Neural Networks For Modelling And Control Of Dynamic Systems A Practitioners Handbook Advanced Textbooks In Control And Signal Processing

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Artificial Neural Networks for Modelling and Control of Non-Linear Systems - Johan A.K. Suykens 1995-12-31
Artificial neural networks possess several properties that make them particularly attractive for applications to modelling and control of complex non-linear systems. Among these properties are their universal approximation ability, their parallel network structure and the availability of on- and off-line learning methods for the interconnection weights. However, dynamic models that contain neural network architectures might be highly non-linear and difficult to analyse as a result. Artificial Neural Networks for Modelling and Control of Non-Linear Systems investigates the subject from a system theoretical point of view. However the mathematical theory that is required from the reader is limited to matrix calculus, basic analysis, differential equations and basic linear system theory. No preliminary knowledge of neural networks is explicitly required. The book presents both classical and novel network architectures and learning algorithms for modelling and control. Topics include non-linear system identification, neural optimal control, top-down model based neural control design and stability analysis of neural control systems. A major contribution of this book is to introduce NLq Theory as an extension towards modern control theory, in order to analyze and synthesize non-linear systems that contain linear together with static non-linear operators that satisfy a sector condition: neural state space control systems are an example. Moreover, it turns out that NLq Theory is unifying with respect to many problems arising in neural networks, systems and control. Examples show that complex non-linear systems can be modelled and controlled within NLq theory, including mastering chaos. The didactic flavor of this book makes it suitable for use as a text for a course on Neural Networks. In addition, researchers and designers will find many important new techniques, in particular NLq emTheory, that have applications in control theory, system theory, circuit theory and Time Series Analysis.
Robust and Fault-Tolerant Control - Krzysztof Patan 2019-03-16
Robust and Fault-Tolerant Control proposes novel automatic control strategies for nonlinear systems developed by means of artificial neural networks and pays special attention to robust and fault-tolerant approaches. The book discusses robustness and fault tolerance in the context of model predictive control, fault accommodation and reconfiguration, and iterative learning control strategies. Expanding on its theoretical deliberations the monograph includes many case studies demonstrating how the proposed approaches work in practice. The most important features of the book include: a comprehensive review of neural network architectures with possible applications in system modelling and control; a concise introduction to robust and fault-tolerant control; step-by-step presentation of the control approaches proposed; an abundance of case studies illustrating the important steps in designing robust and fault-tolerant control; and a large number of figures and tables facilitating the performance analysis of the control approaches described. The material presented in this book will be useful for researchers and engineers who wish to avoid spending excessive time in searching neural-network-based control solutions. It is written for electrical, computer science and automatic control engineers interested in control theory and their applications. This monograph will also interest postgraduate students engaged in self-study of nonlinear robust and fault-tolerant control.

Advanced Applications for Artificial Neural Networks - Adel El-Shahat 2018-02-28
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.
Model Neural Networks and Behavior - Allen Selverston 2013-06-29
The most conspicuous function of the nervous system is to control animal behav ior. From the complex operations of learning and mentation to the molecular con figuration of ionic channels, the nervous system serves as the interface between an animal and its environment. To study and understand the fundamental mecha nisms underlying the control of behavior, it is often both necessary and desirable to employ biological systems with characteristics especially suitable for answering specific questions. In neurobiology, many invertebrates have become established as model systems for investigations at both the systems and the cellular level. Large, readily identifiable neurons have made invertebrates especially useful for cellular studies. The fact that these neurons occur in much smaller numbers than those in higher animals also makes them important for circuit analysis. Although important differences exist, some of the questions that would be tech nically impossible to answer with vertebrates can become experimentally tractable with invertebrates.
Neural Network Applications in Control - Institution of Electrical Engineers 1995
Introducing a wide variety of network types, including Kohenen nets, n-tuple nets and radial basis function networks as well as the more useful multilayer perception back-propagation networks, this book aims to give a detailed appreciation of the use of neural nets in these applications.
Artificial Neural Networks: Formal Models and Their Applications – ICANN 2005 - Wlodzislaw Duch 2005-08-31
The two volume set LNCS 3696 and LNCS 3697 constitutes the refereed proceedings of the 15th International Conference on Artificial Neural Networks, ICANN 2005, held in Warsaw, Poland in September 2005. The over 600 papers submitted to ICANN 2005 were thoroughly reviewed and carefully selected for presentation. The first volume includes 106 contributions related to Biological Inspirations; topics addressed are modeling the brain and cognitive functions, development of cognitive powers in embodied systems spiking neural networks, associative memory models, models of biological functions, projects in the area of neuroIT, evolutionary and other biological inspirations, self-organizing maps and their applications, computer vision, face recognition and detection, sound and speech recognition, bioinformatics, biomedical applications, and information- theoretic concepts in biomedical data analysis. The second volume contains

