Package: moveEZ (via r-universe)

May 21, 2026

Title Animated Biplots

Version 1.2.0

Description Create animated biplots that enables dynamic visualisation of temporal or sequential changes in multivariate data by animating a single biplot across the levels of a time variable. It builds on objects from the 'biplotEZ' package, Lubbe S, le Roux N, Nienkemper-Swanepoel J, Ganey R, Buys R, Adams Z, Manefeldt P (2024) <doi:10.32614/CRAN.package.biplotEZ>, allowing users to create animated biplots that reveal how both samples and variables evolve over time.

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Encoding UTF-8

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VignetteBuilder knitr

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Contents

`.calibrate.axis` *Calibrate axis*

Description

Calibrate axis

Usage

```
.calibrate.axis(
  j,
  Xhat,
  means,
  sd,
  axes.rows,
  ax.which,
  ax.tickvec,
  ax.orthogxvec,
  ax.orthogyvec
)
```

Arguments

`j`	j
`Xhat`	Xhat
`means`	means
`sd`	sd
`axes.rows`	axes.rows
`ax.which`	ax.which
`ax.tickvec`	ax.tickvec
`ax.orthogxvec`	ax.orthogxvec
`ax.orthogyvec`	ax.orothogyvec

Value

Calibrated axes

Africa_climate *Climate studies example dataset*

Description

Data extracted from ERA5 hourly data on single levels from 1940 to present

Format

A dataset with 960 observations and 9 variables.

Details

Year 8 years from 1950 to 2020

Month 12 calendar months

Region 10 IPCC climate reference regions

AccPrec Accumulated precipitation

DailyEva Daily evaporation

Temp Mean temperature

SoilMois Soil moisture

SPI6 6-month standardised precipitation index

wind Windspeed

Source

DOI: 10.24381/cds.adbb2d47 (Accessed on 11-02-2025)

Africa_climate_target *Climate studies target example dataset*

Description

Data extracted from ERA5 hourly data on single levels for 1989

Format

A dataset with 120 observations and 9 variables.

Details

Year 8 years from 1950 to 2020

Month 12 calendar months

Region 10 IPCC climate reference regions

AccPrec Accumulated precipitation

DailyEva Daily evaporation

Temp Mean temperature

SoilMois Soil moisture

SPI6 6-month standardised precipitation index

wind Windspeed

Source

DOI: 10.24381/cds.adbb2d47 (Accessed on 11-02-2025)

`axes_moveEZ` *Provide axes coordinates*

Description

Provide axes coordinates

Usage

```
axes_moveEZ(bp, which.var)
```

Arguments

`bp`	Object
`which.var`	which variable(s) to find coordinates

Value

Axes coordinates

`evaluation` *Measures of comparison for move plot 3*

Description

This function calculates measures of comparison after generalised orthogonal Procrustes Analysis is performed in `moveplot3`. Orthogonal Procrustes Analysis is used to compare a target to a testee configuration. The following measures are calculate: Procrustes Statistic (PS), Congruence Coefficient (CC), Absolute Mean Bias (AMB), Mean Bias (MB) and Root Mean Squared Bias (RMSB).

Usage

```
evaluation(bp, centring = TRUE)
```

Arguments

`bp`	biplot object from `moveEZ`
`centring`	logical argument to apply centring or not (default is `TRUE`)

Value

`eval.tab`	Returns a table of the measures of comparison for each level of the time variable compared to the target.
`fit.plot`	Returns a line plot with the fit measures that are bounded between zero and one: PS and CC. A small PS value and large CC value indicate good fit.
`bias.plot`	Returns a line plot with bias measures that are unbounded: AMB, MB and RMSB. Small values indicate low bias.

