

## Chapter 7 Artificial Neural Networks And Their Applications

Artificial neural networks and genetic algorithms both are areas of research which have their origins in mathematical models constructed in order to gain understanding of important natural processes. By focussing on the process models rather than the processes themselves, significant new computational techniques have evolved which have found application in a large number of diverse fields. This diversity is reflected in the topics which are subjects of the contributions to this volume. There are contributions reporting successful applications of the technology to the solution of industrial/commercial problems. This may well reflect the maturity of the technology, notably in the sense that 'real' users of modelling/prediction techniques are prepared to accept neural networks as a valid paradigm. Theoretical issues also receive attention, notably in connection with the radial basis function neural network. Contributions in the field of genetic algorithms reflect the wide range of current applications, including, for example, portfolio selection, filter design, frequency assignment, tuning of nonlinear PID controllers. These techniques are also used extensively for

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combinatorial optimisation problems.

The material presented in this book addresses the analysis and design of learning control systems. It begins with an introduction to the concept of learning control, including a comprehensive literature review. The text follows with a complete and unifying analysis of the learning control problem for linear LTI systems using a system-theoretic approach which offers insight into the nature of the solution of the learning control problem. Additionally, several design methods are given for LTI learning control, incorporating a technique based on parameter estimation and a one-step learning control algorithm for finite-horizon problems. Further chapters focus upon learning control for deterministic nonlinear systems, and a time-varying learning controller is presented which can be applied to a class of nonlinear systems, including the models of typical robotic manipulators. The book concludes with the application of artificial neural networks to the learning control problem. Three specific ways to neural nets for this purpose are discussed, including two methods which use backpropagation training and reinforcement learning. The appendices in the book are particularly useful because they serve as a tutorial on artificial neural networks.

Due to the complexity and non-linearity of most ecological problems, artificial neural networks (ANNs) have attracted attention from ecologists and

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environmental scientists in recent years. As these networks are increasingly being used in ecology for modeling, simulation, function approximation, prediction, classification and data mining, this unique and self-contained book will be the first comprehensive treatment of this subject, by providing readers with overall and in-depth knowledge on algorithms, programs, and applications of ANNs in ecology. Moreover, a new area of ecology, i.e., computational ecology, is proposed and its scopes and objectives are defined and discussed. Computational Ecology consists of two parts: the first describes the methods and algorithms of ANNs, interpretability and mathematical generalization of neural networks, Matlab neural network toolkit, etc., while the second provides case studies of applications of ANNs in ecology, Matlab codes, and comparisons of ANNs with conventional methods. This publication will be a valuable reference for research scientists, university teachers, graduate students and high-level undergraduates in the areas of ecology, environmental sciences, and computational science.

Artificial neural networks (ANNs) present many benefits in analyzing complex data in a proficient manner. As an effective and efficient problem-solving method, ANNs are incredibly useful in many different fields. From education to medicine and banking to engineering, artificial neural networks are a growing phenomenon

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as more realize the plethora of uses and benefits they provide. Due to their complexity, it is vital for researchers to understand ANN capabilities in various fields. The Research Anthology on Artificial Neural Network Applications covers critical topics related to artificial neural networks and their multitude of applications in a number of diverse areas including medicine, finance, operations research, business, social media, security, and more. Covering everything from the applications and uses of artificial neural networks to deep learning and non-linear problems, this book is ideal for computer scientists, IT specialists, data scientists, technologists, business owners, engineers, government agencies, researchers, academicians, and students, as well as anyone who is interested in learning more about how artificial neural networks can be used across a wide range of fields.