162 contributions related to Formal Models and their Applications and deals with new neural network models, supervised learning algorithms, ensemble-based learning, unsupervised learning, recurent neural networks, reinforcement learning, bayesian approaches to learning, learning theory, artificial neural networks for system modeling, decision making, optimalization and control, knowledge extraction from neural networks, temporal data analysis, prediction and forecasting, support vector machines and kernel-based methods, soft computing methods for data representation, analysis and processing, data fusion for industrial, medical and environmental applications, non-linear predictive models for speech processing, intelligent multimedia and semantics, applications to natural language processing, various applications, computational intelligence in games, and issues in hardware implementation.

An Introduction to Neural Networks - Kevin Gurney 2018-10-08

Though mathematical ideas underpin the study of neural networks, the author presents the fundamentals without the full mathematical apparatus. All aspects of the field are tackled, including artificial neurons as models of their real counterparts; the geometry of network action in pattern space; gradient descent methods, including back-propagation; associative memory and Hopfield nets; and self-organization and feature maps. The traditionally difficult topic of adaptive resonance theory is clarified within a hierarchical description of its operation. The book also includes several real-world examples to provide a concrete focus. This should enhance its appeal to those involved in the design, construction and management of networks in commercial environments and who wish to improve their understanding of network simulator packages. As a comprehensive and highly accessible introduction to one of the most important topics in cognitive and computer science, this volume should interest a wide range of readers, both students and professionals, in cognitive science, psychology, computer science and electrical engineering.

Adaptive Sliding Mode Neural Network Control for Nonlinear Systems - Yang Li 2018-11-16

Adaptive Sliding Mode Neural Network Control for Nonlinear Systems introduces nonlinear systems basic knowledge, analysis and control methods, and applications in various fields. It offers instructive examples and simulations, along with the source codes, and provides the basic architecture of control science and engineering. Introduces nonlinear systems' basic knowledge, analysis and control methods, along with applications in various fields Offers instructive examples and simulations, including source codes Provides the basic architecture of control science and engineering

Dynamic Interactions in Neural Networks: Models and Data - Michael A. Arbib 1989

The study of neural networks is enjoying a great renaissance, both in computational neuroscience, the development of information processing models of living brains, and in neural computing, the use of neurally inspired concepts in the construction of "intelligent" machines. Thus the title of this volume has two interpretations: It presents models and data on the dynamic interactions occurring in the brain, and it exhibits the dynamic interactions between research in computational neuroscience and in neural computing, as scientists seek to find common principles to guide the understanding of the living brain and the design of artificial neural networks. This collection of contributions presents the current state of research, future trends and open problems in an exciting field of today's science.

Fuzzy Neural Networks for Real Time Control Applications - Erdal Kayacan 2015-10-07

AN INDISPENSABLE RESOURCE FOR ALL THOSE WHO DESIGN AND IMPLEMENT TYPE-1 AND TYPE-2 FUZZY NEURAL NETWORKS IN REAL TIME SYSTEMS Delve into the type-2 fuzzy logic systems and become engrossed in the parameter update algorithms for type-1 and type-2 fuzzy neural networks and their stability analysis with this book! Not only does this book stand apart from others in its focus but also in its application-based presentation style. Prepared in a way that can be easily understood by those who are experienced and inexperienced in this field. Readers can benefit from the computer source codes for both identification and control purposes which are given at the end of the book. A clear and an in-depth examination has been made of all the necessary mathematical foundations, type-1 and type-2 fuzzy neural network structures and their learning algorithms as well as their stability analysis. You will find that each chapter is devoted to a different learning algorithm for the tuning of type-1 and type-2 fuzzy neural networks; some of which are: • Gradient descent • Levenberg-Marquardt • Extended Kalman filter In addition to the aforementioned conventional learning methods above, number of novel sliding mode control theory-based learning algorithms, which are simpler and have closed forms, and their stability analysis have been proposed. Furthermore, hybrid methods consisting of particle swarm optimization and sliding mode control theory-based algorithms have also been introduced. The potential readers of this book are expected to be the undergraduate and graduate students, engineers, mathematicians and computer scientists. Not only can this book be used as a reference source for a scientist who is interested in fuzzy neural networks and their real-time implementations but also as a course book of fuzzy neural networks or artificial intelligence in master or doctorate university studies. We hope that this book will serve its main purpose successfully. Parameter update algorithms for type-1 and type-2 fuzzy neural networks and their stability analysis Contains algorithms that are applicable to real time systems Introduces fast and simple adaptation rules for type-1 and type-2 fuzzy neural networks Number of case studies both in identification and control Provides MATLAB® codes for some algorithms in the book

