Training Feedforward Networks With The Marquardt Algorithm

This book provides a broad yet detailed introduction to neural networks and machine learning in a statistical framework. A single, comprehensive resource for study and further research, it explores the major popular neural network models and statistical learning approaches with examples and exercises and allows readers to gain a practical working understanding of the content. This updated new edition presents recently published results and includes six new chapters that correspond to the recent advances in computational learning theory, sparse coding, deep learning, big data and cloud computing. Each chapter features state-of-the-art descriptions and significant research findings. The topics covered include: • multilayer perceptron; • the Hopfield network; • associative memory models;• clustering models and algorithms; • t he radial basis function network; • recurrent neural networks; • nonnegative matrix factorization; • independent component analysis; •probabilistic and Bayesian networks; and • fuzzy sets and logic. Focusing on the prominent accomplishments and their practical aspects, this book provides academic and technical staff, as well as graduate students and researchers with a solid foundation and comprehensive reference on the fields of neural networks, pattern recognition, signal processing, and machine learning.

This decade has seen an explosive growth in computational speed and memory and a rapid enrichment in our understanding of artificial neural networks. These two factors provide systems engineers and statisticians with the ability to build models of physical, economic, and information-based time series and signals. This book provides a thorough and coherent introduction to the mathematical properties of feedforward neural networks and to the intensive methodology which has enabled their highly successful application to complex problems.

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 combinatorial optimisation problems.

This volume contains the papers presented at the 12th Annual Conference on Algorithmic Learning Theory (ALT 2001), which was held in Washington DC, USA, during November 25–28, 2001. The main objective of the conference is to provide an inter-disciplinary forum for the discussion of theoretical foundations of machine learning, as well as their relevance to practical applications. The conference was co-located with the Fourth International Conference on Discovery Science (DS 2001). The volume includes 21 contributed papers. These papers were selected by the program committee from 42 submissions based on clarity, signi?cance, o- ginality, and relevance to theory and practice of machine learning. Additionally, the volume contains the invited talks of ALT 2001 presented by Dana Angluin of Yale University, USA, Paul R. Cohen of the University of Massachusetts at Amherst, USA, and the joint invited talk for ALT 2001 and DS 2001 presented by Setsuo Arikawa of Kyushu University, Japan. Furthermore, this volume includes abstracts of the invited talks for DS 2001 presented by Lindley Darden and Ben Shneiderman both of the University of Maryland at College Park, USA. The complete versions of these papers are published in the DS 2001 proceedings (Lecture Notes in Arti?cial Intelligence Vol. 2226).

Bridging the gap between human-computer engineering and control engineering, Human Behavior Learning and Transfer delineates how to abstract human action and reaction skills into computational models. The authors include methods for modeling a variety of human action and reaction behaviors and explore processes for evaluating, optimizing, and trans

Applications of Neural Networks gives a detailed description of 13 practical applications of neural networks, selected because the tasks performed by the neural networks are real and significant. The contributions are from leading researchers in neural networks and, as a whole, provide a balanced coverage across a range of application areas and algorithms. The book is divided into three sections. Section A is an introduction to neural networks for nonspecialists. Section B looks at examples of applications using `Supervised Training'. Section C presents a number of examples of `Unsupervised Training'. For neural network enthusiasts and interested, open-minded sceptics. The book leads the latter through the fundamentals into a convincing and varied series of neural success stories -- described carefully and honestly without over-claiming. Applications of Neural Networks is essential reading for all researchers and designers who are tasked with using neural networks in real life applications.

A comprehensive text on foundations and techniques of graph neural networks with applications in NLP, data mining, vision and healthcare.

First Published in 1995. Routledge is an imprint of Taylor & Francis, an informa company.

Designing and Training Feed-Forward Artificial Neural Networks For Secure Access Authorization.

This book provides successful implementations of metaheuristic methods for neural network training. It is the first book to achieve this objective. Moreover, the basic principles and fundamental ideas given in the book will allow the readers to create successful training methods on their own. Overall, the book's aim is to provide a broad coverage of the concepts, methods, and tools of the important area of ANNs within the realm of continuous optimization.

This book covers neural networks with special emphasis on advanced learning methodologies and applications. It includes practical issues of weight initializations, stalling of learning, and escape from a local minima, which have not been covered by many existing books in this area. Additionally, the book highlights the important feature selection problem, which baffles many neural networks practitioners because of the difficulties handling large datasets. It also contains several interesting IT, engineering and bioinformatics applications.

presents a unified and in-depth development of neural network learning algorithms and neural network expert systems

In recent years, there has been a growing interest in applying neural networks to dynamic systems identification (modelling), prediction and control. Neural networks are computing systems

characterised by the ability to learn from examples rather than having to be programmed in a conventional sense. Their use enables the behaviour of complex systems to be modelled and predicted and accurate control to be achieved through training, without a priori information about the systems' structures or parameters. This book describes examples of applications of neural networks In modelling, prediction and control. The topics covered include identification of general linear and non-linear processes, forecasting of river levels, stock market prices and currency exchange rates, and control of a time-delayed plant and a two-joint robot. These applications employ the major types of neural networks and learning algorithms. The neural network types considered in detail are the muhilayer perceptron (MLP), the Elman and Jordan networks and the Group-Method-of-Data-Handling (GMDH) network. In addition, cerebellar-model-articulation-controller (CMAC) networks and neuromorphic fuzzy logic systems are also presented. The main learning algorithm adopted in the applications is the standard backpropagation (BP) algorithm. Widrow-Hoff learning, dynamic BP and evolutionary learning are also described.

