

```
empirical.semivariogram{slm}
```

Empirical Semivariograms

Description

Computes sample (empirical) variograms with options for *classical* or *robust* estimators.

Usage

```
empirical.semivariogram(data, x, y, var,  
  nlag = 20, directions = c(0,45,90,135),  
  tolerance = 22.5, inc = 0, maxlag = 1e32, nlagcutoff = 1,  
  EmpVarMeth = "MethMoment")
```

Arguments

<code>data</code>	a data frame containing the variables in the model.
<code>x</code>	the column containing the x-coordinate values in the data frame. The default is a variable called <code>xcol</code> that contains the name of the <code>xcol</code> . If it is typed in directly, it should be quoted; e.g., <code>xcol = "x"</code> .
<code>y</code>	the column containing the y-coordinate values in the data frame. The default is a variable called <code>ycol</code> that contains the name of the <code>ycol</code> . If it is typed in directly, it should be quoted; e.g., <code>ycol = "y"</code> .
<code>var</code>	the response variable name. It should be quoted, e.g., <code>"z"</code> .
<code>nlag</code>	the number of lags (also called bins)
<code>directions</code>	a list of the directions for which to compute the empirical semivariogram. The default values are 0, 45, 90, and 135. See details below.
<code>tolerance</code>	numerical value for the tolerance angle, when computing directional semivariograms. The default is 22.5. See details below.
<code>inc</code>	the distance increment for each lag. If <code>inc = 0</code> , then the increment is <code>maxlag/nlag</code> . The default is <code>inc = 0</code> .
<code>maxlag</code>	the maximum lag distance. Distances between any two locations that exceed this distance will be eliminated from computations.
<code>nlagcutoff</code>	The minimum number of values in a lag. Any lags that have less than this value will be eliminated from output.
<code>EmpVarMeth</code>	Method to be used to compute empirical semivariogram. The default is the classical method of moments estimator, <code>"MethMoment"</code> . Robust options are <code>"RobustMean"</code> and <code>"RobustMedian"</code> . See details below.

Details

Variograms are widely used in geostatistical analysis for exploratory purposes, to estimate covariance parameters and/or to compare theoretical and fitted models against sample variograms.

Directions

The directions are in degrees clockwise from the y-axis (i.e., geographic coordinates, with 0 to the north, 90 to the east, etc.). Note that the empirical semivariogram is radially symmetric, so directions only need to be between 0 and 180.

Tolerance

For each direction, binning will occur for each lag class distance and within the tolerance as specified. The default is 22.5, meaning that if the direction is 45, all vectors that have a direction from 22.5 to 67.5 degrees will fall in this lag class.

Method

The classical method is method of moments, given by “MethMoment.” This is the default. Two robust versions, based on the mean of the square-roots, “RobustMean” and the median of the square-roots, “RobustMedian” are also included. See Cressie (1993, pg. 75, for all 3 estimators).

Value

`empirical.semivariogram` returns a data frame with the following columns:

<code>distance</code>	the mean for all distances calculated for that lag class.
<code>gamma</code>	the empirical semivariogram value for that lag class.
<code>np</code>	the number of pairs in that lag class.
<code>azimuth</code>	The direction for that lag class.
<code>hx</code>	The x-coordinate of the vector for the center of that lag class
<code>hy</code>	The y-coordinate of the vector for the center of that lag class

Examples

```
# --- AN OMNIDIRECTIONAL EXAMPLE WITH 20 BINS OF SIZE 1000 METERS
empirical.semivariogram(data = caozone, x = "x", y = "y", var =
  "OZONE", nlag = 20, directions = 90,
  tolerance = 90, inc = 1000)
```

```
# --- A ROBUST ESTIMATOR USING MULTIPLE DIRECTIONS, A MINIMUM OF 3
PAIRS PER BIN, AND AUTOMATIC INCREMENTS USING MAXLAG

empirical.semivariogram(data = caozone, x = "x", y = "y", var =
  "OZONE", nlag = 20, directions = c(0,45,90,135),
  tolerance = 22.5, inc = 0, maxlag = 20000, nlagcutoff = 3,
  EmpVarMeth = "RobustMean")
```