This book provides comprehensive coverage of neural networks, their evolution, their structure, the problems they can solve, and their applications. The first half of the book looks at theoretical investigations on artificial neural networks and addresses the key architectures that are capable of implementation in various application scenarios. The second half is designed specifically for the production of solutions using artificial neural networks to solve practical problems arising from different areas of knowledge. It also describes the various implementation

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details that were taken into account to achieve the reported results. These aspects contribute to the maturation and improvement of experimental techniques to specify the neural network architecture that is most appropriate for a particular application scope. The book is appropriate for students in graduate and upper undergraduate courses in addition to researchers and professionals. Artificial neural networks are most suitable for solving problems that are complex, ill-defined, highly nonlinear, of many and different variables, and/or stochastic. Such problems are abundant in medicine, in finance, in security and beyond. This volume covers the basic theory and architecture of the major artificial neural networks. Uniquely, it presents 18 complete case studies of applications of neural networks in various fields, ranging from cell-shape classification to micro-trading in finance and to constellation recognition — all with their respective source codes. These case studies demonstrate to the readers in detail how such case studies are designed and executed and how their specific results are obtained. The book is written for a one-semester graduate or senior-level undergraduate course on artificial neural networks. It is also intended to be a self-study and a reference text for scientists, engineers and for researchers in medicine, finance and data mining. Contents: Introduction and Role of Artificial Neural Networks Fundamentals of Biological Neural Networks Basic Principles of ANNs

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and Their Early Structures  
The Perceptron  
The Madaline  
Back Propagation  
Hopfield Networks  
Counter Propagation  
Large Scale Memory Storage and Retrieval (LAMSTAR)  
Network  
Adaptive Resonance Theory  
The Cognitron and the Neocognitron  
Statistical Training  
Recurrent (Time Cycling) Back Propagation  
Networks  
Readership: Graduate and advanced senior students in artificial intelligence, pattern recognition & image analysis, neural networks, computational economics and finance, and biomedical engineering.

Keywords: Neural Networks; Mathematical Derivations; Source Codes; Medical Applications; Data Mining; Cell-Shape Recognition; Micro-Trading

1.1 Overview We are living in a decade recently declared as the "Decade of the Brain". Neuroscientists may soon manage to work out a functional map of the brain, thanks to technologies that open windows on the mind. With the average human brain consisting of 15 billion neurons, roughly equal to the number of stars in our milky way, each receiving signals through as many as 10,000 synapses, it is quite a view. "The brain is the last and greatest biological frontier", says James Weston codiscoverer of DNA, considered to be the most complex piece of biological machinery on earth. After many years of research by neuroanatomists and neurophysiologists, the overall organization of the brain is well understood, but many of its detailed neural mechanisms remain to be

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decoded. In order to understand the functioning of the brain, neurobiologists have taken a bottom-up approach of studying the stimulus-response characteristics of single neurons and networks of neurons, while psychologists have taken a top-down approach of studying brain functions from the cognitive and behavioral level. While these two approaches are gradually converging, it is generally accepted that it may take another fifty years before we achieve a solid microscopic, intermediate, and macroscopic understanding of brain.

"This book is the first book to provide opportunities for millions working in economics, accounting, finance and other business areas education on HONNs, the ease of their usage, and directions on how to obtain more accurate application results. It provides significant, informative advancements in the subject and introduces the HONN group models and adaptive HONNs"--Provided by publisher.

This book provides an approach toward the applications and principle theory of digital signal processing in modern intelligent systems, biological engineering, telecommunication, and information technology. Assuming the reader already has prior knowledge of signal processing theory, this book will be useful for finding novel methods that fit special needs in digital signal processing (DSP). The combination of signal processing and intelligent systems in hybrid structures

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rather than serial or parallel processing provide the best mechanism that is a better fit with the comprehensive nature of human. This book is a practical reference that places the emphasis on principles and applications of DSP in digital systems. It covers a broad area of digital systems and applications of machine learning methods including convolutional neural networks, evolutionary algorithms, adaptive filters, spectral estimation, data compression and functional verification. The level of the book is ideal for professional DSP users and useful for graduate students who are looking for solutions to their design problems. The theoretical principles provide the required base for comprehension of the methods and application of modifications for the special needs of practical projects.

