

Igor Aizenberg

Complex-Valued Neural Networks with Multi-Valued Neurons



Springer

Complex Valued Neural Networks With Multi Valued Neurons Studies In Computational Intelligence

Xin-She Yang, Slawomir Koziel



Complex Valued Neural Networks With Multi Valued Neurons Studies In Computational Intelligence:

Complex-Valued Neural Networks with Multi-Valued Neurons Igor Aizenberg, 2011-06-24 Complex Valued Neural Networks have higher functionality learn faster and generalize better than their real valued counterparts This book is devoted to the Multi Valued Neuron MVN and MVN based neural networks It contains a comprehensive observation of MVN theory its learning and applications MVN is a complex valued neuron whose inputs and output are located on the unit circle Its activation function is a function only of argument phase of the weighted sum MVN derivative free learning is based on the error correction rule A single MVN can learn those input output mappings that are non linearly separable in the real domain Such classical non linearly separable problems as XOR and Parity n are the simplest that can be learned by a single MVN Another important advantage of MVN is a proper treatment of the phase information These properties of MVN become even more remarkable when this neuron is used as a basic one in neural networks The Multilayer Neural Network based on Multi Valued Neurons MLMVN is an MVN based feedforward neural network Its backpropagation learning algorithm is derivative free and based on the error correction rule It does not suffer from the local minima phenomenon MLMVN outperforms many other machine learning techniques in terms of learning speed network complexity and generalization capability when solving both benchmark and real world classification and prediction problems Another interesting application of MVN is its use as a basic neuron in multi state associative memories The book is addressed to those readers who develop theoretical fundamentals of neural networks and use neural networks for solving various real world problems It should also be very suitable for Ph D and graduate students pursuing their degrees in computational intelligence

Complex-Valued Neural Networks Akira Hirose, 2012-03-23 This book is the second enlarged and revised edition of the first successful monograph on complex valued neural networks CVNNs published in 2006 which lends itself to graduate and undergraduate courses in electrical engineering informatics control engineering mechanics robotics bioengineering and other relevant fields In the second edition the recent trends in CVNNs research are included resulting in e g almost a doubled number of references The parametron invented in 1954 is also referred to with discussion on analogy and disparity Also various additional arguments on the advantages of the complex valued neural networks enhancing the difference to real valued neural networks are given in various sections The book is useful for those beginning their studies for instance in adaptive signal processing for highly functional sensing and imaging control in unknown and changing environment robotics inspired by human neural systems and brain like information processing as well as interdisciplinary studies to realize comfortable society It is also helpful to those who carry out research and development regarding new products and services at companies The author wrote this book hoping in particular that it provides the readers with meaningful hints to make good use of neural networks in fully practical applications The book emphasizes basic ideas and ways of thinking Why do we need to consider neural networks that deal with complex numbers What advantages do the complex valued neural networks have What is the origin of the

advantages In what areas do they develop principal applications This book answers these questions by describing details and examples which will inspire the readers with new ideas The book is useful for those beginning their studies for instance in adaptive signal processing for highly functional sensing and imaging control in unknown and changing environment robotics inspired by human neural systems and brain like information processing as well as interdisciplinary studies to realize comfortable society It is also helpful to those who carry out research and development regarding new products and services at companies The author wrote this book hoping in particular that it provides the readers with meaningful hints to make good use of neural networks in fully practical applications The book emphasizes basic ideas and ways of thinking Why do we need to consider neural networks that deal with complex numbers What advantages do the complex valued neural networks have What is the origin of the advantages In what areas do they develop principal applications This book answers these questions by describing details and examples which will inspire the readers with new ideas

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Complex-Valued Neural Networks: Utilizing High-Dimensional Parameters Nitta, Tohru, 2009-02-28 This book covers the current state of the art theories and applications of neural networks with high dimensional parameters Provided by publisher

