Package ‘iccTraj’

April 17, 2023

Type Package
Title Estimates the Intraclass Correlation Coefficient for Trajectory Data
Version 1.0.2
Depends R (>= 4.0)
Imports doParallel, dplyr, magic, trajectories, sp, spacetime, purrr, utils, foreach
Description Estimates the intraclass correlation coefficient for trajectory data using a matrix of distances between trajectories. The distances implemented are the extended Hausdorff distances (Min et al. 2007) <doi:10.1080/13658810601073315> and the discrete Fréchet distance (Magdy et al. 2015) <doi:10.1109/IntelCIS.2015.7397286>.
License GPL (>= 2)
Encoding UTF-8
LazyData true
RoxygenNote 7.2.3
NeedsCompilation no
Author Josep L. Carrasco [aut, cre]
Maintainer Josep L. Carrasco <jlcarrasco@ub.edu>
Repository CRAN
Date/Publication 2023-04-17 09:50:02 UTC

R topics documented:

  gull_data ................................................. 2
  HD ......................................................... 2
  ICC ......................................................... 3
  iccTraj ................................................... 4
  interval ................................................. 6

Index 7
gull_data  

Description

A data frame with sample of 90 gull trajectories.

Usage

gull_data

Format

A data frame containing 90 trajectories

ID  Subject identifier
trip  Trip identifier
LONG  Longitude
LAT  Latitude
triptime  Time in seconds when the locations were obtained

HD  

Computes extended Hausdorff distance between two trajectories.

Description

Computes extended Hausdorff distance between two trajectories.

Usage

HD(pp1, pp2, q = 1)

Arguments

pp1  Set of spatial points for the first trajectory. It can be a matrix of 2D points, first column x/longitude, second column y/latitude, or a SpatialPoints or SpatialPointsDataFrame object.

pp2  Set of spatial points for the second trajectory. It can be a matrix of 2D points, first column x/longitude, second column y/latitude, or a SpatialPoints or SpatialPointsDataFrame object.

q  Quantile for the extended Hausdorff distance. Default value q=1 uses the maximum that leads to classical Hausdorff distance.
Value

A numerical value with the distance.

References


Examples

# Take two trajectories
library(dplyr)
library(sp)
sample_data<-gull_data %>% filter(ID %in% c(5107912,5107913), trip %in% c("V02","V01"))
tr1<-gull_data %>% filter((ID == 5107912) & (trip=="V02"))
tr2<-gull_data %>% filter((ID == 5107913) & (trip=="V01"))
pts1 = SpatialPoints(tr1[c("LONG","LAT")], proj4string=CRS("+proj=longlat"))
pts2 = SpatialPoints(tr2[c("LONG","LAT")], proj4string=CRS("+proj=longlat"))
# Hausdorff distance
HD(pts1,pts2,q=1)
# Median Hausdorff distance
HD(pts1,pts2,q=0.5)

ICCs

Computes the intraclass correlation coefficient (ICC) using a matrix of distances.

Description

Computes the intraclass correlation coefficient (ICC) using a matrix of distances.

Usage

ICC(X, nt)

Arguments

X Matrix with the pairwise distances.
nt Data frame with the number of trips by subject

Details

The intraclass correlation coefficient is estimated using the distance matrix among trajectories.
iccTraj

Estimates the intraclass correlation coefficient (ICC) for trajectory data

Value

Data frame with the estimates of the ICC (r), the subjects’ mean sum-of-squares (MSA), the between-subjects variance (sb), the total variance (st), and the within-subjects variance (se).

Description

Estimates the intraclass correlation coefficient (ICC) for trajectory data

Usage

```
iccTraj(
data, 
ID, 
trip, 
LON, 
LAT, 
time, 
projection = CRS("+proj=longlat"), 
origin = "1970-01-01 UTC", 
parallel = TRUE, 
distance = c("H", "F"), 
bootCI = TRUE, 
nBoot = 100, 
q = 0.5
)
```

Arguments

data A data frame with the locations and times of trajectories. It is assumed the time between locations is uniform. It must contain at least five columns: subject identifier, trip identifier, latitude, longitude, and time of the reading.

ID Character string indicating the name of the subjects column in the dataset.

trip Character string indicating the trip column in the dataset.

LON Numeric. Longitude readings.

LAT Numeric. Latitude readings.

time Numeric. Time of the readings.

projection Projection string of class CRS-class.

origin Optional. Origin of the date-time. Only needed in the internal process to create an object of type POSIXct.

parallel TRUE/FALSE value. Use parallel computation? Default value is TRUE.
The intraclass correlation coefficient is estimated using the distance matrix among trajectories.

Bootstrap resamples are obtained using balanced randomized cluster bootstrap approach (Davison and Hinkley, 1997; Field and Welsh, 2007)

Value

An object of class `iccTraj`. The output is a list with the following components:

- `*est*`. Data frame with the following estimates: the ICC (r), the subjects’ mean sum-of-squares (MSA), the between-subjects variance (sb), the total variance (st), and the within-subjects variance (se).
- `*boot*`. If bootCI argument is set to TRUE, data frame with the bootstrap estimates.
- `*D*`. Data frame with the pairwise distances among trajectories.

References


Examples

```r
# Using median Hausdorff distance.
Hd<-iccTraj(gull_data,"ID","trip","LONG","LAT","triptime")
Hd$est

# Using discrete Fréchet distance.
Fd<-iccTraj(gull_data,"ID","trip","LONG","LAT","triptime", distance="F")
Fd$est
```
interval Computes the confidence interval for the ICC

Description
Computes the confidence interval for the ICC

Usage
interval(x, conf = 0.95, method = c("EB", "AN", "ZT"))

Arguments
x An object of class "iccTraj"
conf Numeric. Level of confidence. Default is set to 0.95.
method String. Method used to estimate the confidence interval. Accepted values are "EB" for Empirical Bootstrap, "AN" for asymptotic Normal, and "ZT" for asymptotic Normal using the Z-transformation.

Details
Let \( \hat{\theta} \) denote the ICC sample estimate and \( \theta^B_i \) denote the ICC bootstrap estimates with \( i = 1, \ldots, B \). Let \( \delta_{\alpha/2}^B \) and \( \delta_{1-\alpha/2}^B \) be the \( \frac{\alpha}{2} \) and \( 1 - \frac{\alpha}{2} \) percentiles of \( \delta^B_i = \theta^B_i - \hat{\theta} \). The empirical bootstrap confidence interval is then estimated as \( \hat{\theta} + \delta_{\alpha/2}^B, \hat{\theta} + \delta_{1-\alpha/2}^B \).

Asymptotic Normal (AN) interval is obtained as \( \hat{\theta} \pm Z_{1-\alpha/2} \times SE_B \) where \( SE_B \) denotes the standard deviation of \( \theta^B_i \), and \( Z_{1-\alpha/2} \) stands for the \( 1 - \alpha/2 \) quantile of the standard Normal distribution.

In the ZT approach, the ICC is transformed using Fisher’s Z-transformation. Then, the AN approach is applied to the transformed ICC.

Value
A vector with the two boundaries of the confidence interval.

Examples
# Using median Hausdorff distance
Hd<-iccTraj(gull_data,"ID","trip","LONG","LAT","triptime", parallel=FALSE, distance="H")
Hd$est
interval(Hd)
Index

* datasets
  gull_data, 2

gull_data, 2

HD, 2

ICC, 3

iccTraj, 4

interval, 6