Package ‘traipse’

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Title Shared Tools for Tracking Data

Version 0.3.0

Description A collection of commonly used tools for animal movement and other tracking data. Variously distance, angle, bearing, distance-to, bearing-to and speed are provided for geographic data that can be used directly or within 'tidyverse' syntax. Distances and bearings are calculated using modern geodesic methods as provided by Charles F. F. Karney (2013) <doi:10.1007/s00190-012-0578-z> via the 'geodist' and 'geosphere' packages.

License GPL-3

Encoding UTF-8

LazyData true

RoxygenNote 7.2.1

Depends R (>= 2.10)

Imports magrittr, geodist, geosphere, stats

URL https://github.com/Trackage/traipse

BugReports https://github.com/Trackage/traipse/issues

Suggests covr, testthat (>= 2.1.0), dplyr, tibble, tidyr, spelling

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track_angle

**Description**

Calculate internal track angle on longitude, latitude input vectors. The unit of angle is degrees.

**Usage**

```
track_angle(x, y)
```

**Arguments**

- `x`: longitude
- `y`: latitude

**Details**

By convention the first and last values are set to NA missing value, because the angle applies to the location between each previous and next location.

To use this on multiple track ids, use a grouped data frame with tidyverse code like: `data %>% group_by(id) %>% mutate(angle = track_angle(lon, lat))`.

The maximum possible value is 180 and the minimum is 0.

**Value**

A numeric vector of the relative internal angle between sequential locations in degrees, see Details.

**Examples**

```
track_angle(trips0$x, trips0$y)[1:10]
```

# maximum value
```
track_angle(c(0, 0, 0), c(0, 1, 2))
```

# minimum value
```
track_angle(c(0, 0, 0), c(0, 1, 0))
```
track_bearing

Description
Calculate sequential bearing on longitude, latitude input vectors. The unit of bearing is degrees.

Usage
track_bearing(x, y)

Arguments
x longitude
y latitude

Details
By convention the last value is set to NA missing value, because the bearing applies to the segment extending from the current location.
To use this on multiple track ids, use a grouped data frame with tidyverse code like data %>% group_by(id) %>% mutate(turn = track_bearing(lon, lat)).
Absolute bearing is relative to North (0), and proceeds clockwise positive and anti-clockwise negative N = 0, E = 90, S = +/-180, W = -90.
The last value will be NA as the bearing is relative to the first point of each segment.

Value
a numeric vector of absolute bearing in degrees, see Details

Examples
track_bearing(trips0$x, trips0$y)[1:10]

---

track_bearing_to

Description
Calculate geodesic bearing to a location or locations based on longitude, latitude (from) input vectors and longitude, latitude (to) input vectors. The unit of bearing is degrees. The to values may be a single value or individual to each from location.
track_distance

Description

Calculate geodesic distance on longitude, latitude input vectors. The unit of distance is metres.

Usage

track_distance(x, y)
Track distance to location/s

Description
Calculate geodesic distance to a location or locations based on longitude, latitude (from) input vectors and longitude, latitude (to) input vectors. The unit of distance is metres. The to values may be a single value or individual to each from location.

Usage
track_distance_to(x, y, to_x, to_y)

Arguments
- x: longitude
- y: latitude
- to_x: longitude vector of to location/s
- to_y: latitude vector of to locations/s

Details
No missing values are required as padding, but input data with NAs will incur an NA in the output.
To use this on multiple track ids, use a grouped data frame with tidyverse code like data %>% group_by(id) %>% mutate(distance = track_distance_to(lon, lat))
**track_grid**

**Value**

a numeric vector of distance-to values in metres

**Examples**

```r
track_distance_to(trips0$x, trips0$y, to_x = 147, to_y = -42)[1:10]
```

---

**Description**

Computes the cell a track location point falls in on a grid.

**Usage**

```r
track_grid(x, y, dimension, extent = NULL)
```

**Arguments**

- **x**: longitude or x
- **y**: latitude or y
- **dimension**: grid size 'nx', 'ny' 2 element vector (ncol, nrow)
- **extent**: grid extent, if not supplied we use the range of the data input

**Details**

A grid is defined by a 'dimension' ('ncol', 'nrow') and 'extent' ('xmin', 'xmax', 'ymin', 'ymax'). The cell index returned is in 'raster order', this is by top row, left to right and down as per 'rasterImage'. This is aligned with usage in the Github organization 'hypoidey' packages 'vaster' and 'ximage', and is how other raster packages work.

This function doesn't care if the x,y input values are longitude latitude or x, y and it makes no difference at all. No account of movement between points is made.

**Value**

cell index of each input point in the grid specification

**Examples**

```r
dimension <- c(50, 35)
extent <- c(range(trips0$x), range(trips0$y))
cells <- track_grid(trips0$x, trips0$y, dimension = dimension, extent = extent)
plot(extent[1:2], extent[3:4], asp = 1, type = "n")
tab <- tabulate(cells, nbin = prod(dimension))
rasterImage(matrix(1 - (tab/max(tab)), dimension[2L], byrow = FALSE),
extent[1L], extent[3L], extent[2L], extent[4L], interpolate = FALSE)
points(trips0$x, trips0$y, pch = ".", col = "firebrick")
```
track_intermediate

Track intermediate points

Description

Calculate great circle intermediate points on longitude, latitude input vectors. A spherical model is used, from the geosphere package.