“This book is a splendid and valuable addition to this subject. The whole book is well written and I have no hesitation to recommend that this can be adapted as a textbook for graduate courses in Business Intelligence and Data Mining.” Dr. Edi Shivaji, Des Moines, Iowa “As a complete novice to this area just starting out on a MBA course I found the book incredibly useful and very easy to follow and understand. The concepts are clearly explained and make it an easy task to gain an understanding of the subject matter.” -- Mr. Craig Domoney, South Africa. Business Intelligence and Data Mining is a conversational and informative book



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in the exploding area of Business Analytics. Using this book, one can easily gain the intuition about the area, along with a solid toolset of major data mining techniques and platforms. This book can thus be gainfully used as a textbook for a college course. It is also short and accessible enough for a busy executive to become a quasi-expert in this area in a couple of hours. Every chapter begins with a case-let from the real world, and ends with a case study that runs across the chapters.

Following the intense research activities of the last decade, artificial neural networks have emerged as one of the most promising new technologies for improving the quality of healthcare. Many successful applications of neural networks to biomedical problems have been reported which demonstrate, convincingly, the distinct benefits of neural networks, although many of these have only undergone a limited clinical evaluation. Healthcare providers and developers alike have discovered that medicine and healthcare are fertile areas for neural networks: the problems here require expertise and often involve non-trivial pattern recognition tasks - there are genuine difficulties with conventional methods, and data can be plentiful. The intense research activities in medical neural networks, and allied areas of artificial intelligence, have led to a substantial body of knowledge and the introduction of some neural systems into

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clinical practice. An aim of this book is to provide a coherent framework for some of the most experienced users and developers of medical neural networks in the world to share their knowledge and expertise with readers.

With the growing complexity of pattern recognition related problems being solved using Artificial Neural Networks, many ANN researchers are grappling with design issues such as the size of the network, the number of training patterns, and performance assessment and bounds. These researchers are continually rediscovering that many learning procedures lack the scaling property; the procedures simply fail, or yield unsatisfactory results when applied to problems of bigger size. Phenomena like these are very familiar to researchers in statistical pattern recognition (SPR), where the curse of dimensionality is a well-known dilemma. Issues related to the training and test sample sizes, feature space dimensionality, and the discriminatory power of different classifier types have all been extensively studied in the SPR literature. It appears however that many ANN researchers looking at pattern recognition problems are not aware of the ties between their field and SPR, and are therefore unable to successfully exploit work that has already been done in SPR. Similarly, many pattern recognition and computer vision researchers do not realize the potential of the ANN approach to solve problems such as feature extraction, segmentation, and object recognition.

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The present volume is designed as a contribution to the greater interaction between the ANN and SPR research communities.

During the 1980s and early 1990s there was significant work in the design and implementation of hardware neurocomputers. Nevertheless, most of these efforts may be judged to have been unsuccessful: at no time have hardware neurocomputers been in wide use. This lack of success may be largely attributed to the fact that earlier work was almost entirely aimed at developing custom neurocomputers, based on ASIC technology, but for such niche - cases this technology was never sufficiently developed or competitive enough to justify large-scale adoption. On the other hand, gate-arrays of the period mentioned were never large enough nor fast enough for serious artificial-neural-network (ANN) applications. But technology has now improved: the capacity and performance of current FPGAs are such that they present a much more realistic alternative.

Consequently neurocomputers based on FPGAs are now a much more practical proposition than they have been in the past. This book summarizes some work towards this goal and consists of 12 papers that were selected, after review, from a number of submissions. The book is nominally divided into three parts: Chapters 1 through 4 deal with foundational issues; Chapters 5 through 11 deal with a variety of implementations; and Chapter 12 looks at the lessons learned

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from a large-scale project and also reconsiders design issues in light of current and future technology.

