

# Package ‘TrackMateR’

July 21, 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 TrackMate 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 . . . . .	2
calculateMSD . . . . .	2
correctTrackMateData . . . . .	3
makeReport . . . . .	4
makeSummary . . . . .	4
plotMSD . . . . .	5
plotNMSD . . . . .	6
readTrackMateXML . . . . .	6

<b>Index</b>	<b>7</b>
--------------	----------

---

calculateAlpha	<i>Calculate alpha (relationship between MSD and normal diffusion)</i>
----------------	--

---

### Description

Normal diffusion is  $\alpha = 1$ . Subdiffusion is  $\alpha < 1$  and superdiffusion is  $\alpha > 1$ .

### 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	<i>Calculate Mean Squared Displacement (MSD)</i>
--------------	--

---

### Description

Calculation of the MSD of multiple tracks. There are two methods for averaging 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"
data <- readTrackMateXML(XMLpath = xmlPath)
data <- correctTrackMateData(data, xy = 0.04)
msdDF <- 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, xysize = 1, tsize = 1)
```

**Arguments**

df	data frame of imported track mate data
xysize	pixel size of original movie. Assumes isotropic scaling, i.e. pixel height = pixel width
tsize	time. Frame interval of tracked data.

**Value**

data frame

**Examples**

```
xmlPath <- "~/Desktop/FakeTracks.xml"
data <- readTrackMateXML(XMLpath = xmlPath)
data <- correctTrackMateData(data, xy = 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, titleStr, subStr)
```

### Arguments

df	imported TrackMate data with correct units
msdlist	MSD summary and alpha list = output from calculateMSD()
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)
data <- correctTrackMateData(data, xy = 0.04)
result <- calculateMSD(data, method = "ensemble", N = 3, short = 8)
fileName <- tools::file_path_sans_ext(basename(xmlPath))
makeReport(data, result, "", 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, titleStr, subStr)
```

**Arguments**

df	imported TrackMate data with correct units
msddf	MSD summary = output from calculateMSD()
titleStr	string used as the title for the summary
subStr	string used as the subtitle for the summary

**Value**

patchwork ggplot

---

plotMSD	<i>Make a plot of MSD data</i>
---------	--------------------------------

---

**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 = "s", bars = FALSE, xlog = FALSE, ylog = FALSE)
```

**Arguments**

df	MSD summary = output from calculateMSD()
units	string to describe time units (default is 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"
data <- readTrackMateXML(XMLpath = xmlPath)
data <- correctTrackMateData(data, xy = 0.04)
msdobj <- calculateMSD(data, method = "ensemble", N = 3, short = 8)
msddf <- msdobj[[1]]
plotMSD(msddf, bars = FALSE)
```

---

plotNMSD	<i>Plot several (n) MSD curves</i>
----------	------------------------------------

---

**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	<i>Read TrackMate XML output files.</i>
------------------	---

---

**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**

data frame

**Examples**

```
xmlPath <- "~/Desktop/FakeTracks.xml"
data <- readTrackMateXML(XMLpath = xmlPath)
```

# Index

calculateAlpha, [2](#)  
calculateMSD, [2](#)  
correctTrackMateData, [3](#)  
  
makeReport, [4](#)  
makeSummary, [4](#)  
  
plotMSD, [5](#)  
plotNMSD, [6](#)  
  
readTrackMateXML, [6](#)