BOOK REVIEW
MATLAB for Neuroscientists: An Introduction to Scientific Computing in MATLAB (second edition)

By Pascal Wallisch, Michael E. Lusignan, Marc D. Benayoun, Tanya I. Baker, Adam Seth Dickey, Nicholas G. Hatsopoulos
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This ambitious work covers a broad range of topics from basic programming to fairly advanced and involved data analyses and neural modeling using MATLAB. Each chapter is laid out with a brief explanatory text and then presents the material directly relevant to using MATLAB, including lines of code. All the chapters were readable but not always well-worded. The book is laid out into four sections: Fundamentals, Data Collection with MATLAB, Data analysis with MATLAB, and Data modeling with MATLAB.

The Fundamentals section includes a chapter on principles and best practices in writing code and discusses the rudiments of programming including common pitfalls. The Fundamentals section also includes a chapter on manipulating matrices, linear algebra, and statistics. The latter was not a very accessible treatment of some pretty simple ideas. Nonetheless, I appreciated this first section the most and felt that the material presented in this section of the book could be of some value to undergraduates seeking to tackle MATLAB programming as well as faculty who were beginning to employ this valuable tool.

The Data Collection section included some chapters on topics that would be of interest to many undergraduate instructors of behavioral neuroscience laboratories or perceptual neuroscience. Topics covered in this section include MATLAB application for visual search, reaction times, psychophysics, and signal detection theory. These chapters provided some valuable resources and models for building one's own scripts.

The Data Analysis section addressed some topics that will be familiar to most neuroscientists such as neural encoding, analyzing binned spike data, and local field potentials. This section also introduced a higher level of complexity conceptually and certainly higher mathematics. For example, chapters in this section employ Fourier analyses and principle component analysis, which may be well beyond most undergraduates. Other chapters deal with phase plane analysis and the Fitzhugh-Nagumo model. If you don't like differential equations, you won't like these chapters. The chapter on Convolution gets into integrals and does a nice bit of coding for Mach bands and the Mexican hat function, which visual neuroscientists will appreciate. The chapter on fMRI is fairly good, but really requires that the reader be fairly steeped in this field for it to make sense—this also could be said of most of the chapters in this section.

The final section in the book addresses data modeling with MATLAB. These chapters were shorter on explanation and longer on examples of code that would lead to the desired result. Some of the topics addressed might help undergraduates apprehend material more readily if they were presented as already-done-models or if the students themselves had to write the code. This is particularly true for modeling voltage gated ion channels, synaptic transmission, a simplified model of a spiking neuron, and modeling the retina—although one needed to be fairly conversant with electrophysiology in order to understand most of these chapters. Other chapters employed MATLAB as applications for decision theory, neural networks as forest fires, and neural networks in supervised and unsupervised learning. These latter chapters might prove valuable in an undergraduate course on neural networks. Other chapters in this section dealt with more esoteric topics such as the Wilson-Cowan equations, modeling spike trains as Poisson processes, and the Markov model, which they apply to an analysis of birdsong. More than likely, most of the material in this last section would be over the heads of most undergraduates. The math alone would send them screaming toward a major in humanities.

Some aspects of this book were surprisingly inadequate. First, and probably most importantly, there is no mention made of Octave, which is the open-access version of MATLAB that is freely available and can run most MATLAB scripts. Secondly, problem sets are provided but there are no solutions presented in the book. Rather, solutions are available only on the companion website to which I did not have access. The website promises special resources for instructors, however. The text says that the website will be maintained as long as the book is in print, so purchasers will have to hope that sales will be good (the book is in the second edition).

This book will be a handy resource for instructors of neuroscience, particularly those interested in more intense data analysis and/or neural modeling. As a whole, this book is an appropriate text for an advanced graduate course, but not for undergraduates. Undergraduates might benefit from the fundamentals subsection, but most of this book would be over their heads unless they were at MIT or some equivalent institution. In some highly specialized courses such as neural networks, advanced undergraduates could find this text useful, but in general its utility as an undergraduate text is slight. This book's greatest value to faculty teaching undergraduate

neuroscience and perceptual neuroscience will be as a reference text for their own use.

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