Sponsored by the Committee on Expert Systems and Artificial Intelligence of the Technical Council on Computer Practices of ASCE. This report illustrates advanced methods and new developments in the application of artificial neural networks to solve problems in civil engineering. Topics include: evaluating new construction technologies; using multi-layered artificial neural network architecture to overcome problems with conventional traffic signal control systems; increasing the computational efficiency of an optimization model; predicting carbonation depth in concrete structures; detecting defects in concrete piles; analyzing pavement systems; using neural network hybrids to select the most appropriate bidders for a construction project; and predicting the Energy Performance Index of residential buildings. Many of the ideas and techniques discussed in this book cross across disciplinary boundaries and, therefore, should be of interest to all civil engineers.

Prepared by the Water Supply Engineering Technical Committee of the Infrastructure Council of the Environmental and Water Resources Institute of ASCE. This report examines the application of artificial neural network (ANN) technology to water supply engineering problems. Although ANN has rarely been

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used in in this area, those who have done so report findings that were beyond the capability of traditional statistical and mathematical modeling tools. This report describes the availability of diverse applications, along with the basics of neural network modeling, and summarizes the experiences of groups of researchers around the world who successfully demonstrated significant benefits from using ANN technology in water supply engineering. Topics include: Forecasting salinity levels in River Murray, South Australia; Predicting gastroenteritis rates and waterborne outbreaks; Modeling pH levels in a eutrophic Middle Loire River, France; and ANNs as function approximation tools replacing rigorous mathematical simulation models for analyzing water distribution networks. This book focuses on forecasting foreign exchange rates via artificial neural networks (ANNs), creating and applying the highly useful computational techniques of Artificial Neural Networks (ANNs) to foreign-exchange rate forecasting. The result is an up-to-date review of the most recent research developments in forecasting foreign exchange rates coupled with a highly useful methodological approach to predicting rate changes in foreign currency exchanges.

This two-volume proceedings compilation is a selection of research papers presented at the ICANN-92. The scope of the volumes is interdisciplinary, ranging from the

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minutiae of VLSI hardware, to new discoveries in neurobiology, through to the workings of the human mind. USA and European research is well represented, including not only new thoughts from old masters but also a large number of first-time authors who are ensuring the continued development of the field.

Elements of Artificial Neural Networks provides a clearly organized general introduction, focusing on a broad range of algorithms, for students and others who want to use neural networks rather than simply study them. The authors, who have been developing and team teaching the material in a one-semester course over the past six years, describe most of the basic neural network models (with several detailed solved examples) and discuss the rationale and advantages of the models, as well as their limitations. The approach is practical and open-minded and requires very little mathematical or technical background. Written from a computer science and statistics point of view, the text stresses links to contiguous fields and can easily serve as a first course for students in economics and management. The opening chapter sets the stage, presenting the basic concepts in a clear and objective way and tackling important -- yet rarely addressed -- questions related to the use of neural networks in practical situations. Subsequent chapters on supervised learning (single layer and multilayer networks), unsupervised learning, and associative models are structured around classes of problems to which networks can be applied. Applications are discussed along with the algorithms. A separate chapter takes up optimization

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methods. The most frequently used algorithms, such as backpropagation, are introduced early on, right after perceptrons, so that these can form the basis for initiating course projects. Algorithms published as late as 1995 are also included. All of the algorithms are presented using block-structured pseudo-code, and exercises are provided throughout. Software implementing many commonly used neural network algorithms is available at the book's website. Transparency masters, including abbreviated text and figures for the entire book, are available for instructors using the text.

Advanced conceptual modeling techniques serve as a powerful tool for those in the medical field by increasing the accuracy and efficiency of the diagnostic process. The application of artificial intelligence assists medical professionals to analyze and comprehend a broad range of medical data, thus eliminating the potential for human error. *Medical Diagnosis Using Artificial Neural Networks* introduces effective parameters for improving the performance and application of machine learning and pattern recognition techniques to facilitate medical processes. This book is an essential reference work for academicians, professionals, researchers, and students interested in the relationship between artificial intelligence and medical science through the use of informatics to improve the quality of medical care.