Network Models for Control and Processing - Martin D. Fraser 2000

This book provides a powerful tool for collecting and correlating related bodies of research in modelling control and processing in distributed networks. While traditional publications in the field of network models have focussed on specific areas, this successfully intersects many related fields. These cover: control processes, modelling features and operations of biological neural networks and neurons, simulation of biological experimentation, and representation of artificial neural networks (ANNs) Within the fields mentioned, the topics discussed include: control solutions using theoretical computational learning models, learning algorithms and polynomial networks; simulating biological experimentation and physical mechanisms with computer-assisted and hardware models of biological neural networks and neurons; improving processes for representing artificial neural networks by verification from SPICE and global optimization techniques.

Neural Network Engineering in Dynamic Control Systems - Kenneth J. Hunt 2012-12-06

The series Advances in Industrial Control aims to report and encourage technology transfer in control engineering. The rapid development of control technology impacts all areas of the control discipline. New theory, new controllers, actuators, sensors, new industrial processes, computer methods, new applications, new philosophies, ... , new challenges. Much of this development work resides in industrial reports, feasibility study papers and the reports of advanced collaborative projects. The series offers an opportunity for researchers to present an extended exposition of such new work in all aspects of industrial control for wider and rapid dissemination. Within the control community there has been much discussion of and interest in the new Emerging Technologies and Methods. Neural networks along with Fuzzy Logic and Expert Systems is an emerging methodology which has the potential to contribute to the development of intelligent control technologies. This volume of some thirteen chapters edited by Kenneth Hunt, George Irwin and Kevin Warwick makes a useful contribution to the literature of neural network methods and applications. The chapters are arranged systematically progressing from theoretical foundations, through the training aspects of neural nets and concluding with four chapters of applications. The applications include problems as diverse as oven tempera ture control, and energy/load forecasting routines. We hope this interesting but balanced mix of material appeals to a wide range of readers from the theoretician to the industrial applications engineer.

Robot Control using an Artificial Neural Network - Olaf Wandel 2001-05-16

Inhaltsangabe:Abstract: The aim of the project was to control three joints of an industrial robot in terms of its position, velocity and acceleration. The work considered the necessary hardware, principles of neural networks and controlling techniques. The hardware comprised of a robot with three DC-motors and three optical position encoders, a personal computer with a D/A card for voltage output to the robot and two D/D cards. One D/D card for receiving values from the optical encoders and one for timing. The basics of artificial neural network type perceptrons were described. The special features bias, output feedback, momentum term, adjustment of momentum factor and adjustment of learning rate for this artificial neural network type were considered. An introduction to learning and control structures using artificial neural networks were given. These were controller copying, direct modelling, direct inverse modelling, control with a model and an inverse model, forward and inverse modelling, control action feedback error learning, feedback error learning, learning and control using the plant s Jacobian. The conversion of two learning and control structures, direct inverse modelling and control action feedback error learning, was

implemented in software using MS QuickBASIC 4.5 . One joint was controlled with a direct inverse model. One joint and all joints together were controlled with control action feedback error learning. The results of experiments with these learning and control structures were documented. Inhaltsverzeichnis:Table of Contents: 1.Introduction8 2.The hardware9 2.1The robot9 2.2The computer and the software11 2.3The PCL-726 D/A card11 2.4The D/D card11 2.5The PCL-812 D/D card12 2.6The G64 rack12 3.Neural networks13 3.1The neuron13 3.2Conversion of neural networks14 3.3Learning principles of neural networks17 3.4Special modifications to the neural network used19 3.5Learning capacity22 4.Teaching and control techniques23 5.The software28 5.1The teaching and control program28 5.1.1The direct inverse modelling and trajectory estimation program29 5.1.2The control action feedback error learning program30 6.Experiments with learning and control structures31 6.1Direct inverse modelling31 6.1.1Direct inverse modelling of the waist32 6.1.2Trajectory estimation for the waist34 6.2Control action feedback error learning (CAFEL)36 6.2.1Control action feedback error learning of the waist37 6.2.2Control action [...]