The aim of this B is to design fast thesisd forward neural networks to present a method to solve initial value problem for ordinary differential equations. That is to develop an algorithm which can speedup the solution times, reduce solver failures, and increase possibility of obtaining the globally optimal solution. The applicability of this approach ranges from single ordinary differential equations, to systems of ordinary differential equations with initial condition . Also, a variant types of compute the search direction k of conjugate gradient training algorithm are introduced and we describing several different training algorithms, many modified and new algorithms have been proposed for training Feed Forward Neural Network(FFNN), many of them having a very fast convergence rate for reasonable size networks. In all of these algorithms we use the gradient of the performance function(energy function) to determine how to adjust the weights such that the performance function is minimized, where the back propagation algorithm has been used to increase the speed of training. Finally, we illustrate the method by solving a variety of model problems."

Connectionist feed-forward networks, trained with back-propagation, can be used both for nonlinear regression and for (discrete one-of-C) classification, depending on the form of training. This report contains two papers on feed-forward networks. The papers can be read independently. They are intended for the theoretically-aware practitioner or algorithm-designer; however, they also contain a review and comparison of several learning theories so they provide a perspective for the theoretician. The first paper works through Bayesian methods to complement back-propagation in the training of feed-forward networks. The second paper addresses a problem raised by the first: how to efficiently calculate second derivatives on feed-forward networks. Buntine, Wray L. and Weigend, Andreas S. Ames Research Center...

Machine learning uses two types of techniques: supervised learning, which trains a model on known input and output data so that it can predict future outputs, and unsupervised learning, which finds hidden patterns or intrinsic structures in input data. The aim of supervised machine learning is to build a model that makes predictions based on evidence in the presence of uncertainty. A supervised learning algorithm takes a known set of input data and known responses to the data (output) and trains a model to generate reasonable predictions for the response to new data. Supervised learning uses classification and regression techniques to develop predictive models. • Classification techniques predict categorical responses, for example, whether an email is genuine or spam, or whether a tumor is cancerous or benign. Classification models classify input data into categories. Typical applications include medical imaging, image and speech recognition, and credit scoring. • Regression techniques predict continuous responses, for example, changes in temperature or fluctuations in power demand. Typical applications include electricity load forecasting and algorithmic trading. This book develops time series forecasting techniques using neural networks

A batch training algorithm for feed-forward networks is proposed which uses Newton's method to estimate a vector of optimal scaling factors for output errors in the network. Using this vector, backpropagation is used to modify weights feeding into the hidden units. Linear equations are then solved for the network's output weights. Elements of the new method's Gauss-Newton Hessian matrix are shown to be weighted sums of elements from the total network's Hessian. The effect of output transformation on training a feed-forward network is reviewed and explained, using the concept of equivalent networks. In several examples, the new method performs better than backpropagation and conjugate gradient, with similar numbers of required multiplies. The method performs about as well as Levenberg-Marquardt, with several orders of magnitude fewer multiplies due to the small size of its Hessian.

In order to facilitate complexity optimization in feedforward networks, several inte- grated growing and pruning algorithms are developed. First, a growing scheme is reviewed which iteratively adds new hidden units to full-trained networks. Then, a non-heuristic one-pass pruning technique is reviewed, which utilizes orthogonal least squares. Based upon pruning, a one-pass approach is developed for producing the validation error versus network size curve. Then, a combined approach is devised in which grown networks are pruned. As a result, the hidden units are ordered according to their usefulness, and less useful units are eliminated. In several examples, it is shown that networks designed using the integrated growing and pruning method have less training and validation error. This combined method exhibits reduced sensitivity to the choice of the initial weights and produces an almost monotonic error versus network size curve.

Starting from the strict interpolation equations for multivariate polynomials, an upper bound is developed for the number of patterns that can be memorized by a non-linear feedforward network. A straightforward proof by contradiction is presented for the upper bound. It is shown that the hidden activations do not have to be analytic. Networks, trained by conjugate gradient, are used to demonstrate the tightness of the bound for random patterns. The theoretical results agree closely to the simulations on two class problems solved by support vector machines. We model large classifiers like Support Vector Machines (SVMs) by smaller networks in order to decrease the computational cost. The key idea is to generate additional training patterns using a trained SVM and use these additional patterns along with the original training patterns to train a much smaller neural network. Results shown verify the validity of the technique and the method used to generate additional patterns. We also generalize this idea and prove that any learning machine can be used to generate additional patterns and in turn train any other machine to improve its performance.

