apca'
plot(
  x,
  pc_x = 1,
  pc_y = 2,
  col = "steelblue",
  pch = 16,
  cex = 1.2,
  las = 1,
  ...
)
```

Arguments

`x`	An object of class "apca".
`pc_x`	Integer. The principal component to plot on the X-axis (default: 1).
`pc_y`	Integer. The principal component to plot on the Y-axis (default: 2).
`col`	Color of the points (default: "steelblue").
`pch`	Point character (default: 16).
`cex`	Point size (default: 1.2).
`las`	Axis label orientation (default: 1).
`...`	Additional graphical parameters passed to the base plot function.

Value

No return value, called for side effects (plotting).

Examples

```
data(mtcars)
res <- apca(mtcars, n_components = 3, method = "svd", scale = TRUE)

# Plot PC1 vs PC2 (Default)
plot(res)

# Plot PC1 vs PC3 with custom base R graphical parameters
plot(res, pc_x = 1, pc_y = 3, col = "red", pch = 19)
```

`summary.apca` *Summary Method for APCA Objects*

Description

Extracts and calculates cumulative variance metrics from an APCA object.

Usage

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

Arguments

`object`	An object of class "apca".
`...`	Additional arguments affecting the summary produced.

Value

A list of class "summary.apca" containing variance explained, cumulative variance, and other specific algorithm metrics (like noise variance).

Examples

```
data(mtcars)
res <- apca(mtcars, n_components = 3, method = "svd", scale = TRUE)

# Display cumulative variance summary
summary(res)
```

Index