# **ABS25** Applied Bayesian Statistics School

# SPATIO-TEMPORAL METHODS IN ENVIRONMENTAL EPIDEMIOLOGY

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#### University of Genova, Department of Architecture and Design Stradone di S. Agostino 37 - 16128 Genova, Italy 3-6 June 2025

## Tuesday, June 3th

08.30-09.00	Registration
09.00-10.30	Session 1. <b>An overview of spatio-temporal epidemiology</b> Health-exposure models, examples of spatio-temporal epidemiological analyzes; introduction to modeling health risks and impacts: types of epidemiological studies; measures of risk; relative risk; odds ratio; standardized mortality ratios; GLMs; Poisson models for count data
10.30-11.00	Coffee break
11.00-12.30	Session 2. <b>Introduction to the Bayesian approach</b> Exchangeability; Bayes' theorem; conjugate priors; predictions; approaches to Bayesian computation, Markov chain Monte Carlo methods, INLA
12.30-14.00	Lunch
14.00-15.30	Session 3. Bayesian Hierarchical Models and introduction to Nimble, Stan and R-INLA
15.30-16.00	Coffee break
16.00-17.30	Session 4. Practicum: Data Analysis with Stan and R-INLA
17.30-18.00	Participants' talks

# Wednesday, June 4th

09.00-10.30	Session 5. <b>Spatial modeling: point-referenced data I</b> Stationarity; Isotropy; Variograms; Gaussian processes; Bayesian Kriging
10.30-11.00	Coffee break
11.00-12.30	Session 6. <b>Spatial modeling: point-referenced data II</b> Non-normal outcomes; Examples in Stan and R-INLA
12.30-14.00	Lunch
14.00-15.30	Session 7. Practicum: Fitting Bayesian kriging models with Stan and INLA
15.30-16.00	Coffee break
16.00-17.30	Session 8. <b>Spatial modeling: areal data</b> Moran's Statistics; Conditional Autoregressive models; Besag, York and Mollié (BYM); BYM2; Model comparison
20.00-22.00	Social Dinner

#### Thursday, June 5th

09.00-10.30	Session 9. Practicum: analysis of counts of dengue fever across the neighborhoods of Rio de Janeiro
10.30-11.00	Coffee break
11.00-13.00	Session 10. <b>Time series analysis: an introduction to Dynamic Linear Models</b> Introduction; random walk, trend, seasonal and dynamic regression. Bayesian Inference for DLMs
13.00-24.00	Free time

## Friday, June 6th

09.00-10.30	Session 11. Practicum DLMs
10.30-11.00	Coffee break
11.00-12.30	Session 12. Modeling exposures over space and time
	Separable models, non-separable models, DLMs for space and time
12.30-14.00	Lunch
14.00-15.30	Session 13. Practicum with spatio-temporal DLMs
15.30-16.00	Coffee break
16.00-18.00	Session 14. Advanced topics in spatio-temporal modeling
	Zero-inflated Markov-switching models for infectious diseases. Heavy-tailed spatio-temporal
	processes

### **IMPORTANT NOTE:**

It is important to have your own PC for the practical lessons.

Remember to take it with you before leaving. Please install the following software on your PC in advance to start your lessons smoothly:

• R (>= 4.0)

## **REFERENCES:**

1. Shaddick, G., Zidek, J.V., & Schmidt, A.M. (2023). Spatio–Temporal Methods in Environmental Epidemiology with R (2nd ed.). Chapman and Hall/CRC (DOI: 10.1201/9781003352655).

# All participants will receive a certificate of attendance at the end of the course. The university / ECTS credits granted for attendance of the course are established by the Director of your specific course of study, depending on your university/course criteria