Neural Network Modeling and Identification of Dynamical Systems - Yury Tiumentsev 2019-05-17

Neural Network Modeling and Identification of Dynamical Systems presents a new approach on how to obtain the adaptive neural network models for complex systems that are typically found in real-world applications. The book introduces the theoretical knowledge available for the modeled system into the purely empirical black box model, thereby converting the model to the gray box category. This approach significantly reduces the dimension of the resulting model and the required size of the training set. This book offers solutions for identifying controlled dynamical systems, as well as identifying characteristics of such systems, in particular, the aerodynamic characteristics of aircraft. Covers both types of dynamic neural networks (black box and gray box) including their structure, synthesis and training Offers application examples of dynamic neural network technologies, primarily related to aircraft Provides an overview of recent achievements and future needs in this area

Neural Networks for Modelling and Control of Dynamic Systems - M. Norgaard 2003

Modeling and Control of Uncertain Nonlinear Systems with Fuzzy Equations and Z-Number - Wen Yu 2019-06-27

An original, systematic-solution approach to uncertain nonlinear systems control and modeling using fuzzy equations and fuzzy differential equations There are various numerical and analytical approaches to the modeling and control of uncertain nonlinear systems. Fuzzy logic theory is an increasingly popular method used to solve inconvenience problems in nonlinear modeling. Modeling and Control of Uncertain Nonlinear Systems with Fuzzy Equations and Z-Number presents a structured approach to the control and modeling of uncertain nonlinear systems in industry using fuzzy equations and fuzzy differential equations. The first major work to explore methods based on neural networks and Bernstein neural networks, this innovative volume provides a framework for control and modeling of uncertain nonlinear systems with applications to industry. Readers learn how to use fuzzy techniques to solve scientific and engineering problems and understand intelligent control design and applications. The text assembles the results of four years of research on control of uncertain nonlinear systems with dual fuzzy equations, fuzzy modeling for uncertain nonlinear systems with fuzzy equations, the numerical solution of fuzzy equations with Z-numbers, and the numerical solution of fuzzy differential equations with Z-numbers. Using clear and accessible language to explain concepts and principles applicable to real-world scenarios, this book: Presents the modeling and control of uncertain nonlinear systems with fuzzy equations and fuzzy differential equations Includes an overview of uncertain nonlinear systems for non-specialists Teaches readers to use simulation, modeling and verification skills valuable for scientific research and engineering systems development Reinforces comprehension with illustrations, tables, examples, and simulations Modeling and Control of Uncertain Nonlinear Systems with Fuzzy Equations and Z-Number is suitable as a textbook for advanced students, academic and industrial researchers, and practitioners in fields of systems engineering, learning control systems, neural networks, computational intelligence, and fuzzy logic control.

Neural Networks for Control - W. Thomas Miller 1995

Neural Networks for Control brings together examples of all the most important paradigms for the application of neural networks to robotics and control. Primarily concerned with engineering problems and approaches to their solution through neurocomputing systems, the book is divided into three sections: general principles, motion control, and applications domains (with evaluations of the possible applications by experts in the applications areas.) Special emphasis is placed on designs based on optimization or reinforcement, which will become increasingly important as researchers address more complex engineering challenges or real biological-control problems.A Bradford Book. Neural Network Modeling and Connectionism series

Gas Turbines Modeling, Simulation, and Control - Hamid Asgari 2015-10-16

Gas Turbines Modeling, Simulation, and Control: Using Artificial Neural Networks provides new approaches and novel solutions to the modeling, simulation, and control of gas turbines (GTs) using artificial neural networks (ANNs). After delivering a brief introduction to GT performance and classification, the book:Outlines important criteria to consi

International Joint Conference CISIS'12-ICEUTE´12-SOCO´12 Special Sessions - Álvaro Herrero 2012-08-23

This volume of Advances in Intelligent and Soft Computing contains accepted papers presented at CISIS 2012 and ICEUTE 2012, both conferences held in the beautiful and historic city of Ostrava (Czech Republic), in September 2012. CISIS aims to offer a meeting opportunity for academic and industry-related researchers belonging to the various, vast communities of Computational Intelligence, Information Security, and Data Mining. The need for intelligent, flexible behaviour by large, complex systems, especially in mission-critical domains, is intended to be the catalyst and the aggregation stimulus for the overall event. After a through peer-review process, the CISIS 2012 International Program Committee selected 30 papers which are published in these conference proceedings achieving an acceptance rate of 40%. In the case of ICEUTE 2012, the International Program Committee selected 4 papers which are published in these conference proceedings. The selection of papers was extremely rigorous in order to maintain the high quality of the conference and we would like to thank the members of the Program Committees for their hard work in the reviewing process. This is a crucial process to the creation of a high standard conference and the CISIS and ICEUTE conferences would not exist without their help.