This two volume set LNCS 5163 and LNCS 5164 constitutes the refereed proceedings of the 18th International Conference on Artificial Neural Networks, ICANN 2008, held in Prague Czech Republic, in September 2008. The 200 revised full papers presented were carefully reviewed and selected from more than 300 submissions. The first volume contains papers on mathematical theory of neurocomputing, learning algorithms, kernel methods, statistical learning and ensemble techniques, support vector machines,

reinforcement learning, evolutionary computing, hybrid systems, self-organization, control and robotics, signal and time series processing and image processing.
Neural network technology encompasses a class of methods which attempt to mimic the basic structures used in the brain for information processing. Thetechnology is aimed at problems such as pattern recognition which are difficult for traditional computational methods. Neural networks have potential applications in many industrial areas such as advanced robotics, operations research, and process engineering. This book is concerned with the application of neural network technology to real industrial problems. It summarizes a three-year collaborative international project called ANNIE (Applications of Neural Networks for Industry in Europe) which was jointly funded by industry and the European Commission within the ESPRIT programme. As a record of a working project, the book gives an insight into the real problems faced in taking a new technology from the workbench into a live industrial application, and shows just how it can be achieved. It stresses the comparison between neural networks and conventional approaches. Even the non-specialist reader will benefit from understanding the limitations as well as the advantages of the new technology.
This Text starts with a detailed overview of the Applications of neural Networks, illustrating its importance. The current problems present in the existing training algorithms like Back-Propagation, Newtons algorithm and the popular Levenberg-Marquardt algorithm are reviewed. The use of Multiple Optimal learning factors are explored in the text, followed by its complete analysis and possible methods of improvisation. All the training algorithms are implemented in Visual Studio 2005, and tested with universally accepted data files. It is observed that the Improvement of Multiple Optimal Learning Factors suggested in this text, provides almost the same effectiveness of the Levenberg-Marquardt algorithm with much lesser computational cost.
Optimization Techniques is a unique reference source to a diverse array of methods for achieving optimization, and includes both systems structures and computational methods. The text devotes broad coverage toa unified view of optimal learning, orthogonal transformation techniques, sequential constructive techniques, fast back propagation algorithms, techniques for neural networks with nonstationary or dynamic outputs, applications to constraint satisfaction,optimization issues and techniques for unsupervised learning neural networks, optimum Cerebellar Model of Articulation Controller systems, a new statistical theory of optimum neural learning, and the role of the Radial Basis Function in nonlinear dynamical systems.This volume is useful for practitioners, researchers, and students in industrial, manufacturing, mechanical, electrical, and computer engineering. Provides in-depth treatment of theoretical contributions to optimal learning for neural network systems Offers a comprehensive treatment of orthogonal transformation techniques for the optimization of neural network systems Includes illustrative examples and comprehensive treatment of sequential constructive techniques for optimization of neural network systems Presents a uniquely comprehensive treatment of the highly effective fast back propagation algorithms for the optimization of neural network systems Treats, in detail, optimization techniques for neural network systems with nonstationary or dynamic inputs Covers optimization techniques and applications of neural network systems in constraint satisfaction
This book comprises theoretical foundations to deep learning, machine learning and computing system, deep learning algorithms, and various deep learning applications. The book discusses significant issues relating to deep learning in data analytics. Further in-depth reading can be done from the detailed bibliography presented at the end of each chapter. Besides, this book's material includes concepts, algorithms, figures, graphs, and tables in guiding researchers through deep learning in data science and its applications for society. Deep learning approaches prevent loss of information and hence enhance the performance of data analysis and learning techniques. It brings up many research issues in the industry and research community to capture and access data effectively. The book provides the conceptual basis of deep learning required to achieve in-depth knowledge in computer and data science. It has been done to make the book more flexible and to stimulate further interest in topics. All these help researchers motivate towards learning and implementing the concepts in real-life applications.
The purpose of the 7th International Conference on Enterprise Information Systems (ICEIS) was to bring together researchers, engineers and practitioners interested in the advances and business applications of information systems. ICEIS focuses on real world applications, therefore authors were asked to highlight the benefits of Information Technology for industry and services. Papers included in the book are the best papers presented at the conference.
This book provides a collection of fourty articles containing new material on both theoretical aspects of Evolutionary Computing (EC), and demonstrating the usefulness/success of it for various kinds of large-scale real world problems. Around 23 articles deal with various theoretical aspects of EC and 17 articles demonstrate the success of EC methodologies. These articles are written by leading experts of the field from different countries all over the world.
Optimization Methods for Training Feedforward Neural NetworksFeedforward Neural Network MethodologySpringer Science & Business Media
This is Volume I of a three volume set constituting the refereed proceedings of the Third International Symposium on Neural Networks, ISNN 2006. 616 revised papers are organized in topical sections on neurobiological analysis, theoretical analysis, neurodynamic optimization, learning algorithms, model design, kernel methods, data preprocessing, pattern classification, computer vision, image and signal processing, system modeling, robotic systems, transportation systems, communication networks, information security, fault detection, financial analysis, bioinformatics, biomedical and industrial applications, and more.