Examples

```
data(Africa_climate)
data(Africa_climate_target)
bp <- biplotEZ::biplot(Africa_climate, scaled = TRUE) |> biplotEZ::PCA()
results <- bp |> moveplot3(time.var = "Year", group.var = "Region", hulls = TRUE,
move = FALSE, target = NULL) |> evaluation()
results$eval.tab
results$fit.plot
results$bias.plot

data(Africa_climate)
data(Africa_climate_target)
bp <- biplotEZ::biplot(Africa_climate, scaled = TRUE) |> biplotEZ::PCA()
results <- bp |> moveplot3(time.var = "Year", group.var = "Region", hulls = TRUE,
move = FALSE, target = Africa_climate_target) |> evaluation()
results$eval.tab
results$fit.plot
results$bias.plot
```

`moveplot` *Move plot*

Description

Create animated biplot on samples in a biplot

Create animated biplot on samples in a biplot

Usage

```
moveplot(
  bp,
  time.var,
  group.var,
  move = TRUE,
  hulls = TRUE,
  scale.var = 5,
  shadow = FALSE
)

moveplot(
  bp,
  time.var,
  group.var,
  move = TRUE,
  hulls = TRUE,
  scale.var = 5,
  shadow = FALSE
)
```

Arguments

`bp`	biplot object from biplotEZ
`time.var`	time variable
`group.var`	group variable
`move`	whether to animate (TRUE) or facet (FALSE) samples, according to time.var
`hulls`	whether to display sample points or convex hulls
`scale.var`	scaling the vectors representing the variables
`shadow`	whether the animation will keep past states (only when hulls = FALSE)

Value

`bp`	Returns the elements of the biplot object `bp` from `biplotEZ`.
`plot`	An animated or a facet of biplots based on the dynamic frame.
`bp`	Returns the elements of the biplot object `bp` from `biplotEZ`.
`plot`	An animated or a facet of biplots based on the dynamic frame.

