

Geostatistical methods for the analysis of spatial data

Project for Master in Data Science

Advisor: Georgios P. Karagiannis

Academic year 2021 @ Durham University

Description

The focus of this project is the study and implementation of state-of-the-art statistical techniques/models for the analysis of spatial data sets.

Data sets with the colorful adjectives 'spatial' contain data with labels indicating where have been collected. Such data exist in problems in environmental, climatology, weather forecasting, engineering, biology, etc...

Geostatistical methods involve statistical methods based on regression models (linear or non-linear) tailored to process and analyse such data sets in order to produce meaningful predictions and inferences.

Project specific intended learning outcomes

By the end of this project, students will be able to design suitable statistical models, and apply such models for the analysis of real or simulated spatial data sets by using statistical programming languages and packages.

Potential project directions

For example, some potential directions for the project could possibly be:

Big data sets: A satellite picture of a region may contain several 'pixels' (aka data), or be contaminated by noise. Processing all this information requires the use of suitable methods.

High dimensional data sets: In several cases, the dimensionality of the problem is so large that makes traditional modeling impractical. The proper utilization of statistical strategies analysing such data sets is not straightforward.

Multivariate data: Often when we collect data, (e.g., air pollution), we collect several characteristics/variables (e.g., precipitation, pressure, etc...). Modeling the dependence between different responses given the location is a delicate task.

Analysis of real data: Possible data-sets you can analyze as part of your projects can be: disease (like COVID-19, etc...), air pollution (like CO₂, etc...), remote sensing satellite data, etc ...

References

- Bivand, R. S., Pebesma, E. J., Gomez-Rubio, V., & Pebesma, E. J. (2013). Applied spatial data analysis with R (Vol. 2). Springer.
(<https://asdar-book.org/>)
- Wikle, C. K., Zammit-Mangion, A., & Cressie, N. (2019). Spatio-temporal Statistics with R. CRC Press.
(<https://spacetimewithr.org/download>)

Contact details

Georgios Karagiannis: Office: MCS3088 ; Email: georgios.karagiannis@durham.ac.uk ; Tel: +44 (0) 1913342718