Package 'Dcurvature'

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Type Package

Title Discrete Curvature with 'shiny' Explorer

Version 0.0.3

Description Implements discrete curvature estimation for ordered planar point sequences using circumcenter geometry on consecutive triplets, exposed through compiled C plus plus (C++) code via 'Rcpp' for speed and numerical robustness. The package is useful for objective elbow detection in multivariate workflows, especially principal component analysis (PCA), where selecting the number of retained components can be subjective. It provides a 'shiny' interface that supports upload of raw datasets or explained-variance tables, computes Kaiser-Meyer-Olkin (KMO) sampling-adequacy diagnostics, evaluates individual and cumulative variance curves, and reports curvature-based decision rules (m* and m**) with visual summaries for reproducible component-selection decisions.
References: Arney et al. (2001); Axler (2024) <doi:10.1007/978-3-031-41026-0>; Bjorklund (2019) <doi:10.1111/evo.13835>; Burden and Faires (2015); Chang et al. (2023) <https://CRAN.R-project.org/package=shiny>; Christensen (2019); Cui (2020) <doi:10.18637/jss.v040.i08>; Eddelbuettel and Sanderson (2014) <doi:10.1016/j.csda.2013.02.005>; Engelke et al. (2023) <doi:10.1016/j.jseint.2023.04.010>; Gniazdowski (2021) <doi:10.26348/znwwsi.24.35>; Haynes et al. (2017); Jameel and Al-Salami (2023) <doi:10.24086/cuejhss.v7n1y2023.pp121-125>; Jolliffe (2002); Jolliffe and Cadima (2016) <doi:10.1098/rsta.2015.0202>; Kaiser (1974); Lehnert et al. (2019) <doi:10.18637/jss.v089.i12>; Ma and Dai (2011) <doi:10.1093/bib/bbq090>; Milligan (1995); Onumanyi et al. (2022) <doi:10.3390/app12157515>; Park (2010); Revelle (2024) <https://CRAN.R-project.org/package=psych>; Rodionova et al. (2021) <doi:10.1016/j.chemolab.2021.104304>; Sen and Cohen (2025) <doi:10.1177/01466216251344288>; Serneels and Verdonck (2008) <doi:10.1016/j.csda.2007.05.024>; Shi et al. (2021) <doi:10.1186/s13638-021-01910-w>; Shaukat et al. (2016) <doi:10.1515/eko-2016-0014>; Syakur et al. (2018) <doi:10.1088/1757-899X/336/1/012017>; Wickham and Bryan (2023) <https://CRAN.R-project.org/package=readxl>; Wu et al. (2017)

<doi:10.1088/1755-1315/61/1/012054>; Youssef et al. (2023)
<doi:10.21303/2461-4262.2023.002582>.

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Imports Rcpp, shiny, readxl

Suggests ggplot2, psych, testthat (>= 3.0.0)

LinkingTo Rcpp

Config/testthat/edition 3

RoxygenNote 7.3.2

NeedsCompilation yes

Author Aquiles Darghan [aut],
Jorge Jola [aut, cre]

Maintainer Jorge Jola <jjolaher@purdue.edu>

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Contents

`curvature` *Discrete Curvature for an Ordered 2D Curve*

Description

Compute pointwise discrete curvature from an ordered sequence of 2D points using circumcenter-based geometry on consecutive triplets.

Usage

```
curvature(data)
```

Arguments

`data`	A numeric matrix/data frame with at least two columns representing ordered `x` and `y` coordinates. Additional columns are ignored.

Value

A numeric vector of curvature values with one value per input row. Boundary points are set to 0.

Examples

```
pts <- cbind(
  x = seq(0, 1, length.out = 8),
  y = sin(seq(0, pi, length.out = 8))
)
curvature(pts)
```

`load_example_data` *Load the bundled example data as a data frame*

Description

Reads 'data.xlsx' from the package via `read_excel`.

Usage

```
load_example_data(sheet = NULL, ...)
```

Arguments

`sheet`	Sheet to read; passed to `read_excel`. Default is the first sheet.
`...`	Optional arguments passed to `read_excel`.

Value

A data frame.

Examples

```
x <- load_example_data()
head(x)
```

`run_curvature_app` *Run the curvature Shiny app*

Description

Launches the discrete-curvature criterion app. You can start from an explained-variance table (upload CSV/Excel or use the bundled example), or from raw variables (Excel, then PCA). Elbow detection uses `curvature` on the variance curves, with optional KMO in PCA mode.

Usage

```
run_curvature_app(..., .runApp = shiny::runApp)
```

Arguments

`...`	Optional arguments passed to `runApp` (e.g. `port`, `launch.browser`, `host`).
`.runApp`	Internal app runner used for testing. Defaults to `runApp`.

Value

Invisibly returns the result of `shiny::runApp`. Called for its side effect of starting a Shiny app.

Examples

```
if (interactive()) {
  run_curvature_app()
}
```

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