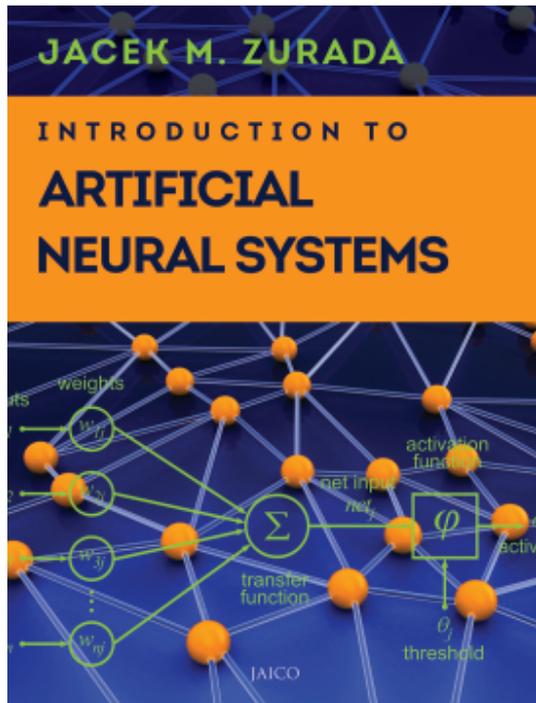


# INTRODUCTION TO ARTIFICIAL NEURAL SYSTEMS

Jacek M. Zurada



Newly developed paradigms of artificial neural networks have strongly contributed to the discovery, understanding and utilization of potential functional similarities between human and artificial information processing systems. Intense research interest persists and the area continues to develop.

Artificial neural systems or neural networks are physically cellular systems which can acquire, store and utilize experimental knowledge. This book focuses on the foundations of such networks. The fundamentals of artificial neural systems theory, algorithms for information acquisition and retrieval examples of applications, and implementations issues are also included.

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## KEY FEATURES

- The book uses mathematical exposition at the depth, essential for artificial neural systems implementation and simulation
- Unified and pedagogical approaches have been used for better understanding of the complex subject by the readers
- Author presents an integrated perspective to blend interdisciplinary aspects of this discipline and also link the approaches and terminologies among them
- The end-of-chapter problems focus on enhancing the understanding of principles

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1. Artificial Neural Systems: Preliminaries
2. Fundamental Concepts and Models of Artificial Neural Systems
3. Single-Layer Perceptron Classifiers
4. Multilayer Feedforward Networks
5. Single-Layer Feedback Networks
6. Associative Memories
7. Matching and Self-Organizing Networks
8. Applications of Neural Algorithms and Systems
9. Neural Networks Implementation

Introduction. In part 1 we were introduced to what artificial neural networks are and we learnt the basics on how they can be used to solve problems. In this tutorial we will begin to find out how artificial neural networks can learn, why learning is so useful and what the different types of learning are. We will specifically be looking at training single-layer perceptrons with the perceptron learning rule. You may recall from the previous tutorial that artificial neural networks are inspired by the biological nervous system, in particular, the human brain. One of the most interesting characteristics of the human brain is its ability to learn. We should note that our understanding of how exactly the brain does this is still very primitive, although we do still have a basic understanding of the process.

Introduction to Artificial Neural Systems. JACEK M. ZURADA Professor of Electrical Engineering and of Computer Science and Engineering. Neural Systems 25 Biological Neurons and Their Artificial Models 26 Biological Neuron 27 McCulloch-Pitts Neuron Model 30 Neuron Modeling for Artificial Neural Systems 31 Models of Artificial Neural Networks 37 Feedforward Network 37 Feedback Network 42 Neural Processing 53 Learning and Adaptation 55 Learning as Approximation or Equilibria Encoding 55 Supervised and Unsupervised Learning 56 Neural Network Learning Rules 59 Hebbian Learning.