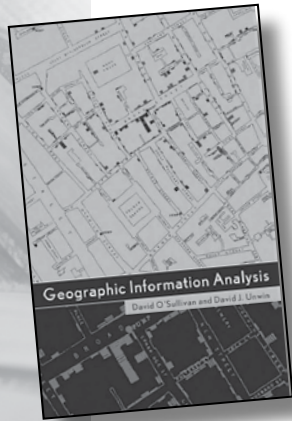


Geographic Information Analysis

David O'Sullivan and David J. Unwin. 2003. **Geographic Information Analysis**. John Wiley & Sons, Inc. 436 pages. ISBN 0-471-21176-1. Hard cover only.



For many GIS users spatial analysis is at the very heart of any GIS; however, there are few books on the subject of spatial analysis that describe analytical techniques in a thorough yet accessible manner. *Geographic Information Analysis* by O'Sullivan and Unwin (2003) promises to “present clear and up-to-date coverage of the foundations of spatial analysis in a Geographic Information Systems environment” – and it delivers on this promise. Compared to several other books covering similar subject matter, this text stands out because of the clarity of its explanation of spatial analysis concepts, consistency in its use of mathematics and statistics, and comprehensive coverage of a wide range of analytical techniques.

One of the book's main strengths is the clear organization of each chapter. Each chapter starts with a set of objectives, uses a set of well-named sections and ends with a chapter review. Each section is also usually not longer than a few pages, making it easy to go back and find specific topics. There is also a wealth of very informative figures and tables, which almost without exception contribute substantially to developing a better understanding of the concepts being described.

The book contains a total of 12 chapters. The introductory chapter provides some of the needed background in terms of definitions of basic concepts and what the authors mean by geographic information analysis: “the study of techniques and methods to enable the representation, description, measurement, comparison, and generation of spatial patterns”. Chapters 2 and 3 then describe more fundamentals, including the characteristics of spatial data which are most relevant for analysis, and the

nature of spatial processes and patterns.

Chapters 4 through 11 describe a series of spatial concepts and analytical techniques applicable to them. First of these concepts is point pattern analysis in Chapters 4 and 5, followed by Chapter 6 on lines and network, and Chapter 7 on area objects. This follows the logical hierarchy of points, polylines and polygons as representation types. Next are Chapters 8 and 9 on fields (i.e. surface representations like raster and TIN), which primarily deal with spatial interpolation techniques such as nearest neighbor, inverse-distance weighting and kriging. Chapter 10 describes map overlay techniques, including Boolean overlay and more sophisticated alternatives. Chapter 11 covers multivariate data, multidimensional space, spatialization and principal component analysis.

The final chapter 12 on new approaches to spatial analysis describes a number of emerging techniques such as expert systems, artificial neural networks, genetic algorithms, agent-based systems and cellular automata. While many techniques described in earlier chapters have made their way into GIS software, these techniques are much more in the development stage and their implementation is not as widespread.

Each of the various spatial concepts is described in a clear and concise manner and with considerable depth. The book's main strength, however, lies in the fact that it is able to describe such a broad range of concepts and analytical techniques in a single volume in a consistent manner. Even for those who have substantial experience in using GIS for spatial analysis, the book is therefore likely to provide some new insights into alternative

approaches to a particular analysis problem. On the other hand, a number of common analytical techniques are not covered in any detail, most notably several forms of proximity analysis (like buffering), raster-based analyses (including overlay, focal and zonal analysis), and spatial regression analysis.

Another strength of the book is its rigor in terms of statistics; basic statistical concepts are described and explained throughout the book and their relevance is clearly demonstrated. This reflects the authors' conviction that spatial analysis requires a consistent recognition of basic statistical considerations. This is severely lacking in most general GIS textbooks, which usually dedicate a few chapters on spatial analysis but rarely do a solid job of including the relevant statistical concepts. For those in need of a refresher on basic statistics, Appendix A of the book describes basic probability theory, sampling distributions and hypothesis testing.

As could be expected for a book of this nature, it includes a fair amount of mathematics. Basic mathematics are not reviewed, but Appendix B does provide a very helpful review of matrices and matrix mathematics.

Each chapter uses a number of "thought exercises" which enforce the concepts described by encouraging the reader to apply the concepts to a specific example. Virtually all these exercises can be done by using pen and paper, and no computer software is required. Unfortunately, no answer key is provided.

While the exercises are very meaningful, it would have been very useful if most of these were presented in a computer-based environment. And herein lies one of the major shortcomings of the book; given that the emphasis of the book is on spatial analysis in a GIS environment, it is somewhat surprising to see that no effort was made to show how the concepts are implemented in current GIS software. Many of the concepts in the book lend themselves to GIS-based exercises, and an accompanying CD-ROM or website with such exercises would have been a very welcome addition. Even without including GIS-based exercises, the book could have benefited from using more real-world datasets as examples. With

a few notable exceptions, most of the examples use simplified and sometimes hypothetical example datasets.

A related shortcoming of the book is that no reference is made to any software that might be used to carry out the spatial analysis techniques described. When used in a course environment, this would obviously be the task of the instructor, but for others using the book as a reference it will take considerable effort to identify how GIS and related software has implemented the various techniques. Most importantly, most commercial GIS software does not include many of the statistical techniques referred to in the text, and the use of a statistical software package is pretty much a requirement for anyone who wants to carry out many of the techniques covered in the book. This is not really a weakness of the book itself, but simply the reality of how most current GIS software has been developed. An appendix describing some of the GIS and statistical software packages which are most suitable for the analytical techniques described in the book would have been helpful.

This book will be most useful as a textbook for upper level undergraduate or graduate courses in GIS; for example, a second course in GIS or a specialized course in spatial analysis. For GIS professionals or scholars with some experience in spatial analysis this book will provide a meaningful reference on a wide range of analytical techniques. While some effort is required to identify exactly how each technique is implemented in a particular GIS software package, for most skilled GIS users this should not prevent them from substantially strengthening their analysis skills by using the concepts explained in this valuable addition to the spatial analysis literature.

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