Spatial sensitivity analysis

Course and practical application

Author

Institut

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Outline

Classical problems in geography / spatial sciences : MAUP, scale dependency, spatial non-stationarity

$=>$ spatial configuration are parameters too
- Space matters - Synthetic generators - Sensitivity to data noise

Contents of this module

General context

At the microscopic scale (district): building layouts
[Raimbault and Perret, 2019]

Results

Point cloud

Population grid

At the mesoscopic scale: population grid
[Raimbault, 2018]
- Reaction-diffusion model - Urban form measures

PSE on the morphological space

At the macroscopic scale: systems of cities

- Evolutive urban theory: systems of cities follow general stylized facts - rank-size law - central place theory

Real data perturbation

How does noise in real data impacts the result ?
- WIP
How does perturbation of real data allows to explore scenario - Forcity example

In the spatial approach, spatial model indicators are also important: what kind of spatial structure does the model produce ?

- previous form indicators at different scales - spatial statistics

Spatial form as indicators

spatial correlations ?

(examples)

Moran index

Spatial autocorrelation at a given range
Given spatial weights w_{ij}

$$I = \frac{N}{\sum_{i,j} w_{ij}} \cdot \frac{\sum_{i,j} w_{ij} \cdot (X_i - \bar{X})(X_j = \bar{X})}{\sum_i (X_i - \bar{X})^2}$$

Optimal autocorrelation spatial scales

Ripley K function

Quantifying level of clustering regarding a null model

Method flowchart

Relative distance of phase diagrams

$$d_r\left(\mu_{\vec{\alpha}_1}, \mu_{\vec{\alpha}_2}\right) = 2 \cdot \frac{d(\mu_{\vec{\alpha}_1}, \mu_{\vec{\alpha}_2})^2}{Var\left[\mu_{\vec{\alpha}_1}\right] + Var\left[\mu_{\vec{\alpha}_2}\right]}$$

Why could the Schelling model be sensitive to space ?
[Banos, 2012]

A model of resource collection

References I

Banos, A. (2012).
Network effects in schelling's model of segregation: new evidence from agent-based simulation.
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