
Book review

Statistical detection and surveillance of geographic clusters

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This aptly titled text focuses on statistical tests for the detection of spatial clusters and geographic temporal surveillance. It gives a thorough introduction to the mathematics, interpretation and practical issues behind the major methods of cluster detection and surveillance. It seeks to serve as an interdisciplinary bridge between the technical realm of spatial statistics and the diverse body of researchers in need of its tools. The themes range from very basic methods used for testing hypotheses of clustering in a region to complex approaches used for detecting, and simultaneously locating geographic trends over space and time.

The authors take an applied approach to explaining the theory and practice of spatial analysis, using many figures and realistic examples throughout the text. Particular emphasis is placed on public health applications: the authors make clear the potentially powerful role of spatial cluster analysis in public health research by providing historical notes on its use in epidemiology and by tailoring their examples and discussions to real health data, such as the spatial distribution of leukemia mortality. Readers with training in epidemiology will find the discussion of methods for case-control data useful. Each newly introduced method of geographic analysis is followed by clear illustrations, making the concepts more readily accessible than the mathematics of the topic might otherwise allow.

The book is divided into three main sections. The first is made of four chapters that provide an introduction to the fundamental concepts and describe the various methods of non-temporal cluster detection. This section begins by presenting approaches used for global tests, in which the entire region is tested against the null hypothesis of no clustering. This is followed by a discussion of the more sophisticated local tests, in which specific sub-regions of the study area are tested for clustering when the whole region is found to have global clustering. Spatial scan statistics are then introduced, which combine the above approaches by systematically searching a region for evidence of local clustering.

The second section consists of a single chapter and briefly reviews methods used for retrospectively detecting changes in spatial patterns. At this point the book moves from methods that are solely spatial to those incorporating aspects of time. It begins by discussing the Knox statistic, which tests for space-time interaction in a fashion conceptually similar to an analysis of contingency tables, and then moves to simpler methods for detecting temporal changes within a single region. The majority of the section, however, discusses methods specially designed for retrospective detection of geographic changes. The third section consists of four chapters and introduces a multitude of approaches used for geographic surveillance, including the prospective detection of changes in spatial

patterns. These are extended to include methods for simultaneously monitoring multiple regions.

Each of the above topics is presented with rigorous mathematical notation and relies on statistical foundations. Readers easily intimidated by formulae or unfamiliar with concepts such as Poisson processes or autocorrelation may find some parts overly technical. The authors also periodically rely on vector algebra notation, calculus and Monte Carlo simulations to present the methods or to investigate their properties. At times, this emphasis on theory may overwhelm those without some training in statistics. Indeed, even with the appropriate training, the notation can be quite heavy, though the nature of the material likely makes this unavoidable. However, the authors' fluent writing style and the pragmatic structure of the book may allow readers without the necessary mathematics to nevertheless understand the main ideas in most cases. Those with even a modest background in applied statistics or geostatistics will find the concepts and notation to be presented in an intuitive fashion.

Geographic analysis has gained popularity within the public health field in recent decades, and so this book is a timely addition to the literature. Epidemiologists, biostatisticians, research demographers and social scientists engaging in spatial analysis will find this compilation to be a useful reference. As well, beginners

interested in familiarizing themselves with the methods and challenges of cluster analysis will profit from reading it. Students of geostatistics searching for an authoritative introductory text with an applied focus will also benefit from adding this to their library.