Package ‘TrackMateR’

July 23, 2022

Type Package

Title Working with TrackMate outputs in R

Version 0.1.0

Author Stephen Royle

Maintainer quantixed <admin@quantixed.org>

Description TrackMate, a plugin for ImageJ/Fiji, is a popular single-particle tracking solution.
Building on the trackR package by Julien Godet, the aim is to import Track-
Mate data into R for further analysis and visualization.

License MIT + file LICENSE

Encoding UTF-8

LazyData true

RoxygenNote 7.2.0

Depends R (>= 2.10)

Imports XML,
doParallel,
foreach,
ggplot2,
dplyr,
patchwork,
zoo

R topics documented:

`calculateAlpha` *Calculate alpha (relationship between MSD and normal diffusion)*

Description

Normal diffusion is alpha = 1. Subdiffusion is alpha < 1 and superdiffusion is alpha > 1. Input is a data matrix of msd curves. Output is mean of log2(alpha), one value for each trace.

Usage

```
calculateAlpha(alphaMat, tstep)
```

Arguments

`alphaMat` matrix of msd curves, each col is a track, each row is time lag (will contain NAs)

`tstep` variable. Time step in seconds

Value

numeric vector

`calculateMSD` *Calculate Mean Squared Displacement (MSD)*

Description

Calculation of the MSD of multiple tracks. There are two methods for everaging MSD data from multiple tracks: ensemble = for each time lag average all squared displacements from all tracks time-averaged = find MSD for each track and then generate the average MSD from these curves The MSD curves will be identical if all tracks are the same length, and diverge if not. Standard deviation will be large for ensemble and smaller for time-averaged data. Input is a data frame of tracks imported using readTrackMateXML()

Usage

```
calculateMSD(df, method = "timeaveraged", N = 4, short = 0)
```

Arguments

`df` data frame must include at a minimum - trace (track ID), x, y and t (in real coords)

`method` string. Either "ensemble" or "timeaveraged" (default)

`N` numeric variable for MSD. dt should be up to 1/N of number of data points (4 recommended)

`short` numeric variable for the shortest number of points we will analyse. Note, this uses the number of frames from start, not number of points in track, i.e. a track with <short points and many gaps will remain

Value

list of a data frame and a vector

Examples

```
xmlPath <- "~/Desktop/FakeTracks.xml"
datalist <- readTrackMateXML(XMLpath = xmlPath)
data <-  datalist[[1]]
data <- correctTrackMateData(data, xy = 0.04)
msdobj <- calculateMSD(data, method = "ensemble", N = 3, short = 8)
```

`correctTrackMateData` *Correct distance and time of imported TrackMate data.*

Description

If the TrackMate data is in pixels and/or frames, the data frame can be converted with this function.

Usage

```
correctTrackMateData(df, xyscalar = 1, tscalar = 1)
```

Arguments

`df`	data frame of imported track mate data
`xyscalar`	numeric multiplier to correct pixel size of original movie. Assumes isotropic scaling, i.e. pixel height = pixel width
`tscalar`	numeric multiplier to correct frame interval of original movie. Frame interval of tracked data.

Value

data frame

Examples

```
xmlPath <- "~/Desktop/FakeTracks.xml"
datalist <- readTrackMateXML(XMLpath = xmlPath)
data <-  datalist[[1]]
# in the case where pixel size is 0.03 um and original data is 1 pixel, xyscalar = 0.03
data <- correctTrackMateData(df = data, xyscalar = 0.03)
```

makeReport *Make Report*

Description

Generate several plots to visualise TrackMate data and generate a report. Note that the units are hard-coded as um and s. The use of um is because ggsave does not currently save unicode to PDF reliably.

Usage

```
makeReport(df, msdlist, units = c("um", "s"), titleStr = "", subStr = "")
```

Arguments

`df`	imported TrackMate data with correct units
`msdlist`	MSD summary and alpha list = output from calculateMSD()
`units`	character vector to describe units (defaults are um, micrometres and s, seconds)
`titleStr`	string used as the title for the report
`subStr`	string used as the subtitle for the report

Value

patchwork ggplot

Examples

```
xmlPath <- "~/Desktop/FakeTracks.xml"
data <- readTrackMateXML(XMLpath = xmlPath)
datalist <- readTrackMateXML(XMLpath = xmlPath)
data <-  datalist[[1]]
msdobj <- calculateMSD(df = data, method = "ensemble", N = 3, short = 8)
fileName <- tools::file_path_sans_ext(basename(xmlPath))
makeReport(df = data, msdlist = msdobj, titleStr = "Report", subStr = fileName)
```

makeSummary *Make Summary*

Description

Generate several plots to visualise TrackMate data and generate a report. Note that the units are hard-coded as um and s. The use of um is because ggsave does not currently save unicode to PDF reliably.

Usage

```
makeSummary(
  df,
  msddf,
  units = c("um", "s"),
  titleStr = "Summary",
  subStr = NULL
)
```

Arguments

`df`	imported TrackMate data with correct units
`msddf`	MSD summary = output from calculateMSD()
`units`	character vector to describe units (defaults are um, micrometres and s, seconds)
`titleStr`	string used as the title for the summary
`subStr`	string used as the subtitle for the summary

Value

patchwork ggplot

`plotMSD` *Make a plot of MSD data*

Description

Generate a plot of MSD over a series of increasing time lags. Input is the output from CalculateMSD(), so the plot will display the ensemble or time-averaged MSD (whatever was requested) A fit to the first four points is displayed to evaluate alpha. Diffusion coefficient from this fit is displayed top-left.

Usage

```
plotMSD(df, units = c("um", "s"), bars = FALSE, xlog = FALSE, ylog = FALSE)
```

Arguments

`df`	MSD summary = output from calculateMSD()
`units`	character vector to describe units (defaults are um, micrometres and s, seconds)
`bars`	boolean to request error bars (1 x SD)
`xlog`	boolean to request log10 x axis
`ylog`	boolean to request log10 y axis

Value

S3 ggplot

Examples

```
xmlPath <- "~/Desktop/FakeTracks.xml"
datalist <- readTrackMateXML(XMLpath = xmlPath)
data <-  datalist[[1]]
# use the ensemble method and only look at tracks with more than 8 points
msdobj <- calculateMSD(df = data, method = "ensemble", N = 3, short = 8)
msddf <- msdobj[[1]]
plotMSD(msddf, bars = FALSE)
```

plotNMSD *Plot several (n) MSD curves*

Description

Generate a plot of several MSD curves together with a summary curve.

Usage

```
plotNMSD(df)
```

Arguments

df	dataframe of MSD summary data from multiple datasets (labelled by dataid)

Value

ggplot

readTrackMateXML *Read TrackMate XML output files.*

Description

Produces a data frame of all spots from filtered tracks, ordered by track number. A warning is generated if the scaling is in pixels rather than real units.

Usage

```
readTrackMateXML(XMLpath)
```

Arguments

XMLpath	path to the xml file

Value

list of two data frames

Examples

```
xmlPath <- "~/Desktop/FakeTracks.xml"
datalist <- readTrackMateXML(XMLpath = xmlPath)
# get the track data in a data frame
data <-  datalist[[1]]
# get the calibration data in a data frame
calibration <- datalist[[2]]
```

Index