Neural Network-Based Adaptive Control of Uncertain Nonlinear Systems - Kasra Esfandiari 2021-06-18

The focus of this book is the application of artificial neural networks in uncertain dynamical systems. It explains how to use neural networks in concert with adaptive techniques for system identification, state estimation, and control problems. The authors begin with a brief historical overview of adaptive control, followed by a review of mathematical preliminaries. In the subsequent chapters, they present several neural network-based control schemes. Each chapter starts with a concise introduction to the problem under study, and a neural network-based control strategy is designed for the simplest case scenario. After these designs are discussed, different practical limitations (i.e., saturation constraints and unavailability of all system states) are gradually added, and other control schemes are developed based on the primary scenario. Through these exercises, the authors present structures that not only provide mathematical tools for navigating control problems, but also supply solutions that are pertinent to real-life systems.

Neural Systems for Control - Omid Omidvar 1997-02-24

Control problems offer an industrially important application and a guide to understanding control systems for those working in Neural Networks. Neural Systems for Control represents the most up-to-date developments in the rapidly growing aplication area of neural networks and focuses on research in natural and artifical neural systems directly applicable to control or making use of modern control theory. The book covers such important new developments in control systems such as intelligent sensors in semiconductor wafer manufacturing; the relation between muscles and cerebral neurons in speech recognition; online compensation of reconfigurable control for spacecraft aircraft and other systems; applications to rolling mills, robotics and process control; the usage of past output data to identify nonlinear systems by neural networks; neural approximate optimal control; model-free nonlinear control; and neural control based on a regulation of physiological investigation/blood pressure control. All researchers and students dealing with control systems will find the fascinating Neural Systems for Control of immense interest and assistance. Focuses on research in natural and artifical neural systems directly applicable to contol or making use of modern control theory Represents the most up-to-date developments in this rapidly growing application

area of neural networks Takes a new and novel approach to system identification and synthesis

Neural Networks Modeling and Control - Jorge D. Rios 2020-01-15

Neural Networks Modelling and Control: Applications for Unknown Nonlinear Delayed Systems in Discrete Time focuses on modeling and control of discrete-time unknown nonlinear delayed systems under uncertainties based on Artificial Neural Networks. First, a Recurrent High Order Neural Network (RHONN) is used to identify discrete-time unknown nonlinear delayed systems under uncertainties, then a RHONN is used to design neural observers for the same class of systems. Therefore, both neural models are used to synthesize controllers for trajectory tracking based on two methodologies: sliding mode control and Inverse Optimal Neural Control. As well as considering the different neural control models and complications that are associated with them, this book also analyzes potential applications, prototypes and future trends. Provide in-depth analysis of neural control models and methodologies Presents a comprehensive review of common problems in real-life neural network systems Includes an analysis of potential applications, prototypes and future trends

Neural Networks in Bioprocessing and Chemical Engineering - D. R. Baughman 2014-06-28

Neural networks have received a great deal of attention among scientists and engineers. In chemical engineering, neural computing has moved from pioneering projects toward mainstream industrial applications. This book introduces the fundamental principles of neural computing, and is the first to focus on its practical applications in bioprocessing and chemical engineering. Examples, problems, and 10 detailed case studies demonstrate how to develop, train, and apply neural networks. A disk containing input data files for all illustrative examples, case studies, and practice problems provides the opportunity for hands-on experience. An important goal of the book is to help the student or practitioner learn and implement neural networks quickly and inexpensively using commercially available, PC-based software tools. Detailed network specifications and training procedures are included for all neural network examples discussed in the book. Each chapter contains an introduction, chapter summary, references to further reading, practice problems, and a section on nomenclature Includes a PC-compatible disk containing input data files for examples, case studies, and practice problems Presents 10 detailed case studies Contains an extensive glossary, explaining terminology used in neural network applications in science and engineering Provides examples, problems, and ten detailed case studies of neural computing applications, including: Process fault-diagnosis of a chemical reactor Leonard Kramer fault-classification problem Process fault-diagnosis for an unsteady-state continuous stirred-tank reactor system Classification of protein secondary-structure categories Quantitative prediction and regression analysis of complex chemical kinetics Software-based sensors for quantitative predictions of product compositions from flourescent spectra in bioprocessing Quality control and optimization of an autoclave curing process for manufacturing composite materials Predictive modeling of an experimental batch fermentation process Supervisory control of the Tennessee Eastman plantwide control problem Predictive modeling and optimal design of extractive bioseparation in aqueous two-phase systems

