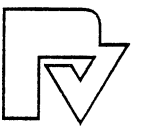
Innovative Teaching and Learning



Studies in Fuzziness and Soft Computing

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Lakhmi C. Jain (Editor)

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With 121 Figures
and 18 Tables

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Dedication

This book is dedicated to all my students

L.C. Jain

Preface

The engineers and scientists of tomorrow require a valid image of science and its interactions with technology and society to enable them to take an active informed role in society. Today's educational institutions are presented with the challenge of exposing students to ever-widening domains. Not only do mathematical techniques need to be addressed, but also computing techniques, and environmental and management aspects.

In the engineering field in particular, the rate of obsolescence is so high that curricula must be revised and updated much more frequently than ever before.

Traditional teaching methods cannot cope with this challenge, and hence there is a need to develop more effective teaching and learning strategies.

This book presents innovative teaching and learning techniques for the teaching of knowledge-based paradigms. The main knowledge-based intelligent paradigms are expert systems, artificial neural networks, fuzzy systems and evolutionary computing. Expert systems are designed to mimic the performance of biological systems. Artificial neural networks can mimic the biological information processing mechanism in a very limited sense. Evolutionary computing algorithms are used for optimization applications, and fuzzy logic provides a basis for representing uncertain and imprecise knowledge.

The first chapter, by Tedman and Jain, presents an introduction to innovative teaching and learning. A valid image of the nature of the interaction between science, technology and society is presented.

Chapter 2, by Lee and Liu, is on teaching and learning the AI modeling. Authors have presented their study into teaching tools to help learning and understanding the concepts of neural networks, fuzzy systems and genetic algorithms.

Chapter 3, by Karr, Sunal and Smith, describes an innovative course developed and taught at The University of Alabama, U.S.A. for students attending the College of Education. This course presents an overview of artificial intelligence (AI) techniques including expert systems, fuzzy systems, neural networks, and genetic algorithms. Its goal is to provide future educators with enough information about the science of the twenty-first century to effectively educate and motivate, their future students.

Chapter 4, by Vega-Riveros, presents the architecture of an intelligent tutoring system for a neural networks course. A new intelligent tutoring system architecture using collaborating agents is proposed.

Chapter 5, by Devedžić, focuses on teaching knowledge modeling. It presents a survey of knowledge modeling techniques that are taught at the School of Business Administration and the School of Electrical Engineering University of Belgrade, Yugoslavia. Theoretical and architectural concepts, design approaches, and research issues of various knowledge modeling techniques used in the class room are discussed.

Chapter 6, by Devedžić, Radović and Jerinić, is devoted to innovative modeling techniques for intelligent tutoring systems. The inclusion of three modeling techniques in teaching environment are included.

Chapter 7, by Fulcher, is concerned with a teaching course on artificial neural networks. A key component of this course is the use of artificial neural networks simulator to undertake laboratory assignments. The visualization of key neural network parameters via the simulator has been found to significantly aid the students' learning process.

Chapter 8, by Hiyama, introduces an innovative education for fuzzy logic stabilization of electric power systems. Matlab/Simulink based transient stability simulation programs for multi-machine power systems are introduced. The programs are used to teach fuzzy logic stabilization of electric power systems as well in the development of generator controllers using fuzzy logic and neural networks.

Chapter 9, by Goh and Amarasinghe, describes a neural network workbench for teaching and learning. The workbench permits to create, train and test various neural network algorithms. One unique feature of this workbench is the use of real time displays for tracking progress when training a neural network.

The final chapter, by Higgins and Mansouri, outlines a coursework system for the automatic assessment of AI programs. The system usefully assesses students' work, improve learning, and allows the marking and assessment of students' progress while learning a particular programming language.

This book will be useful to professors, researchers, scientists, practicing engineers and students who wish to develop successful learning and teaching tools for the teaching of knowledge-based paradigms.

I wish to express my thanks to Berend Jan van der Zwaag and Ashlesha Jain, for their assistance in the preparation of the manuscript. I am grateful to the authors for their contributions. I also thank Professor Janusz Kacprzyk for the opportunity to publish this book, and the Springer-Verlag Company for their excellent editorial assistance.

L.C. Jain, Australia

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