Preface

The purpose of this book is to cover a broad range of topics relevant to computer-assisted techniques for biomedical decision making. The book consists of three parts: neural networks, artificial intelligence, and alternative approaches. Part I provides a basis for understanding the theoretical and practical approaches to the development of neural network models and their implementation in modeling biological systems. At each stage, theoretical techniques are presented, followed by algorithmic development and application to specific problems in biomedicine. The objective is to allow the reader to see how each technique works in practice. A broad range of neural network techniques and learning algorithms are discussed. At the end of Part I, comparative analyses of different approaches are given. Part II addresses topics in artificial intelligence and their applicability to problems in biomedicine. Topics include knowledge-based acquisition and representation, knowledge-based systems, and searching strategies. Part III deals with other methodologies, including genetic algorithms, probabilistic systems, fuzzy systems, and hybrid systems in which two or more techniques are combined. The concluding chapters include a case study, analysis of the symbolic versus the numerical approach, and future perspectives. The exercises range from straightforward problems that measure comprehension of basic concepts to more challenging problems that permit the development of practical models using the theoretical techniques. In addition to the exercises in the book, problems related to each chapter in the text that can be solved using the MATLAB software package are available by FTP. If you have web access, use ftp://ftp.ieee.org/uploads/press/Hudson. If you are using an ftp command,

ftp ftp.ieee.org
login: anonymous
password: (your email address)
cd uploads/press/Hudson.

Although a number of published texts describe decision-making strategies, this book focuses on the use of these methods in conjunction with medical and biological data and the unique problems they pose. The book is intended for upper division or

graduate students in medical informatics, biomedical engineering, and allied fields, as well as for researchers who require an up-to-date and broad-based overview of the field. Extensive references are included to relevant literature, allowing the student or researcher to investigate specific topics in depth.

This book can be used in a number of ways for different course structures. Part I can be used on its own for a one-quarter graduate or one-semester undergraduate course on neural networks. Part II can be used similarly for an artificial intelligence course. The entire book is appropriate for a full-year (three-quarter or two-semester) graduate course on decision-support strategies at an upper division or graduate level. For a general one-quarter or one-semester overview course, topics can be selected from each section. A sample course could include Part I: Overview, Chapters 1–3; Part II: Chapters 9–10; and Part III: Chapters 14–17. In addition, within each chapter, depending on the level of sophistication, the mathematical treatment and algorithm development can initially be omitted.

The book is intended to give a broad overview of the complex area of decision-support systems and their uses in medicine and biology. It contains sufficient theoretical material to provide a deep understanding of the techniques involved. For researchers in the field, the book is an important tool for initiating in-depth studies on specific topics, hopefully producing new and interesting theoretical and practical developments.

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