Contemporary methods in spatial statistics in R with applications to life and social sciences

PhD winter school co-organized by University of Pavia and USI

Dates and venues:

13, 14, 15 December 2021 -- USI, Lugano (Switzerland)
16, 17 December 2021 -- University of Pavia, Pavia (Italy)

The course provides an introduction to Integrated Nested Laplace Approximation (INLA) and spatial Stochastic Partial Differential Equation (SPDE) including model specification, estimation and interpretation. Each day will comprise theory and practical R sessions. Applications focusing on life science will be illustrated including disease mapping, log-Gaussian Cox process for modeling point patterns and air pollution modeling with spatially misaligned data. In view of reproducible science, students will learn how to create R Markdown reports, interactive dashboards, and Shiny web applications that also facilitate the communication of insights to collaborators and policymakers.

Speakers: Prof. Paula Moraga, Prof. David Bolin, Prof. Håvard Rue, Dr. Elias Krainski from King Abdullah University of Science and Technology

The winter school will be held in presence and online. Participation is free but registration is mandatory.
For the participation in presence, Covid-19 green pass is required and a limited number of participants (20) will be admitted on a first serve basis.

For info send an email to: spatialstatschool@gmail.com

For registration, please complete the following form:
https://forms.gle/vuitMKVwD8dLYirx6

Scientific Committee:
Silvia Figini (University of Pavia), Antonietta Mira (Data Science Lab - USI) and Håvard Rue (King Abdullah University of Science and Technology)
Organizing Committee:
Chiara Bardelli, Elena Ballante, Raffaella Cabini (University of Pavia), Lorenzo Ghilotti (University Milano Bicocca and Data Science Lab – USI), Chiara Ghiringhelli (UNICATT and USI)

School Program

Monday

Introduction to the required background on INLA and spatial SPDE models. The R session will introduce GLMs and basic random effects models, and how to use splines for the effect of covariates.

Morning Introduction to INLA, latent Gaussian models and sparse matrices (H. Rue)
Afternoon INLA demonstrations and practicals in R: regression and time series (E. Kraiski) Gaussian SPDE models, part I (D. Bolin)

Tuesday

Advanced methodological topics on INLA and Gaussian SPDE models. Demonstrations and practicals in the afternoon R session how to do geostatistics models with the SPDE's and end with a case study with a spatial Cox proportional hazard model for spatial survival data.

Morning Approximating marginals using Laplace approximations and completing the INLA theory (H. Rue)
Afternoon INLA demonstrations and practicals in R: SPDEs and survival (E. Krainiski) Gaussian SPDE models, part II (D. Bolin)

Wednesday

Non-Gaussian SPDE models and their incorporation into linear mixed effects models for continuous repeated measurement data.

Morning non-Gaussian SPDE models and R practicals (D. Bolin)

Thuersday

Manipulation of point, areal and raster data, and creation of static and interactive maps using R. Estimation and interpretation of spatial and spatio-temporal models for areal data with examples in disease mapping. Finally, we will see how to create reproducible R Markdown reports, interactive dashboards, and Shiny web applications that facilitate the communication of insights to collaborators and policymakers.

Morning maps with R, spatial modelling of areal data (P. Moraga)
Afternoon practicals (type I, II, III and IV spacetime) (E. Krainski) spatio-temporal modeling of areal data, reproducible reports and interactive dashboards (P. Moraga)

Friday

Estimation and interpretation of spatial models to analyze geostatistical data with applications in disease mapping, and log-Gaussian Cox process for modeling point patterns with applications in species distribution modeling. Introduction on how to combine spatially misaligned data with examples to air pollution modeling.

Morning spatial modelling of geostatistical data, log-Gaussian Cox processes (P. Moraga)
Afternoon some advanced topics and examples on combining spatially misaligned data (P. Moraga & E. Krainski)