Artificial Neural Networks for the Modelling and Fault Diagnosis of Technical Processes - Krzysztof Patan 2008-06-24

An unappealing characteristic of all real-world systems is the fact that they are vulnerable to faults, malfunctions and, more generally, unexpected modes of - haviour. This explains why there is a continuous need for reliable and universal monitoring systems based on suitable and e?ective fault diagnosis strategies. This is especially true for engineering systems,whose complexity is permanently growing due to the inevitable development of modern industry as well as the information and communication technology revolution. Indeed, the design and operation of engineering systems require an increased attention with respect to availability, reliability, safety and fault tolerance. Thus, it is natural that fault diagnosis plays a fundamental role in modern control theory and practice. This is re?ected in plenty of papers on fault diagnosis in many control-oriented c- ferencesand journals.Indeed, a largeamount of knowledgeon model basedfault diagnosis has been accumulated through scienti?c literature since the beginning of the 1970s. As a result, a wide spectrum of fault diagnosis techniques have been developed. A major category of fault diagnosis techniques is the model based one, where an analytical model of the plant to be monitored is assumed to be available.

Neural Network Control of Nonlinear Discrete-Time Systems - Jagannathan Sarangapani 2018-10-03

Intelligent systems are a hallmark of modern feedback control systems. But as these systems mature, we have come to expect higher levels of performance in speed and accuracy in the face of severe nonlinearities, disturbances, unforeseen dynamics, and unstructured uncertainties. Artificial neural networks offer a combination of adaptability, parallel processing, and learning capabilities that outperform other intelligent control methods in more complex systems. Borrowing from Biology Examining neurocontroller design in discrete-time for the first time, Neural Network Control of Nonlinear Discrete-Time Systems presents powerful modern control techniques based on the parallelism and adaptive capabilities of biological nervous systems. At every step, the author derives rigorous stability proofs and presents simulation examples to demonstrate the concepts. Progressive Development After an introduction to neural networks, dynamical systems, control of nonlinear systems, and feedback linearization, the book builds systematically from actuator nonlinearities and strict feedback in nonlinear systems to nonstrict feedback, system identification, model reference adaptive control, and novel optimal control using the Hamilton-Jacobi-Bellman formulation. The author concludes by developing a framework for implementing intelligent control in actual industrial systems using embedded hardware. Neural Network Control of Nonlinear Discrete-Time Systems fosters an understanding of neural network controllers and explains how to build them using detailed derivations, stability analysis, and computer simulations.

Intelligent Systems for Knowledge Management - Edward Szczerbicki 2009-09-30

New approaches are needed that could move us towards developing effective systems for problem solving and decision making, systems that can deal with complex and ill-structured situations, systems that can function in information rich environments, systems that can cope with imprecise information, systems that can rely on their knowledge and learn from experience - i.e. intelligent systems. One of the main efforts in intelligent systems development is focused on knowledge and information management which is regarded as the crucial issue in smart decision making support. The 13 Chapters of this book represent a sample of such effort. The overall aim of this book is to provide guidelines to develop tools for smart processing of knowledge and information. Still, the guide does not presume to give ultimate answers. Rather, it poses ideas and case studies to explore and the complexities and challenges of modern knowledge management issues. It also encourages its reader to become aware of the multifaceted interdisciplinary character of such issues. The premise of this book is that its reader will leave it with a heightened ability to think - in different ways - about developing, evaluating, and supporting intelligent knowledge and information management systems in real life based environment.

Artificial Neural Networks for Engineering Applications - Alma Y. Alanis 2019-03-15

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, 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

Artificial Higher Order Neural Networks for Modeling and Simulation - Zhang, Ming 2012-10-31

"This book introduces Higher Order Neural Networks (HONNs) to computer scientists and computer engineers as an open box neural networks tool when compared to traditional artificial neural networks"--Provided by publisher.

Neural Networks for Identification, Prediction, and Control - D. T. Pham 1995

This publication describes examples of applications of neural networks in modelling, prediction and control. Topics covered include identification of general linear and nonlinear processes, forecasting of river levels, stock market prices, currency exchange rates, and control of a time-delayed plant and a two-joint robot.

The neural network types considered are the multilayer perceptron (MLP), the Elman and Jordan networks, the Group-Method-of-Data-Handling (GMDH), the cerebellar-model-articulation-controller (CMAC) networks and neuromorphic fuzzy logic systems. The algorithms presented are the standard backpropagation (BP) algorithm, the Widrow-Hoff learning, dynamic BP and evolutionary learning. Full listings of computer programs written in C for neural-network-based system identification and prediction to facilitate practical experimentation with neural network techniques are included.

