

Chapters 2–7 make up Part II of the book: artificial neural networks. After introducing the basic concepts of neurons and artificial neuron learning rules in Chapter 2, Chapter 3 describes a particular formalism, based on signal-plus-noise, for the learning problem in general. After presenting the basic neural network types this chapter reviews the principal algorithms for error function minimization/optimization and shows how these learning issues are addressed in various supervised models. Chapter 4 deals with issues in unsupervised learning networks, such as the Hebbian learning rule, principal component learning, and learning vector quantization. Various techniques and learning paradigms are covered in Chapters 3–6, and especially the properties and relative merits of the multilayer perceptron networks, radial basis function networks, self-organizing feature maps and reinforcement learning are discussed in the respective four chapters. Chapter 7 presents an in-depth examination of performance issues in supervised learning, such as accuracy, complexity, convergence, weight initialization, architecture selection, and active learning.

Par III (Chapters 8–15) offers an extensive presentation of techniques and issues in evolutionary computing. Besides the introduction to the basic concepts in evolutionary computing, it elaborates on the more important and most frequently used techniques on evolutionary computing paradigm, such as genetic algorithms, genetic programming, evolutionary programming, evolutionary strategies, differential evolution, cultural evolution, and co-evolution, including design aspects, representation, operators and performance issues of each paradigm. The differences between evolutionary computing and classical optimization are also explained.

Part IV (Chapters 16 and 17) introduces swarm intelligence. It provides a representative selection of recent literature on swarm intelligence in a coherent and readable form. It illustrates the similarities and differences between swarm optimization and evolutionary computing. Both particle swarm optimization and ant colonies optimization are discussed in the two chapters, which serve as a guide to bringing together existing work to enlighten the readers, and to lay a foundation for any further studies.

Part V (Chapters 18–21) presents fuzzy systems, with topics ranging from fuzzy sets, fuzzy inference systems, fuzzy controllers, to rough sets. The basic terminology, underlying motivation and key mathematical models used in the field are covered to illustrate how these mathematical tools can be used to handle vagueness and uncertainty.

This book is clearly written and it brings together the latest concepts in computational intelligence in a friendly and complete format for undergraduate/postgraduate students as well as professionals new to the field. With about 250 pages covering such a wide variety of topics, it would be impossible to handle everything at a great length. Nonetheless, this book is an excellent choice for readers who wish to familiarize themselves with computational intelligence techniques or for an overview/introductory course in the field of computational intelligence.

Learning with Kernels: Support Vector Machines, Regularization, Optimization, and Beyond—Bernhard Schölkopf and Alexander Smola, (MIT Press, Cambridge, MA, 2002, ISBN 0-262-19475-9). Reviewed by Amir F. Atiya.

This book is a comprehensive treatment of the topics of support vector machines (SVMs) and kernel methods. SVMs and kernel methods are learning models that have been proposed by Vapnik around 1994. Since then they attracted a lot of research interest and hundreds of articles appeared on them. This book is an advanced treatment of the subject. The authors, Bernhard Schölkopf and Alexander Smola are well-known researchers that contributed significantly to the development of SVMs. The book is intended for the researcher who already has information about the subject and would like to gain depth into the topic. It is not recommended for the starter who wishes to learn SVMs from scratch. For such reader other more introductory texts are more appropriate.

The book is partitioned into three parts. The first part, entitled “Concepts and Tools,” describes general mathematical background and general theory about the kernel methods. It describes the background of kernel methods as was developed in the functional analysis and statistics areas (I found this connection useful as it is often overlooked). It describes the loss functions in a very comprehensive manner. It analyzes the regularization problem, and reviews statistical learning theory with the VC bounds etc. The last section is a good in-depth review of optimization theory, especially quadratic optimization which is the main solution tool for designing SVMs.

The second part of the book, entitled “Support Vector Machines,” describes the core subjects of the book. It describes in detail the application of SVMs in pattern classification, and in regression. It considers quantile estimation and novelty detection (a tool that can be used for clustering and dimensionality reduction). A section on implementation is added that describes tricks and techniques to speed up the optimization. Another section deals with incorporating invariances, and finally the connection with PAC-based bounds and with leave-one-out estimates is explored.

The third and last part of the book, entitled “Kernel Methods,” describes more analysis into ways to design kernels, as well as novel applications of kernel methods. Examples are feature extraction, discriminant functions, principal components and nonlinear dimensionality reduction, and reduced set methods. Each of these topics covers a section. In addition Bayesian kernel methods are described.

In short, this book is a very detailed and comprehensive book. It not only covers the fundamentals of kernel methods and SVM, but also the majority of the variants that appeared on these subjects. So in a sense it will be very useful for researchers working on that topic. The extensive bibliography (more than 600 references) also helps in that regards. I hope that the authors update the book periodically to reflect the growing research in the field.

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