WORKSHOP ON SPATIAL DATA

May 24, 2019

LOCATION

HASSELT UNIVERSITY

CAMPUS DIEPENBEEK

AGORALAAN BUILDING D

ROOM: E139

Center for Statistics, Hasselt

PARTICIPATION IS FREE OF CHARGE, BUT REGISTRATION IS REQUIRED

To register: fill in the registration form before May 21, 2019

In case you have questions, contact anneleen.verhasselt@uhasselt.be

PROGRAM

13:00 – 14:00
Christel Faes (UHasselt)
An introduction to spatial data analysis

14:00 – 14:45
Dr. Thomas Neyens (UHasselt)
Mapping biodiversity using opportunistic samples: should we trust our inferences?

14:45 – 15:00 Coffee break

15:00 – 16:00
Prof. Dr. Rosa M. Crujeiras (University of Santiago de Compostela)
Dealing with spatial dependence in circular data analysis

An introduction to spatial data analysis
Christel Faes (UHasselt)

Abstract:
Spatial statistics concerns the analysis of the geographical pattern of the outcome of interest. Is there a geographical trend? Do events cluster together? In this presentation, an overview is given of different types of spatial data and the type of research questions that can be addressed with such data: spatial lattice data, geostatistical data and point pattern data. A brief introduction to commonly used statistical techniques is presented.

Mapping biodiversity using opportunistic samples: should we trust our inferences?

Dr. Thomas Neyens (UHasselt)

Abstract:
1. Introduction. The use of surveys that have been historically collected by citizens has become a popular means to easily obtain large data-sets of ecological processes. However, the absence of a consistent study design typically results in opportunistic samples and the bias they induce in the statistical analysis remains poorly understood. This has resulted in an ongoing debate on whether accounting for suboptimal sampling in the analysis provides valid inferences, especially in the context of distribution models for a single species. Here, we propose geostatistical models for opportunistic biodiversity samples and investigate the potential of citizen-science data, using forest ground-floor bryophyte species richness data collected in the province of Limburg (Belgium). Our goal is to assess its reliability by comparing model-based spatial biodiversity predictions with those obtained via expert-sourced data.

2. Methods. We develop a log-Gaussian Cox process model to analyse the opportunistic sampling process of the citizen-science data and assess sampling bias. Next, we fit two geostatistical Poisson models, to the opportunistic and to the randomized data-sets, and compare the resulting spatial parameter estimates and biodiversity predictions.

3. Results. From the log-Gaussian Cox Process, we learn that the volunteering citizens have a strong tendency to collect data close to their homes and at locations of high environmental value. We find that the estimated effects of ecological predictors differ strongly between geostatistical models based on citizen-science and expert-science data. A comparison of spatial species richness predictions from both models shows large differences between the citizen-science and randomized samples.

4. Discussion. Unknown inconsistencies in the sampling process, such as unreported observer's effort, and the lack of a hypothesis-driven data sampling methodology necessitate careful use of citizen science data when assessing biodiversity. The occurrence of multiple sources of sampling bias makes it difficult, if not impossible, to provide reliable inferences.

Dealing with spatial dependence in circular data analysis

Prof. Dr. Rosa M. Crujeiras (University of Santiago de Compostela)

Abstract:

Circular data analysis is required when describing the stochastic pattern of orientation measurements or periodic phenomena. Such examples are frequent in applied fields: for instance, when analysing animal orientation (see Batschelet (1983) as a classical reference), wind directions (Fisher, 1995, Ch.5), wildfires occurrences (Ameijeiras-Alonso et al. (2019) and Ameijeiras et al. (2017)) or waves directions (Jona-Lasinio et al. (2012) and Wang et al. (2015)). Modelling purposes may be focused on determining a preferred direction or a specific concentration of events; or they may pursue a broader objective aiming to characterise the data generating mechanism, accounting for large and small scale variability components, following different strategies that include Bayesian and Hidden Markov Models, for instance. In this talk, we will review some of the previous contributions to check how spatial dependence is incorporated in the modelling strategy. In addition, we will show some new results on a nonparametric spatial trend estimator for a circular spatial process. This last part is joint work with A. Meilán-Vila, M. Francisco-Fernández and A. Panzera.

References

[1] Ameijeiras-Alonso, J., Benali, A., Crujeiras, R.M., Rodríguez-Casal, A. and Pereira, J.M.C. (2018) Fire seasonality identification with multimodality tests. Submitted.

[2] Ameijeiras-Alonso, J., Lagona, F., Ranalli, M. and Crujeiras, R.M. (2019). A circular hidden Markov random field for the spatial segmentation of fire occurrence. Environmetrics, 30(2), e2501.

[3] Batschelet, E. (1981). Circular Statistics in Biology. Academic Press, New York.

[4] Fisher, N. I. (1995). Statistical Analysis of Circular Data. Cambridge University Press.

[5] Jona-Lasinio, G., Gelfand, A., and Jona-Lasinio, M. (2012). Spatial analysis of wave direction data using wrapped gaussian processes. Annals of Applied Statistics, 6(4), 14781498.

[6] Wang, F., Gelfand, A. and Jona-Lasinio, G. (2015) Joint spatio-temporal analysis of a linear and a directional variable: space-time modelling of wave heights and wave directions in the Adriatic Sea. Statistica Sinica, 25, 25-39.