Usage

track_intermediate(x, y, date = NULL, distance = NULL, duration = NULL)

Arguments

x  longitude
y  latitude
date  optional input date-time in POSIXct
distance  optional minimum distance (metres) between interpolated points
duration  optional minimum duration (seconds) between interpolated point, if set then distance must be NULL and date must be input

Details

This function returns a list of data frames, with a data frame of interpolated locations for every interval between input locations. There is a final empty data frame to ensure the list is the same length as the inputs. See embedded usage of the tidyr function 'unnest()' for ease of use.

To use on multiple track ids, use a grouped data frame with tidyverse code like

inter <- data %>% group_by(id) %>% mutate(inter = track_intermediate(lon, lat, date = , distance = ))

Then, un-nest this result for further use (the 'inter' above retains the information about the parent locations for custom usage if needed), so the final location of each group has invalid intermediates:

dd <- inter %>% slice(-1) %>% unnest()

Value

a list of data frames of intermediate points (for use with unnest() from tidyr)

Examples

track_intermediate(trips0$x[1:10], trips0$y[1:10], distance = 15000)

track_intermediate(trips0$x[1:10], trips0$y[1:10], date = trips0$date, distance = 1500)

inter_time <- track_intermediate(trips0$x[1:10], trips0$y[1:10],
  date = trips0$date, duration = 1800)
track_query

Query track data for arbitrary locations

Description

Latent positions may be queried using arbitrary date-time values. The only method (for now) is 'linear', but default should be 'geodesic'. In time we include more methods to match the GeoPandas implementation.

Usage

track_query(x, y, date = NULL, query, type = "linear")

Arguments

x  longitude
y  latitude
date  date-time in POSIXct (or can be ignore, for relative index-time)
query  required argument, date-time values to return inferred x, y positions for
type  linear, geodesic, rhumb, forward, backward, nearest (also need open/closed intervals)

Details

If date is not included, time itself is treated as the obvious index on n-locations so simple relative time, and query is expected to match this.

We use group_modify to keep the id groups: trips0 %>% group_by(id) %>% group_modify(~track_query(.x$x, .x$y, query = c(4.5, 6.7)))

Value

data frame of 'x,y,date' of inferred positions

Examples

track_query(trips0$x[1:10], trips0$y[1:10], query = c(4.5, 5.5, 6.5))
track_query(trips0$x[1:10], trips0$y[1:10], trips0$date[1:10], query = trips0$date[1:10] + 10)
s <- seq(min(trips0$date), max(trips0$date), by = "1 hour")
**track_speed**

*Track speed*

**Description**

Calculate speed (m/s) based on geodesic distance with longitude, latitude, date-time input vectors. The unit of speed is metres per second.

**Usage**

track_speed(x, y, date)

**Arguments**

- x: longitude
- y: latitude
- date: date-time in POSIXct

**Details**

By convention the first value is set to NA missing value, because the difference applies to each sequential pair of locations.

To use this on multiple track ids, use a grouped data frame with tidyverse code like data %>%

group_by(id) %>%

mutate(speed = track_speed(lon, lat, date))

**Value**

numeric vector of sequential distances in metres per second, see Details

**Examples**

track_speed(trips0$x, trips0$y, trips0$date)[1:10]

---

**track_time**

*Track time duration*

**Description**

Calculate time duration based on sequential difference of date-time input. The unit of time duration is seconds.

**Usage**

track_time(date)
Arguments

date date-time in POSIXct

Details

By convention the first value is set to NA missing value, because the difference applies to each sequential pair of locations.

To use this on multiple track ids, use a grouped data frame with tidyverse code like data %>%
group_by(id) %>% mutate(duration = track_time(date))

Value

numeric vector of duration between sequential date-time values in seconds, see Details

Examples

track_time(trips0$date)[1:10]

track_turn x, y

Arguments

x longitude

y latitude

Details

By convention the last value is set to NA missing value, because the angle applies to the relative turn from the current location.

To use this on multiple track ids, use a grouped data frame with tidyverse code like data %>%
group_by(id) %>% mutate(turn = track_turn(lon, lat)).

The maximum possible value is 180 degrees and the minimum is -180, although these particular values are a special case and will probably always be positive. Turn angle is a signed quantity with negative values for a left turn and positive values for a right turn.
Value

a numeric vector of absolute turn angles, in degrees

Examples

    track_turn(trips0$x, trips0$y)[1:10]

    ## maximum turn angle
    track_turn(c(0, 0, 0), c(0, 1, 0))
    ## minimum turn angle
    track_turn(c(0, 0, 0), c(0, 1, 2))

trips0  Simulated track data

Description

trips0 is an ungrouped data frame of x, y, date, id
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