Book review

A. Baddeley, E. Rubak and R. Turner, Spatial Point Patterns: Methodology and Applications with R. Boca Raton: Chapman & Hall/CRC Press.

M.N.M. van Lieshout

As possibly the first user of the software package now known as 'spatstat', it is an honour and a pleasure to review Baddeley, Rubak and Turner's wonderful new book entitled 'Spatial point patterns: Methodology and applications with R'.

Contrary to popular belief, the spatstat cradle did not stand in Western Australia. Indeed, the package's roots can be traced back at least to the first half of the 1990s when Adrian Baddeley, then based in Amsterdam, wrote routines for the computation of (Kaplan–Meier) estimates of functional summary statistics for stationary point processes. Since then, Baddeley and Turner, later joined by Rubak, with input from many leading experts in point process analysis, have turned the package into an indispensable tool for researchers and practitioners alike. In a reverse direction, new discoveries are being implemented quickly in spatstat.

The fruits of this decades' long process are very well documented in the book. As the authors point out in their preface, the book is not intended to be an introduction to point process theory for mathematicians. Rather, they aim to focus on the principles of statistical inference for spatial data and to help researchers in application domains with the practicalities of the analysis and the interpretation of the results. In this, they have succeeded brilliantly.

The book is written in a distinct, at times funny, always accessible style. General principles of every aspect of spatial point pattern analysis, from data collection to model validation, are discussed in great detail with pointers to the specialised literature for those who wish to gain a deeper understanding of the technicalities. The principles are illustrated by means of a wide collection of examples that can be reproduced by the reader in R. Moreover, a selection of frequently asked questions from spatstat users is answered at the end of each chapter.

The book is conveniently organised in four main parts. In the first part, an informal introduction to point patterns, R and the spatstat package is given. The second part is devoted to exploratory data analysis. After describing tools for plotting spatial data, attention is paid to classical summary statistics such as the intensity, pair correlation function and distance based functionals for quantifying the degree of clustering or regularity in the data.

The longest and, perhaps, core part of the book is the third one in which statistical inference is considered. In this part, the authors present a coherent framework for model fitting, selection and validation. In chapter 9, the main focus is on likelihood based inference for Poisson models defined by a loglinear intensity function. The next chapter discusses hypothesis testing. It explains in detail how Monte Carlo envelopes can and cannot be used, before turning to residuals and other tools for model validation in chapter 11. Inference for Cox, cluster and Markov point processes is discussed as well. For the latter class of models, the default technique is pseudo- or composite likelihood. Throughout, connections to standard statistical techniques are emphasised and common misconceptions cleared up.

The last three chapters concern more specialist and less developed topics, including spatio-temporal point processes and replication.

In summary, I warmly recommend the book to anyone who wishes to analyse point patterns professionally.

M.N.M. van Lieshout
CWI and University of Twente
Amsterdam and Enschede, The Netherlands
M.N.M.van.Lieshout@cwi.nl