Book Review

Statistical Analysis and Modelling of Spatial Point Patterns (Wiley Series Statistics in Practice). J. Illian, A. Penttinen, H. Stoyan, and D. Stoyan (2008).Chichester: John Wiley & Sons. ISBN 978-0-470-01491-2.

A spatial marked point pattern is a set of objects scattered over a region of interest. Such patterns arise in many scientific disciplines, including archeology, astronomy, physics, forestry, ecology, biology, medicine, computer vision, and material science. Statistical inference aims to describe the stochastic mechanism that produced the pattern and to quantify the geometric structure of the observations.

The book by Illian et al., a successor to Stoyan & Stoyan (1994), is aimed at researchers and students in the aforementioned disciplines interested in learning more about the statistics involved in analysing the marked point patterns that arise in their fields. Thus, the authors do not rely on background knowledge beyond a first course in probability and statistics and have strived to keep the book self-contained. They explain the basic ideas, present the mathematical facts, and discuss a large number of well-chosen illustrative examples with realistic data. The textbook is accompanied by a website containing these data sets, which enables the reader to experiment further. Throughout the text, proofs are avoided (the more mathematically inclined reader is referred to Daley & Vere-Jones (2003, 2008) or to Van Lieshout (2000)) and emphasis is placed on classical, generally applicable non-parametric statistical methods, somewhat at the expense of modern Bayesian methods as covered in e.g. Moeller and Waagepetersen (2004) that often need finetuning.

Among the topics covered are sampling and data collection, basic notions and characteristics of point processes (Chapter 1), and a detailed account of the fundamental homogeneous Poisson process (Chapter 2). Chapter 3 focusses on the analysis of finite point processes, the subclass that is of most practical relevance. As many characteristics simplify considerably when the point process under consideration is stationary, and statistical inference can usefully exploit the inherent replication present in such patterns, a comprehensive review of non-parametric analysis of stationary point processes is given in Chapter 4, whilst stationary marked point patterns are studied in Chapter 5. Together, these two chapters form the heart of the book. The final two chapters are devoted to model building, selection, and validation.

The book is written in a clear and accessible style. Throughout, concepts and techniques are illustrated by carefully chosen examples, encouraging the reader to experiment further, either on his/her own data or on the patterns available at the companion website. I would recommend the book most warmly to any scientist working with spatial patterns.

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