Artificial Neural Networks for Engineering Applications Academic Press

As book review editor of the IEEE Transactions on Neural Networks, Mohamad

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Hassoun has had the opportunity to assess the multitude of books on artificial neural networks that have appeared in recent years. Now, in *Fundamentals of Artificial Neural Networks*, he provides the first systematic account of artificial neural network paradigms by identifying clearly the fundamental concepts and major methodologies underlying most of the current theory and practice employed by neural network researchers. Such a systematic and unified treatment, although sadly lacking in most recent texts on neural networks, makes the subject more accessible to students and practitioners. Here, important results are integrated in order to more fully explain a wide range of existing empirical observations and commonly used heuristics. There are numerous illustrative examples, over 200 end-of-chapter analytical and computer-based problems that will aid in the development of neural network analysis and design skills, and a bibliography of nearly 700 references. Proceeding in a clear and logical fashion, the first two chapters present the basic building blocks and concepts of artificial neural networks and analyze the computational capabilities of the basic network architectures involved. Supervised, reinforcement, and unsupervised learning rules in simple nets are brought together in a common framework in chapter three. The convergence and solution properties of these learning rules are then treated mathematically in chapter four, using the "average learning equation" analysis approach. This organization of material makes it natural to switch into learning multilayer nets using backprop and its variants, described in chapter five. Chapter six covers most of the major neural network



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paradigms, while associative memories and energy minimizing nets are given detailed coverage in the next chapter. The final chapter takes up Boltzmann machines and Boltzmann learning along with other global search/optimization algorithms such as stochastic gradient search, simulated annealing, and genetic algorithms.

This textbook is intended for a first-year graduate course on Artificial Neural Networks. It assumes no prior background in the subject and is directed to MS students in electrical engineering, computer science and related fields, with background in at least one programming language or in a programming tool such as Matlab, and who have taken the basic undergraduate classes in systems or in signal processing. The uniqueness of the book is in the breadth of its coverage over the range of all major artificial neural network approaches and in extensive hands-on case-studies on each and every neural network considered. These detailed case studies include complete program print-outs and results and deal with a range of problems, to illustrate the reader's ability to solve problems ranging from speech recognition, character recognition to control and signal processing problems, all on the basis of following the present text. Another unique aspect of the text is its coverage of important new topics of recurrent (time-cycling) networks and of large memory storage and retrieval problems. The text also attempts to show the reader how he can modify or combine one or more of the neural networks covered, to tailor them to a given problem which does not appear to fit any of the more standard designs, as is very often the case.

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In this computer-based era, neural networks are an invaluable tool. They have been applied extensively in business forecasting, machine health monitoring, process control, and laboratory data analysis due to their modeling capabilities. There are numerous applications for neural networks, but a great deal of care and expertise is necessary to keep a neural-based project in working order. This all-inclusive coverage gives you everything you need to put neural networks into practice. This informative book shows the reader how to plan, run, and benefit from a neural-based project without running into the roadblocks that often crop up. The author uses the most popular type of neural network, the Multi-Layer Perceptron, and presents every step of its development. Each chapter presents a subsequent stage in network development through easy-to-follow discussion. Every decision and possible problem is considered in depth, and solutions are offered. The book includes a how-to-do-it reference section, and a set of worked examples. The second half of the book examines the successful application of neural networks in fields including signal processing, financial prediction, business decision support, and process monitoring and control. The book comes complete with a disk containing C and C++ programs to get you started. Key Features

- \* Divides chapters into three sections for quick reference: Discussion, How to do it, and Examples
- \* Examines many case studies and real world examples to illustrate the methods presented
- \* Includes a disk with C and C++ programs which implement many of the techniques discussed in the text
- \* Allows the reader to develop a neural network based solution

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This tutorial text provides the reader with an understanding of artificial neural networks (ANNs), and their application, beginning with the biological systems which inspired them, through the learning methods that have been developed, and the data collection processes, to the many ways ANNs are being used today. The material is presented with a minimum of math (although the mathematical details are included in the appendices for interested readers), and with a maximum of hands-on experience. All specialized terms are included in a glossary. The result is a highly readable text that will teach the engineer the guiding principles necessary to use and apply artificial neural networks.