Identification of Nonlinear Systems Using Neural Networks and Polynomial Models - Andrzej Janczak 2004-11-18

This monograph systematically presents the existing identification methods of nonlinear systems using the block-oriented approach It surveys various known approaches to the identification of Wiener and Hammerstein systems which are applicable to both neural network and polynomial models. The book gives a comparative study of their gradient approximation accuracy, computational complexity, and convergence rates and furthermore presents some new and original methods concerning the model parameter adjusting with gradient-based techniques. "Identification of Nonlinear Systems Using Neural Networks and Polynomal Models" is useful for researchers, engineers and graduate students in nonlinear systems and neural network theory.

Reactive Distillation - Vandana Sakhre 2022-04-19

Neural Networks is an integral part in machine learning and a known tool for controlling nonlinear processes. The area is under rapid development and provides a tool for modelling and controlling of advanced processes. This book provides a comprehensive overview for modelling, simulation, measurement and control strategies for reactive distillations using neural networks.

Neural Networks for Identification, Prediction, and Control - D. T. Pham 1995

This publication describes examples of applications of neural networks in modelling, prediction and control. Topics covered include identification of general linear and nonlinear processes, forecasting of river levels, stock market prices, currency exchange rates, and control of a time-delayed plant and a two-joint robot. The neural network types considered are the multilayer perceptron (MLP), the Elman and Jordan networks, the Group-Method-of-Data-Handling (GMDH), the cerebellar-model-articulation-controller (CMAC) networks and neuromorphic fuzzy logic systems. The algorithms presented are the standard backpropagation (BP) algorithm, the Widrow-Hoff learning, dynamic BP and evolutionary learning. Full listings of computer programs written in C for neural-network-based system identification and prediction to facilitate practical experimentation with neural network techniques are included.

Neural Network Applications - J.G. Taylor 2012-12-06

Neural Network Applications contains the 12 papers presented at the second British Neural Network Society Meeting (NCM '91) held at King's College London on 1st October 1991. The meeting was sponsored by the Centre for Neural Networks, King's College, and the British Neural Network Society, and was also part of the DEANNA ESPRIT programme. The papers reflect the wide spectrum of neural network applications that are currently being attempted in industry and medicine. They cover medical diagnosis, robotics, plant control, machine learning, and visual inspection, as well as more general discussions on net learning and knowledge representation. The breadth and depth of coverage is a sign of the health of the subject, as well as indicating the importance of neural network developments in industry and the manner in which the applications are progressing. Among the actual topics covered are: Learning algorithms - theory and practice; A review of medical diagnostic applications of neural networks; Simulated ultrasound tomographic imaging of defects; Linear quadtrees for neural network based position invariant pattern recognition; The pRTAM as a hardware-realisable neuron; The cognitive modalities ("CM") system of knowledge representation - the DNA of neural networks? This volume provides valuable reading for all those attempting to apply neural networks, as well as those entering the field, including researchers and postgraduate students in computational neuroscience, neurobiology, electrical engineering, computer science, mathematics, and medicine.

Fundamentals of Neural Network Modeling - Randolph W. Parks 1998

Provides an introduction to the neural network modeling of complex cognitive and neuropsychological processes. Over the past few years, computer modeling has become more prevalent in the clinical sciences as an alternative to traditional symbol-processing models. This book provides an introduction to the neural network modeling of complex cognitive and neuropsychological processes. It is intended to make the neural network approach accessible to practicing neuropsychologists, psychologists, neurologists, and psychiatrists. It will also be a useful resource for computer scientists, mathematicians, and interdisciplinary cognitive neuroscientists. The editors (in their introduction) and contributors explain the basic concepts behind modeling and avoid the use of high-level mathematics. The book is divided into four parts. Part I provides an extensive but basic overview of neural network modeling, including its history, present, and future trends. It also includes chapters on attention, memory, and primate studies. Part II discusses neural network models of behavioral states such as alcohol dependence, learned helplessness, depression, and waking and sleeping. Part III presents neural network models of neuropsychological tests such as the Wisconsin Card Sorting Task, the Tower of Hanoi, and the Stroop Test. Finally, part IV describes the application of neural network models to dementia: models of acetycholine and memory, verbal fluency, Parkinsons disease, and Alzheimer's disease. Contributors J. Wesson Ashford, Rajendra D. Badgaiyan, Jean P. Banquet, Yves Burnod, Nelson Butters, John Cardoso, Agnes S. Chan, Jean-Pierre Changeux, Kerry L. Coburn, Jonathan D. Cohen, Laurent Cohen, Jose L. Contreras-Vidal, Antonio R. Damasio, Hanna Damasio, Stanislas Dehaene, Martha J. Farah, Joaquin M. Fuster, Philippe Gaussier, Angelika Gissler, Dylan G. Harwood, Michael E. Hasselmo, J, Allan Hobson, Sam Leven, Daniel S. Levine, Debra L. Long, Roderick K. Mahurin, Raymond L. Ownby, Randolph W. Parks, Michael I. Posner, David P. Salmon, David Servan-Schreiber, Chantal E. Stern, Jeffrey P. Sutton, Lynette J. Tippett, Daniel Tranel, Bradley Wyble

