Book Review

STATISTICAL ANALYSIS OF fMRI DATA

by F. Gregory Ashby, 332 pp., MIT Press, 2011, \$45

fMRI is an increasingly popular research tool, with new methods of analysis published yearly. The analysis of fMRI data is complicated, with multiple variables to consider and several potential sources of error. Without guidance, novices may become overwhelmed trying to prioritize and review a vast number of publications covering different aspects of fMRI. There is an increasing need for a concise but thorough introduction to the field of fMRI analysis.

Statistical Analysis of fMRI Data is not a textbook for clinicians looking to interpret their patients' fMRI results. Rather, it aims to introduce new researchers with some background in statistics to the process of analyzing fMRI data. Dr. Ashby is the former Director of the Brain Imaging Center at the University of California, Santa Barbara, and has taught graduate-level statistics to people of various mathematical backgrounds for more than 25 years. He not only has expertise in the field of fMRI, but also in teaching complex statistical concepts to a broad audience. Dr. Ashby's book contains elegant, precise prose and well-explained mathematical formulations, MATLAB code, and graphs to introduce novices to this highly technical field.

In 12 chapters, the book covers both basic and more advanced analytic techniques. The first chapters review analytic processes common to almost all forms of fMRI data analysis, including data formats, different models of the blood oxygen level-dependent response, preprocessing, the General Linear Model, the multiple comparisons problem, and applications of these techniques to group data. The rest of the book covers

more recent and advanced techniques, including functional connectivity and multivariate approaches, as well as a brief introduction to other advanced methods. For those who lack advanced mathematical training, 2 appendices cover the basics of matrix algebra and multivariate probability distributions.

Rather than delving into technical details, Dr. Ashby focuses on the strengths and weaknesses of various methodologies, providing researchers with a precise understanding of the logic behind every step in their analysis. *Statistical Analysis of fMRI Data* manages sophisticated statistical concepts by providing an overview for readers without extensive mathematical backgrounds while occasionally going into greater detail for those with more training. This is a difficult balance that ultimately ensures there is something to be learned in this text for all readers and that most readers will likely continue to learn on a second reading.

In short, *Statistical Analysis of fMRI Data* provides a clear, concise overview of fMRI data analysis. The text provides pertinent examples as well as MATLAB code for those with the interest and ability to learn by doing. While certain advanced concepts will be difficult for some readers, the book ensures that everyone gets an introduction to different approaches to fMRI analysis and provides guidance for further learning. While most accessible to those with higher mathematical training, *Statistical Analysis of fMRI Data* will serve as an excellent guide to anyone interested in becoming involved with fMRI research.

Reviewed by Peter Pressman, MD

Disclosure: Dr. Pressman serves on the editorial team for the *Neurology*[®] Resident & Fellow Section.

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