Engineers have long been fascinated by how efficient and how fast biological neural networks are capable of performing such complex tasks as recognition. Such networks are capable of recognizing input data from any of the five senses with the necessary accuracy and speed to allow living creatures to survive. Machines which perform such complex tasks as recognition, with similar accuracy and speed, were difficult to implement until the technological advances of VLSI circuits and systems in the late 1980's. Since then, the field of VLSI Artificial Neural Networks (ANNs) have witnessed an exponential growth and a new engineering discipline was born. Today, many engineering curriculums have included a course or more on the subject at the graduate or senior under graduate levels. Since the pioneering book by Carver Mead; "Analog VLSI and Neural Systems", Addison-Wesley, 1989; there were a number of excellent text and reference books on the subject, each dealing with one or two topics. This book attempts to present an integrated approach of a single research team to VLSI ANNs

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## Engineering.

An intelligent system is one which exhibits characteristics including, but not limited to, learning, adaptation, and problem-solving. Artificial Neural Network (ANN) Systems are intelligent systems designed on the basis of statistical models of learning that mimic biological systems such as the human central nervous system. Such ANN systems represent the theme of this book. This book also describes concepts related to evolutionary methods, clustering algorithms, and other networks which are complementary to ANN systems. The book is divided into two parts. The first part explains basic concepts derived from the natural biological neuron and introduces purely scientific frameworks used to develop a viable ANN model. The second part expands over to the design, analysis, performance assessment, and testing of ANN models. Concepts such as Bayesian networks, multi-classifiers, and neuromorphic ANN systems are explained, among others. Artificial Neural Systems: Principles and Practice takes a developmental perspective on the subject of ANN systems, making it a beneficial resource for students undertaking graduate courses and research projects, and working professionals (engineers, software developers) in the field of intelligent systems design.

Processing information and analyzing data efficiently and effectively is crucial for any company that wishes to stay competitive in its respective market. Nonlinear data presents new challenges to organizations, however, due to its complexity and unpredictability. The only technology that can properly handle this form of data is artificial neural networks. These modeling systems present a high level of benefits in analyzing complex data in a proficient manner, yet considerable research on the specific applications of these intelligent components is significantly deficient. Applications of Artificial Neural Networks for Nonlinear Data is a

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collection of innovative research on the contemporary nature of artificial neural networks and their specific implementations within data analysis. While highlighting topics including propagation functions, optimization techniques, and learning methodologies, this book is ideally designed for researchers, statisticians, academicians, developers, scientists, practitioners, students, and educators seeking current research on the use of artificial neural networks in diagnosing and solving nonparametric problems.

"This book introduces and explains Higher Order Neural Networks (HONNs) to people working in the fields of computer science and computer engineering, and how to use HONNS in these areas"--Provided by publisher.

In this book, highly qualified multidisciplinary scientists grasp their recent researches motivated by the importance of artificial neural networks. It addresses advanced applications and innovative case studies for the next-generation optical networks based on modulation recognition using artificial neural networks, hardware ANN for gait generation of multi-legged robots, production of high-resolution soil property ANN maps, ANN and dynamic factor models to combine forecasts, ANN parameter recognition of engineering constants in Civil Engineering, ANN electricity consumption and generation forecasting, ANN for advanced process control, ANN breast cancer detection, ANN applications in biofuels, ANN modeling for manufacturing process optimization, spectral interference correction using a large-size spectrometer and ANN-based deep learning, solar radiation ANN prediction using NARX model, and ANN data assimilation for an atmospheric general circulation model.

The book should serve as a text for a university graduate course or for an advanced undergraduate course on neural networks in engineering and computer science departments.

