Environmental Statistics

Analysis of areal data

June 4, 2020

The R-project folder `exam-areal` contains two folders:

- `data-areal`
  This folder contains the `csv` file `data-molise.csv` with four variables: `Id` and `Name` are the code and name of the Molise Region municipalities, `y` is the study variable while `x` is a covariate to be used for the estimation of a spatial regression model;
- `map-exam-areal`
  This folder contains the shapefile of the Molise Region municipalities.

First of all, **open the** `exam-areal.Rproject` file.
Build an R script to answer the following questions:

1. Import the map of the Molise Region municipalities. The object you obtain *must* be called `molise`.
2. Read the file `data-molise.csv` usign the `read_csv2` function. The object you obtain *must* be called `db`.
3. Obtain a choropleth map of the study variable: the location of the legend has to be top left.
4. Build the adjacency matrix as both an `spdep` list and a `matrix` object.
5. Build the row-standardised adjacency matrix as both an `spdep` list and a `matrix` object.
6. Compute the global Moran's I with the row-standardised adjacency matrix. You should *not* use the `spdep` functions.
7. Provide a brief description of the advantages in using the row-standardised matrix for computing Moran's I.
8. Obtain the spatially lagged variable and compare its variance with the variance of the study variable. Discuss the difference.

9. Test for spatial dependence of the `y` variable using a Monte Carlo test, using the appropriate `spdep` function. Is the hypothesis of spatial independence accepted? Discuss.

10. Estimate the linear regression model of the dependent variable on the independent variable with the OLS estimator.

11. Test for residual spatial autocorrelation. Provide a brief comment on the result.

12. Estimate the spatial error model. Discuss the main theoretical features of this model.

13. Compare the simple linear regression model and the spatial error model. Which model is preferred? (Do not use the Lagrange Multipliers test)

Save the R script as `LastnameName-areal.R`.