BOOK REVIEWS

N. A. C. Cressie (1991): Statistics for Spatial Data. New York: John Wiley & Sons, 920 pp., ISBN 0-471-84336-9, 71 £ Sterling

This Book is a part of the Wiley Series in Probability and Mathematical Statistics. It contains more than 900 pages about the analysis of spatial data, i.e data sets, in which each observation is referenced to a site or area. These data are usually correlated and thus require a special methods of analysis.

After a short introduction on when and why methods of spatial data analysis should be used, the rest of the book is divided into three parts according to the type of data: geostatistical data, lattice data and point patterns.

The first part (Chapters 2 to 5) is concerned with data whose spatial location index can vary continuously in $\mathbb{R}^d$. Here Cressie has gathered a lot of literature from geological journals that is typically not available for a statistician. Cressie himself for instance has published widely on a prediction method named Kriging in such journals. In chapter 3 the different methods of Kriging are presented, except intrinsic random function Kriging, which is deferred to paragraph 5. These methods are then applied to six different data sets in chapter 4. The data sets (not only in this part but also in the rest) are reproduced in the book. Paragraph 2 is mainly concerned with the Variogram (a measure of dependence used in geostatistics) and the problems of its estimation. In Chapter 5 Cressie considers the stability of Kriging and asymptotics, plus assorted other themes. This part is the heaviest in the book, containing about 350 pages.

The second part (Chapters 6 and 7) treats the problem of the analysis of data, whose spatial location index is within a countable subset D of $\mathbb{R}^d$. Chapter 6 gives an overview of the methods for specifying spatial models on lattices, discussing conditionally and simultaneously specified models. The material presented on conditionally specified models is similar to Besag's (1974) famous article in the Journal of the Royal Statistical Society. Chapter 7 considers estimation methods for lattice models and uses them in the investigation of two data sets. It also treats the very important problem of remote sensing and image analysis.

The third part (chapters 8 and 9) is concerned with point patterns. This means that the variable under investigation is the location of events. In paragraph 8, the most theoretic in the whole book, Cressie gives an introduction to the theory of point processes which is comparable to the content of the chapters 2, 4 and 5 of "Stochastic Geometry and its Applications" by Stoyan, Kendall and Mecke (1987). These methods are then used to investigate a data set of longleaf pines. However, this analysis is carried out before the theory is presented. This seems very unsatisfactory to me. Chapter 9 is concerned with the modelling of objects (mainly pictures) via random sets. Whereas in Chapter 8 the aim was mainly restoration of pictures, here the focus is to characterize the form of objects. After an introduction to the theory of random closed sets, Cressie discusses methods of parameter estimation in the special case of the Boolean Model.

After 800 pages concerned with the analysis of spatial data, there are an additional 70 pages of more than 1000 references. This bibliography is certainly very useful, as the author has summarized such diverse material, that he could only give an overview on many of the subjects. However, this is also a drawback of this book, as the reader is sometimes confronted with formulae, that are badly motivated and hard to understand.

I think that this book will be mainly a source of methods to investigate spatial data, both for the theoretical and the applied statistician, as in every section there is material concerning each of them. The book is much more comprehensive than "Spatial Statistics" by Ripley (1981) and "Spatial Data Analysis by Example: Point Pattern and Quantitative Data" by Upton and Fingleton (1985). It gives an up to date review of the state of art in this field of statistical science, so I think this book is worth its price.

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