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It should also serve as a self-study course for engineers and computer scientists in the industry. Covering major neural network approaches and architectures with the theories, this text presents detailed case studies for each of the approaches, accompanied with complete computer codes and the corresponding computed results. The case studies are designed to allow easy comparison of network performance to illustrate strengths and weaknesses of the different networks.

In today's modernized market, various disciplines continue to search for universally functional technologies that improve upon traditional processes. Artificial neural networks are a set of statistical modeling tools that are capable of processing nonlinear data with strong accuracy. Due to their complexity, utilizing their potential was previously seen as a challenge. However, with the development of artificial intelligence, this technology has proven to be an effective and efficient problem-solving method. Artificial Neural Network Applications in Business and Engineering is an essential reference source that illustrates recent advancements of artificial neural networks in various professional fields, accompanied by specific case studies and practical examples. Featuring research on topics such as training algorithms, transportation, and computer security, this book is ideally designed for researchers, students, developers, managers, engineers, academicians, industrialists, policymakers, and educators seeking coverage on modern trends in artificial neural networks and their real-world implementations. This book covers 27 articles in the applications of artificial neural networks (ANN) in various disciplines which includes business, chemical technology, computing, engineering, environmental science, science and nanotechnology. They modeled the ANN with verification in different areas. They demonstrated that the ANN is very useful model and the ANN could be

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applied in problem solving and machine learning. This book is suitable for all professionals and scientists in understanding how ANN is applied in various areas.

State of the Art in Neural Networks and Their Applications presents the latest advances in artificial neural networks and their applications across a wide range of clinical diagnoses. Advances in the role of machine learning, artificial intelligence, deep learning, cognitive image processing and suitable data analytics useful for clinical diagnosis and research applications are covered, including relevant case studies. The application of Neural Network, Artificial Intelligence, and Machine Learning methods in biomedical image analysis have resulted in the development of computer-aided diagnostic (CAD) systems that aim towards the automatic early detection of several severe diseases. State of the Art in Neural Networks and Their Applications is presented in two volumes. Volume 1 covers the state-of-the-art deep learning approaches for the detection of renal, retinal, breast, skin, and dental abnormalities and more. Includes applications of neural networks, AI, machine learning, and deep learning techniques to a variety of imaging technologies Provides in-depth technical coverage of computer-aided diagnosis (CAD), with coverage of computer-aided classification, Unified Deep Learning Frameworks, mammography, fundus imaging, optical coherence tomography, cryo-electron tomography, 3D MRI, CT,

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and more. Covers deep learning for several medical conditions including renal, retinal, breast, skin, and dental abnormalities, Medical Image Analysis, as well as detection, segmentation, and classification via AI.

Neural networks and fuzzy systems are different approaches to introducing human-like reasoning into expert systems. This text is the first to combine the study of these two subjects, their basics and their use, along with symbolic AI methods to build comprehensive artificial intelligence systems. In a clear and accessible style, Kasabov describes rule-based and connectionist techniques and then their combinations, with fuzzy logic included, showing the application of the different techniques to a set of simple prototype problems, which makes comparisons possible. A particularly strong feature of the text is that it is filled with applications in engineering, business, and finance. AI problems that cover most of the application-oriented research in the field (pattern recognition, speech and image processing, classification, planning, optimization, prediction, control, decision making, and game simulations) are discussed and illustrated with concrete examples. Intended both as a text for advanced undergraduate and postgraduate students as well as a reference for researchers in the field of knowledge engineering, Foundations of Neural Networks, Fuzzy Systems, and Knowledge Engineering has chapters structured for various levels of teaching



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and includes original work by the author along with the classic material. Data sets for the examples in the book as well as an integrated software environment that can be used to solve the problems and do the exercises at the end of each chapter are available free through anonymous ftp.

Neural networks are a computing paradigm that is finding increasing attention among computer scientists. In this book, theoretical laws and models previously scattered in the literature are brought together into a general theory of artificial neural nets. Always with a view to biology and starting with the simplest nets, it is shown how the properties of models change when more general computing elements and net topologies are introduced. Each chapter contains examples, numerous illustrations, and a bibliography. The book is aimed at readers who seek an overview of the field or who wish to deepen their knowledge. It is suitable as a basis for university courses in neurocomputing.

