Book Reviews

Introduction to Artificial Neural Systems—Jacek M. Zurada (St. Paul, MN: West Publishing Company, 1992, 783 pp., hardbound, $40.00). *Reviewed by Robert W. Newcomb.*

The good news is that *Introduction to Artificial Neural Systems* is now available. This book has long been awaited by those of us teaching artificial neural networks from an engineering viewpoint, something in which this book excels.

The level of the book is suitable for senior undergraduate students as well as beginning graduate students. Although a reader with some engineering knowledge can study any chapter on its own, the real advantage of this book is its logical coherency and flow of chained ideas from the beginning to the end of the book. For that reason it is ideal for the senior students to whom it is addressed.

There are nine chapters with associated examples, problems, and references as well as nine appendices. In order to best indicate the contents of the book it seems appropriate to list the chapters by title and length while also giving an indication of the ideas of the chapter. The chapter titles are:

1) Artificial Neural Systems: Preliminaries (24 pp.)
   This gives an overview of artificial neural networks (ANN's) giving some of the main ideas to be covered in detail later and defining some terms to be used throughout. Also it contains a small amount of historical and future outlook.
2) Fundamental Concepts and Models of Artificial Neural Systems (66 pp.)
   Contained in this chapter are several key learning rules which are nicely summarized in a table (2.1) along with a table (2.2) classifying over a dozen architectures to be covered in the text.
3) Single-Layer Perceptron Classifiers (69 pp.)
   Here training and optimization aspects are introduced with some nice error function plots illustrating the concepts.
4) Multilayer Feedforward Networks (87 pp.)
   In this chapter, learning is expanded upon and error back-propagation introduced including for it a useful flowchart, Fig. 4.8.
5) Single-Layer Feedback Networks (61 pp.)
   This chapter introduces dynamical systems concepts and associated energy functions for evolving ANN's. The mathematical treatment while not overly deep is appropriate to the level of the intended audience.
6) Associative Memories (75 pp.)
   Various associator types (linear, recurrent, bidirectional, multidirectional) are introduced with recurrent autoasspciative ones given considerable emphasis.
7) Matching and Self-Organizing Networks (64 pp.)
   The Hamming and Max nets are used to introduce unsupervised learning and then lead into feature mapping, counterpropagation, self-organization, and ART1 (which is summarized in flowchart, Fig. 7.24, and algorithmic steps).
8) Applications of Neural Algorithms and Systems (108 pp.)
   Six different sections of examples are covered (linear programming, character recognition, control and robotics [process identification, inverted pendulum and robot neurocontrollers, CMAC, target position determination], medical diagnosis [skin disease, low back pain, coronary occlusion], semantic relation extraction). Although none are covered in extreme depth, most are treated in enough detail to show a student how one can apply many of the concepts of earlier chapters to meaningful situations.
9) Neural Networks Implementation (118 pp.)
   Electronic circuits are introduced for the hardware realization of the ANN's covered in previous chapters. This begins with the use of resistor-op-amp circuits for the realization of neurons and continues with some CMOS options and CMOS associative memory implementations. This chapter gives a flavor for implementations leading to the further study that would be needed to make practical systems in hardware.

Most of the appendices are short, the first seven essentially being mathematical background all with nice examples. The last appendix gives a listing of the key statements for a TurboPascal program; a full listing with include statements, etc., along with a compiled version and data, include, and help files is available from the publisher. Although useful, the program disk could be made more user friendly by some instructions to the user on how to proceed. It is my understanding, though, that the disk is primarily intended for instructor use and not for general circulation.

By way of comparison with other recent textbooks that one may consider for a course, Zurada's book is the only one I consider to be engineering design oriented; it is less abstract than B. Kosko's, *Neural Networks and Fuzzy Systems: A Dynamical Systems Approach to Machine Intelligence*, less biologically motivated than J. E. Dayhoff's, *Neural Network Architectures An Introduction*, and broader in scope that C. Mead's *Analog VLSI and Neural Systems*. From my experience in using the manuscript verison over two semesters I have found it to be excellent in building up students' background so that they can go on to study papers in the literature, such as those collected in the recent IEEE Press book *Artificial Neural Networks Paradigms, Applications, and Hardware Implementations*, edited by E. Sanchez-Sinencio and C. Lau.

In summary this book treats what are becoming known as "artificial neural networks" in a coherent treatment starting with basic notions and ending with using them in a number of applications. As such it fulfills its purpose of being written as a text for a one semester course at the senior level, primarily for engineering and computer science oriented students. Because it assumes very little background and has a large number of worked examples and end-of-chapter problems and references it is also suitable for self-study and as a reference for entry into digesting the technical journal literature, especially that which is engineering design oriented.

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Books in Brief

Neural Networks in Pattern Recognition and Their Applications—C. H. Chen, Ed. (Singapore: World Scientific, 1991, 159 pp., hardbound, $38.00, ISBN 981–02–0766–2).

This book is a collection of papers based on those presented at the 10th International Conference on Pattern Recognition held at

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