Advanced Computational Applications of Geometric Algebra David William Honorio Araujo Da Silva, Dietmar Hildenbrand, Eckhard Hitzer, 2024-06-03 How Geometric Algebra can naturally serve for constructing solutions for pattern recognition machine learning data

compression games robotics quantum computing data encoding to cite a few Moreover there is ample evidence that further research on GA and related areas can significantly expand the number of real world applications in a wide variety of areas A mathematical system that is very easy to handle highly robust and superior performance for engineering applications Good thematic introduction for engineers and researchers new to the subject Extensive illustrations and code examples Thematically well structured with many hands on examples Learning about GA and how to use it for daily tasks in engineering research and development *Impact of Class Assignment on Multinomial Classification Using Multi-Valued Neurons* Julian Knaup, 2022-08-06 Multilayer neural networks based on multi valued neurons MLMVNs have been proposed to combine the advantages of complex valued neural networks with a plain derivative free learning algorithm In addition multi valued neurons MVNs offer a multi valued threshold logic resulting in the ability to replace multiple conventional output neurons in classification tasks Therefore several classes can be assigned to one output neuron This book introduces a novel approach to assign multiple classes to numerous MVNs in the output layer It was found that classes that possess similarities should be allocated to the same neuron and arranged adjacent to each other on the unit circle Since MLMVNs require input data located on the unit circle two employed transformations are reevaluated The min max scaler utilizing the exponential function and the 2D discrete Fourier transform restricting to the phase information for image recognition The evaluation was performed on the Sensorless Drive Diagnosis dataset and the Fashion MNIST dataset Computational Optimization and Applications in Engineering and Industry Xin-She Yang, Slawomir Koziel, 2011-06-19 Contemporary design in engineering and industry relies heavily on computer simulation and efficient algorithms to reduce the cost and to maximize the performance and sustainability as well as profits and energy efficiency Solving an optimization problem correctly and efficiently requires not only the right choice of optimization algorithms and simulation methods but also the proper implementation and insight into the problem of interest This book consists of ten self contained detailed case studies of real world optimization problems selected from a wide range of applications and contributed from worldwide experts who are working in these exciting areas Optimization topics and applications include gas and water supply networks oil field production optimization microwave engineering aerodynamic shape design environmental emergence modelling structural engineering waveform design for radar and communication systems parameter estimation in laser experiment and measurement engineering materials and network scheduling These case studies have been solved using a wide range of optimization techniques including particle swarm optimization genetic algorithms artificial bee colony harmony search adaptive error control derivative free pattern search surrogate based optimization variable fidelity modelling as well as various other methods and approaches This book is a practical guide to help graduates and researchers to carry out optimization for real world applications More advanced readers will also find it a helpful reference and aide memoire

Claudio Moraga: A Passion for Multi-Valued Logic and Soft Computing Rudolf Seising, Héctor

Allende-Cid,2016-10-20 The book is an authoritative collection of contributions by leading experts on the topics of fuzzy logic multi valued logic and neural network Originally written as an homage to Claudio Moraga seen by his colleagues as an example of concentration discipline and passion for science the book also represents a timely reference guide for advance students and researchers in the field of soft computing and multiple valued logic [Intelligent Computer Graphics 2011](#)

Dimitri Plemenos,Georgios Miaoulis,2011-10-19 In Computer Graphics the use of intelligent techniques started more recently than in other research areas However during these last two decades the use of intelligent Computer Graphics techniques is growing up year after year and more and more interesting techniques are presented in this area The purpose of this volume is to present current work of the Intelligent Computer Graphics community a community growing up year after year This volume is a kind of continuation of the previously published Springer volumes Artificial Intelligence Techniques for Computer Graphics 2008 Intelligent Computer Graphics 2009 2009 and Intelligent Computer Graphics 2010 2010 This volume contains selected extended papers from the last 3IA Conference 3IA 2011 which has been held in Athens Greece in May 2011 This year papers are particularly exciting and concern areas like virtual reality artificial life data visualization games global illumination point cloud modelling declarative modelling scene reconstruction and many other very important themes

Emotional Cognitive Neural Algorithms with Engineering Applications Leonid Perlovsky,Ross Deming,Roman Ilin,2011-08-20 Dynamic logic DL recently had a highest impact on the development in several areas of modeling and algorithm design The book discusses classical algorithms used for 30 to 50 years where improvements are often measured by signal to clutter ratio and also new areas which did not previously exist These achievements were recognized by National and International awards Emerging areas include cognitive emotional intelligent systems data mining modeling of the mind higher cognitive functions evolution of languages and other Classical areas include detection recognition tracking fusion prediction inverse scattering and financial prediction All these classical areas are extended to using mixture models which previously was considered unsolvable in most cases Recent neuroimaging experiments proved that the brain mind actually uses DL Emotional Cognitive Neural Algorithms with Engineering Applications is written for professional scientists and engineers developing computer and information systems for professors teaching modeling and algorithms and for students working on Masters and Ph D degrees in these areas The book will be of interest to psychologists and neuroscientists interested in mathematical models of the brain and mind as well

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