Thematic Course
PhD in "Scienze Economiche e Statistiche"
SEAS Department
University of Palermo

Academic Year	2022-2023
Subject	Introduction to Point Processes
Instructor	Nicoletta D'Angelo
Course description	Point processes are stochastic processes defining a natural and convenient formal tool to describe the process of discrete events. Depending on the domain where the events occur, we can talk about spatial, temporal, or spatio-temporal point processes. Examples, spanning many scientific branches, are found with forest fires, crimes, earthquakes, diseases, or animal locations, to name a few. The aim of this course is to introduce the definitions of point processes, together with some techniques to model their realization, i.e. *point patterns*. To put them into context, the classification of different kind of spatial data will first be provided. Then, the course will focus on some modelling strategies for the analysis of point patterns, crucial in many scientific and engineering fields, such as environmental sciences, seismology, astronomy, epidemiology and criminology. Furthermore, some methodologies to assess the goodness of fit of such models, are provided in the course. Finally, a lecture will be devoted to show real data analyses, in order to provide advanced hints for future studies.
Learning Objectives	Students are expected to be able to: - discuss about the main features of point processes, with particular emphasis on the specific language of point process theory and their fundamentals. - classify spatial and spatio-temporal data depending on the nature of the underlying random processes and their support. - apply their knowledge and comprehension to tackle problems on observed space-time phenomena by means of suitable point process models. - know about the main R packages to run their own analyses.
Suggested readings	• Baddeley, A., Rubak, E., & Turner, R. (2015). *Spatial point patterns: methodology and applications with R*. CRC press. • Cressie, N. (2015). *Statistics for spatial data*. John Wiley & Sons. • González, J. A., Rodríguez-Cortés, F. J., Cronie, O., & Mateu, J. (2016). Spatio-temporal point process statistics: a review. *Spatial Statistics*, *18*, 505-544. Other papers for further reading.
Course Activity (hrs)	10h
Credits	3
Assessment Method	A written report
Teaching Methods	Each section utilizes a combination of lecturing, computer lab (using the R software) and class discussion.
Calendar	May 2023
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Calendar of Classes

Lecture	Date	Topic	Duration
1	TBA	Classification of spatial and spatio-temporal data	2h
2	TBA	Point processes	2h
3	TBA	Models and inference	2h
4	TBA	Global and local diagnostics	2h
5	TBA	Real data analyses	2h