Examples

```
data(Africa_climate)
bp <- biplot(Africa_climate, scaled = TRUE) |> PCA()

# Convex hulls facet plot
bp |> moveplot(time.var = "Year", group.var = "Region", hulls = TRUE, move = FALSE)

# Samples facet plot
bp |> moveplot(time.var = "Year", group.var = "Region", hulls = FALSE, move = FALSE)

# Specifying colours with colour palette in biplotEZ
bp <- biplot(Africa_climate, scaled = TRUE, group.aes = Africa_climate$Region) |>
PCA() |> samples(col = RColorBrewer::brewer.pal(10, "Paired"))
bp |> moveplot(time.var = "Year", group.var = "Region", hulls = TRUE, move = FALSE)

# Specifying plotting characters for grouping variable in biplotEZ
bp <- biplot(Africa_climate, scaled = TRUE, group.aes = Africa_climate$Region) |>
PCA() |> samples(pch = c(19, 21, 3))
bp |> moveplot(time.var = "Year", group.var = "Region", hulls = FALSE, move = FALSE)

# Specifying opacity of plotting characters and size of variable lables
bp <- biplot(Africa_climate, scaled = TRUE, group.aes = Africa_climate$Region) |>
PCA() |> samples(opacity = 0.4) |> axes(label.cex = 1.2)
bp |> moveplot(time.var = "Year", group.var = "Region", hulls = FALSE, move = FALSE)

# Specifying colours manually in biplotEZ
bp <- biplot(Africa_climate, scaled = TRUE, group.aes = Africa_climate$Region) |>
PCA() |> samples(col = c("firebrick4", "indianred3", "tomato", "sandybrown",
 "khaki1", "palegreen1", "darkseagreen2", "mediumaquamarine", "deepskyblue4", "mediumpurple4"))
bp |> moveplot(time.var = "Year", group.var = "Region", hulls = TRUE, move = FALSE)

# Convex hulls move plot

if(interactive()) {
bp |> moveplot(time.var = "Year", group.var = "Region", hulls = TRUE, move = TRUE)}

# Samples move plot with shadows

if(interactive()) {
bp |> moveplot(time.var = "Year", group.var = "Region", hulls = FALSE, move = TRUE, shadow = TRUE)}
data(Africa_climate)
bp <- biplot(Africa_climate, scaled = TRUE) |> PCA()

# Convex hulls facet plot
bp |> moveplot(time.var = "Year", group.var = "Region", hulls = TRUE, move = FALSE)

# Samples facet plot
bp |> moveplot(time.var = "Year", group.var = "Region", hulls = FALSE, move = FALSE)

# Specifying colours with colour palette in biplotEZ
bp <- biplot(Africa_climate, scaled = TRUE, group.aes = Africa_climate$Region) |>
PCA() |> samples(col = RColorBrewer::brewer.pal(10, "Paired"))
```

```
bp |> moveplot(time.var = "Year", group.var = "Region", hulls = TRUE, move = FALSE)

# Specifying plotting characters for grouping variable in biplotEZ
bp <- biplot(Africa_climate, scaled = TRUE, group.aes = Africa_climate$Region) |>
PCA() |> samples(pch = c(19, 21, 3))
bp |> moveplot(time.var = "Year", group.var = "Region", hulls = FALSE, move = FALSE)

# Specifying opacity of plotting characters and size of variable lables
bp <- biplot(Africa_climate, scaled = TRUE, group.aes = Africa_climate$Region) |>
PCA() |> samples(opacity = 0.4) |> axes(label.cex = 1.2)
bp |> moveplot(time.var = "Year", group.var = "Region", hulls = FALSE, move = FALSE)

# Specifying colours manually in biplotEZ
bp <- biplot(Africa_climate, scaled = TRUE, group.aes = Africa_climate$Region) |>
PCA() |> samples(col = c("firebrick4", "indianred3", "tomato", "sandybrown",
 "khaki1", "palegreen1", "darkseagreen2", "mediumaquamarine", "deepskyblue4", "mediumpurple4"))
bp |> moveplot(time.var = "Year", group.var = "Region", hulls = TRUE, move = FALSE)

# Extracting measures of fit of PCA
bp <- biplot(Africa_climate, scaled = TRUE) |> PCA() |> fit.measures()
bp <- bp |> moveplot(time.var = "Year", group.var = "Region", hulls = TRUE, move = FALSE)
bp$quality
bp$axis.predictivity

# Convex hulls move plot

if(interactive()) {
bp |> moveplot(time.var = "Year", group.var = "Region", hulls = TRUE, move = TRUE)}

# Samples move plot with shadows

if(interactive()) {
bp |> moveplot(time.var = "Year", group.var = "Region", hulls = FALSE, move = TRUE, shadow = TRUE)}

# CVA biplot
bp <- biplot(Africa_climate, scaled = TRUE) |> CVA(class = Africa_climate$Region)
bp |> moveplot2(group.var = "Region", time.var = "Year", move = FALSE)

# Extracting measures of fit of CVA
bp <- biplot(Africa_climate, scaled = TRUE) |> CVA(classes = Africa_climate$Region) |> fit.measures()
bp <- bp |> moveplot(time.var = "Year", group.var = "Region", hulls = TRUE, move = FALSE)
bp$quality
bp$axis.predictivity
bp$within.class.axis.predictivity
bp$within.class.sample.predictivity
```

`moveplot2` *Move plot 2*

Description

Create animated biplot on samples and variables in a biplot

Create animated biplot on samples and variables in a biplot

Usage

```
moveplot2(
  bp,
  time.var,
  group.var,
  move = TRUE,
  hulls = TRUE,
  scale.var = 5,
  align.time = NA,
  reflect = NA
)

moveplot2(
  bp,
  time.var,
  group.var,
  move = TRUE,
  hulls = TRUE,
  scale.var = 5,
  align.time = NA,
  reflect = NA
)
```

Arguments

bp	biplot object from biplotEZ
time.var	time variable
group.var	group variable
move	whether to animate (TRUE) or facet (FALSE) samples and variables, according to time.var
hulls	whether to display sample points or convex hulls
scale.var	scaling the vectors representing the variables
align.time	a vector specifying the levels of time.var for which the biplots should be aligned. Only biplots corresponding to these time points will be used to compute the alignment transformation.
reflect	a character vector specifying the axis of reflection to apply at each corresponding time point in align.time. One of FALSE (default), "x" for reflection about the x-axis, "y" for reflection about the y-axis and "xy" for reflection about both axes.

