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BOOK REVIEW

Handbook of spatial point-pattern analysis in ecology, by Thorsten Wiegand and Kirk A. Moloney, Boca Raton, FL, Chapman and Hall/CRC, 2013, 538 pp., US$75.00, €78.00, £54.00 (hardback), ISBN 9781420082548

The *Handbook of Spatial Point-Pattern Analysis in Ecology* by Thorsten Wiegand and Kirk A. Moloney is an excellent, modern and detailed overview of the methods and approaches for analyzing location based-data in its geographic context. The book defines spatial point-patterns broadly, including not just point location data but also the numerous permutations where categorical or continuous variables are associated with specific locations, e.g., what would traditionally be called correlogram or variogram analysis. Spatial methods which rely on fundamentally different types of data (e.g., transects, raster surfaces or polygons) are not covered in this book. The one category of analysis which generally would be applied to point data but which is entirely absent from this text is tessellation and connection/network analysis.

One general strength of the book is the use of standardized terminology: the history of spatial analysis development has led to a multiplicity of overlapping and confusing terms. The authors use consistent, carefully worded terminology to place all of their methods into a common framework. The single problem with their approach is they fail to connect their modern terminology to the older literature. For example, in a discussion of mark-correlation functions for quantitatively marked patterns, the authors present six different test functions (labeled t_1 through t_6). They explicitly call the 4th of these functions a mark-variogram function because of its analogy to the variogram in geostatistics, but fail to note that because it is standardized by its variance in their usage, this equation is exactly equivalent to the correlogram function Geary's *c*. They call the 6th function a 'Moran's *I* type summary statistic' because it is a modification of the traditional Moran's *I* function, yet fail to note that the 5th function in their list is exactly the traditional Moran's *I* function. They never state that classic variogram or correlogram (a term which does not appear in the book even once) analyses that one might find in the literature are simply special cases of their general mark-correlation paradigm. Similarly, they fail to mention that the 'mark-connection functions' for qualitatively marked patterns are equivalent to the commonly used 'join-count analysis' techniques in the classic literature. This simple failure to tie the standardized language used in the book to that found in the historical literature can only lead to confusion when readers new to the field look at older papers; this is particularly a shame since they could have avoided this problem entirely with a simple table of terms and equivalencies.

Another strength of the text is the very explicit focus on different types of point-pattern data and the corresponding null hypotheses which need to be used to test data of that type. Of particular importance is the distinction between a bivariate point pattern and a univariate pattern with two qualitative labels. On the surface this seems to be a distinction without a difference, but as the authors point out, this distinction completely changes the null hypothesis and thus the proper procedure needed to test the significance of an observed pattern. There are numerous studies in the literature with flawed statistical

testing due to the failure to recognize this distinction. Unfortunately, it is at this point in the text (early in Chapter 2) that the structure of the book interferes a bit with clarity. The book has three main chapters: a description of the fundamentals of point-pattern analysis, a more detailed description of the mathematical estimators and tools, and a systematic collection of worked examples. These chapters are framed by a short introductory chapter and a short chapter containing a course outline for teaching these methods (as an aside, I would have completely left this final chapter out of the book; it would have been best served as an online supplement available from the publisher). While the structure makes a lot of basic sense, it ends up separating the description and details of methods across many different parts of the book which can make finding specific details quite difficult. For example, when the distinction between bivariate point pattern and multi-labeled univariate patterns was made early in the second chapter (pp. 26–38), it was obvious to me what the proper testing procedure was for the latter, but not the former. Since the proper approach was not described at this juncture, I jumped forward to the bivariate section (pp. 185–192) in the third chapter (estimators and tools), only to discover no mention whatsoever of the testing procedure. I then tried the bivariate example in the fourth chapter (pp. 361–379) to finally discover a detailed discussion of this issue. This discussion then referred back to a different part of Chapter 3 (pp. 293–297) which (after looking up a key term in the index) eventually lead back to pages 276–279 where the appropriate method is finally actually described in detail. This is just a single example of needing to jump back and forth between disparate sections of the book (occasionally with nonobvious headers) to find the necessary details about a method of interest.

Despite these (and other more nitpicky) issues, this truly is an excellent book on point-pattern analysis and should serve as a major reference work in the field for a long time to come.

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