Adaptive Control with Recurrent High-order Neural Networks - George A. Rovithakis 2012-12-06

The series Advances in Industrial Control aims to report and encourage technology transfer in control engineering. The rapid development of control technology has an impact on all areas of the control discipline. New theory, new controllers, actuators, sensors, new industrial processes, computer methods, new applications, new philosophies ... , new challenges. Much of this development work resides in industrial reports, feasibility study papers and the reports of advanced collaborative projects. The series offers an opportunity for researchers to present an extended exposition of such new work in all aspects of industrial control for wider and rapid dissemination. Neural networks is one of those areas where an initial burst of enthusiasm and optimism leads to an explosion of papers in the journals and many presentations at conferences but it is only in the last decade that significant theoretical work on stability, convergence and robustness for the use of neural networks in control systems has been tackled. George Rovithakis and Manolis Christodoulou have been interested in these theoretical problems and in the practical aspects of neural network applications to industrial problems. This very welcome addition to the Advances in Industrial Control series provides a succinct report of their research. The neural network model at the core of their work is the Recurrent High Order Neural Network (RHONN) and a complete theoretical and simulation development is presented. Different readers will find different aspects of the development of interest. The last chapter of the monograph discusses the problem of manufacturing or production process scheduling.

Research Anthology on Artificial Neural Network Applications - Management Association, Information Resources 2021-07-16

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 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.

Artificial Neural Networks for Modelling and Control of Non-Linear Systems - Johan A.K. Suykens 2012-12-06

Artificial neural networks possess several properties that make them particularly attractive for applications to modelling and control of complex non-linear systems. Among these properties are their universal approximation ability, their parallel network structure and the availability of on- and off-line learning methods for the interconnection weights. However, dynamic models that contain neural network architectures might be highly non-linear and difficult to analyse as a result. Artificial Neural Networks for Modelling and Control of Non-Linear Systems investigates the subject from a system theoretical point of view. However the mathematical theory that is required from the reader is limited to matrix calculus, basic analysis, differential equations and basic linear system theory. No preliminary knowledge of neural networks is explicitly required. The book presents both classical and novel network architectures and learning algorithms for modelling and control. Topics include non-linear system identification, neural optimal control, top-down model based neural control design and stability analysis of neural control systems. A major contribution of this book is to introduce NLq Theory as an extension towards modern control theory, in order to analyze and synthesize non-linear systems that contain linear together with static non-linear operators that satisfy a sector condition: neural state space control systems are an example. Moreover, it turns out that NLq Theory is unifying with respect to many problems arising in neural networks, systems and control. Examples show that complex non-linear systems can be modelled and controlled within NLq theory, including mastering chaos. The didactic flavor of this book makes it suitable for use as a text for a course on Neural Networks. In addition, researchers and designers will find many important new techniques, in particular NLq emTheory, that have applications in control theory, system theory, circuit theory and Time Series Analysis.

Advanced Models of Neural Networks - Gerasimos G. Rigatos 2014-08-27

This book provides a complete study on neural structures exhibiting nonlinear and stochastic dynamics, elaborating on neural dynamics by introducing advanced models of neural networks. It overviews the main findings in the modelling of neural dynamics in terms of electrical circuits and examines their stability properties with the use of dynamical systems theory. It is suitable for researchers and postgraduate students engaged with neural networks and dynamical systems theory.

Artificial Neural Networks in Food Processing - Mohamed Tarek Khadir 2021-01-18

Artificial Neural Networks (ANNs) is a powerful computational tool to mimic the learning process of the mammalian brain. This book gives a comprehensive overview of ANNs including an introduction to the topic, classifications of single neurons and neural networks, model predictive control and a review of ANNs used in food processing. Also, examples of ANNs in food processing applications such as pasteurization control are illustrated.

Application of neural networks to modelling and control - George F. Page 1993