Value

bp	Returns the elements of the biplot object bp from biplotEZ.
plot	An animated or a facet of biplots based on the dynamic frame.
bp	Returns the elements of the biplot object bp from biplotEZ.
plot	An animated or a facet of biplots based on the dynamic frame.

Examples

```
data(Africa_climate)
bp <- biplot(Africa_climate, scaled = TRUE) |> PCA()

if(interactive()) {
bp |> moveplot2(time.var = "Year", group.var = "Region", hulls = TRUE, move = TRUE)}
data(Africa_climate)
bp <- biplot(Africa_climate, scaled = TRUE) |> PCA()

if(interactive()) {
bp <- bp |> moveplot2(time.var = "Year", group.var = "Region", hulls = TRUE, move = TRUE)}

# Extracting measures of fit for PCA
bp <- bp |> moveplot2(time.var = "Year", group.var = "Region", hulls = TRUE, move = FALSE)
bp$quality
bp$axis.predictivity

# Extracting measures of fit for CVA
bp <- biplot(Africa_climate) |> CVA(classes = Africa_climate$Region)
bp <- bp |> moveplot2(time.var = "Year", group.var = "Region", hulls = TRUE, move = FALSE)
bp$quality
bp$axis.predictivity
bp$within.class.axis.predictivity
bp$within.class.sample.predictivity
```

---

moveplot3 *Move plot 3*

Description

Create animated biplot on samples and variables in a biplot with a given target

Create animated biplot on samples and variables in a biplot with a given target

Usage

```
moveplot3(
  bp,
  time.var,
  group.var,
  move = TRUE,
```

```
  hulls = TRUE,
  scale.var = 5,
  target = NULL
)

moveplot3(
  bp,
  time.var,
  group.var,
  move = TRUE,
  hulls = TRUE,
  scale.var = 5,
  target = NULL
)
```

Arguments

bp	biplot object from biplotEZ
time.var	time variable
group.var	group variable
move	whether to animate (TRUE) or facet (FALSE) samples and variables, according to time.var
hulls	whether to display sample points or convex hulls
scale.var	scaling the vectors representing the variables
target	Target data set to which all biplots should be matched consisting of the the same dimensions. If not specified, the centroid of all available biplot sample coordinates from time.var will be used. Default NULL.

Value

bp	Returns the elements of the biplot object bp from biplotEZ.
iter_levels	The levels of the time variable.
coord_set	The coordinates of the configurations before applying Generalised Orthogonal Procrustes Analysis.
GPA_list	The coordinates of the configurations after applying Generalised Orthogonal Procrustes Analysis.
plot	An animated or a facet of biplots based on the dynamic frame.
bp	Returns the elements of the biplot object bp from biplotEZ.
iter_levels	The levels of the time variable.
coord_set	The coordinates of the configurations before applying Generalised Orthogonal Procrustes Analysis.
GPA_list	The coordinates of the configurations after applying Generalised Orthogonal Procrustes Analysis.
plot	An animated or a facet of biplots based on the dynamic frame.

Examples

```
data(Africa_climate)
data(Africa_climate_target)
bp <- biplot(Africa_climate, scaled = TRUE) |> PCA()
bp |> moveplot3(time.var = "Year", group.var = "Region", hulls = TRUE,
move = FALSE, target = NULL)

if(interactive()) {
bp |> moveplot3(time.var = "Year", group.var = "Region", hulls = TRUE,
move = TRUE, target = NULL)}
bp |> moveplot3(time.var = "Year", group.var = "Region", hulls = TRUE,
move = FALSE, target = Africa_climate_target)
data(Africa_climate)
data(Africa_climate_target)
bp <- biplot(Africa_climate, scaled = TRUE) |> PCA()
bp |> moveplot3(time.var = "Year", group.var = "Region", hulls = TRUE,
move = FALSE, target = NULL)

if(interactive()) {
bp |> moveplot3(time.var = "Year", group.var = "Region", hulls = TRUE,
move = TRUE, target = NULL)}
bp |> moveplot3(time.var = "Year", group.var = "Region", hulls = TRUE,
move = FALSE, target = Africa_climate_target)
```

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