Artificial Neural Network for Drug Design, Delivery and Disposition provides an in-depth look at the use of artificial neural networks (ANN) in pharmaceutical research. With its ability to learn and self-correct in a highly complex environment, this predictive tool has tremendous potential to help researchers more effectively design, develop, and deliver successful drugs. This book illustrates how to use ANN methodologies and models with the intent to treat

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diseases like breast cancer, cardiac disease, and more. It contains the latest cutting-edge research, an analysis of the benefits of ANN, and relevant industry examples. As such, this book is an essential resource for academic and industry researchers across the pharmaceutical and biomedical sciences. Written by leading academic and industry scientists who have contributed significantly to the field and are at the forefront of artificial neural network (ANN) research Focuses on ANN in drug design, discovery and delivery, as well as adopted methodologies and their applications to the treatment of various diseases and disorders Chapters cover important topics across the pharmaceutical process, such as ANN in structure-based drug design and the application of ANN in modern drug discovery Presents the future potential of ANN-based strategies in biomedical image analysis and much more

The field of Artificial Neural Networks is the fastest growing field in Information Technology and specifically, in Artificial Intelligence and Machine Learning. This must-have compendium presents the theory and case studies of artificial neural networks. The volume, with 4 new chapters, updates the earlier edition by highlighting recent developments in Deep-Learning Neural Networks, which are the recent leading approaches to neural networks. Uniquely, the book also includes case studies of applications of neural networks — demonstrating how

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such case studies are designed, executed and how their results are obtained. The title is written for a one-semester graduate or senior-level undergraduate course on artificial neural networks. It is also intended to be a self-study and a reference text for scientists, engineers and for researchers in medicine, finance and data mining.

The idea of simulating the brain was the goal of many pioneering works in Artificial Intelligence. The brain has been seen as a neural network, or a set of nodes, or neurons, connected by communication lines. Currently, there has been increasing interest in the use of neural network models. This book contains chapters on basic concepts of artificial neural networks, recent connectionist architectures and several successful applications in various fields of knowledge, from assisted speech therapy to remote sensing of hydrological parameters, from fabric defect classification to application in civil engineering. This is a current book on Artificial Neural Networks and Applications, bringing recent advances in the area to the reader interested in this always-evolving machine learning technique.

Artificial Neural Networks for Engineering Applications presents current trends for the solution of complex engineering problems that cannot be solved through conventional methods. The proposed methodologies can be applied to modeling,

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pattern recognition, classification, forecasting, estimation, and more. Readers will find different methodologies to solve various problems, including complex nonlinear systems, cellular computational networks, waste water treatment, attack detection on cyber-physical systems, control of UAVs, biomechanical and biomedical systems, time series forecasting, biofuels, and more. Besides the real-time implementations, the book contains all the theory required to use the proposed methodologies for different applications. Presents the current trends for the solution of complex engineering problems that cannot be solved through conventional methods Includes real-life scenarios where a wide range of artificial neural network architectures can be used to solve the problems encountered in engineering Contains all the theory required to use the proposed methodologies for different applications

Neural networks represent a new generation of information processing paradigms designed to mimic-in a very limited sense-the human brain. They can learn, recall, and generalize from training data, and with their potential applications limited only by the imaginations of scientists and engineers, they are commanding tremendous popularity and research interest. Over the last four decades, researchers have reported a number of neural network paradigms, however, the newest of these have not appeared in book form-until now. Recent

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Advances in Artificial Neural Networks collects the latest neural network paradigms and reports on their promising new applications. World-renowned experts discuss the use of neural networks in pattern recognition, color induction, classification, cluster detection, and more. Application engineers, scientists, and research students from all disciplines with an interest in considering neural networks for solving real-world problems will find this collection useful.

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