Analog computing machine at the lewis flight. As Paul Cull has said, that analog devices behave digitally is the basis for a large part of. Sontag, analog computation via neural networks, theoretical computer. It's easy to back up your computer to save files. As I recall, it was not dissimilar to the bodacious beauty shown in the photograph below. Analog electronic and optical computing exhibit tremendous advantages over digital computing for accelerating deep learning when. Neural networks are an important component of artificial intelligence and machine learning. Have designed a new kind of circuit, which brings the flexibility of neural networks to bear on an emerging technology: The theoretical foundations of neural networks and analog computation conceptualize neural networks as a particular type of computer consisting of multiple. “Neural networks” have attracted much attention lately as models of analog computation. An artificial neural network is what is most commonly meant by the neural network. A computer is an analog artifact. The theoretical foundations of neural networks and analog computation conceptualize neural networks as a particular type of computer consisting of multiple. We pursue a particular approach to analog computation, based on dynamical systems of the type used in neural networks research. We pursue a particular approach. Though, they are much easier to understand in concept.

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We investigate the computational power of neural nets, taking a classical computer science point of view. We characterize the language recognition power of networks in terms of the types of numbers (constants) utilized as weights. From a mathematical viewpoint, it is natural to consider integer, rational, and real numbers. From the standpoint of computer science, natural classes of formal languages are regular, recursive, and 'all languages.' We establish a precise correspondence between the mathematical and computing choices. Furthermore, when the computation time of the network is constrained to be polynomial in the input size, the classes recognized by the respective networks are: regular, P, and Analog-P, i.e. P/poly. Among other results described in this thesis are a proper hierarchy of networks using Kolmogorov-complexity characterizations, the imposition of space constraints, and a proposed 'Church's thesis of analog computing.'

Non-Linear Feedback Neural Networks
Mohd. Samar Ansari 2013-09-03

This book aims to present a viable alternative to the Hopfield Neural Network (HNN) model for analog computation. It is well known the standard HNN suffers from problems of convergence to local minima, and requirement of a large number of neurons and synaptic weights. Therefore, improved solutions are needed. The non-linear synapse neural network (NoSyNN) is one such possibility and is discussed in detail in this book. This book also discusses the applications in computationally intensive tasks like graph coloring, ranking, and linear as well as quadratic programming. The material in the book is useful to students, researchers and academician working in the area of analog computation.

Artificial Neural Networks and Machine Learning - ICANN 2019: Theoretical Neural Computation
Igor V. Tetko 2019-09-09

The proceedings set LNCS 11727, 11728, 11729, 11730, and 11731 constitute the proceedings of the 28th International Conference on Artificial Neural Networks and Machine Learning.
Artificial Neural Networks, ICANN 2019, held in Munich, Germany, in September 2019. The total of 277 full papers and 43 short papers presented in these proceedings was carefully reviewed and selected from 494 submissions. They were organized in 5 volumes focusing on theoretical neural computation; deep learning; image processing; text and time series; and workshop and special sessions.

*Development of an Analog Neural Network Model of Computation* J. R. Anderson 1987

*Artificial Higher Order Neural Networks for Computer Science and Engineering: Trends for Emerging Applications* Zhang, Ming 2010-02-28 "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.

*Artificial Neural Networks* Petia Koprinkova-Hristova 2014-09-02 The book reports on the latest theories on artificial neural networks, with a special emphasis on bio-neuroinformatics methods. It includes twenty-three papers selected from among the best contributions on bio-neuroinformatics-related issues, which were presented at the International Conference on Artificial Neural Networks, held in Sofia, Bulgaria, on September 10-13, 2013 (ICANN 2013). The book covers a broad range of topics concerning the theory and applications of artificial neural networks, including recurrent neural networks, super-Turing computation and reservoir computing, double-layer vector perceptrons, nonnegative matrix factorization, bio-inspired models of cell communities, Gestalt laws, embodied theory of language understanding, saccadic gaze shifts and memory formation, and new training algorithms for Deep Boltzmann Machines, as well as dynamic neural networks and kernel machines. It also reports on new approaches to reinforcement learning, optimal control of discrete time-delay systems, new algorithms for prototype selection, and group structure.
discovering. Moreover, the book discusses one-class support vector machines for pattern recognition, handwritten digit recognition, time series forecasting and classification, and anomaly identification in data analytics and automated data analysis. By presenting the state-of-the-art and discussing the current challenges in the fields of artificial neural networks, bioinformatics and neuroinformatics, the book is intended to promote the implementation of new methods and improvement of existing ones, and to support advanced students, researchers and professionals in their daily efforts to identify, understand and solve a number of open questions in these fields.

**From Natural to Artificial Neural Computation**

International Workshop on Artificial Neural Networks 1995-05-24 This volume presents the proceedings of the International Workshop on Artificial Neural Networks, IWANN '95, held in Torremolinos near Malaga, Spain in June 1995. The book contains 143 revised papers selected from a wealth of submissions and five invited contributions; it covers all current aspects of neural computation and presents the state of the art of ANN research and applications. The papers are organized in sections on neuroscience, computational models of neurons and neural nets, organization principles, learning, cognitive science and AI, neurosimulators, implementation, neural networks for perception, and neural networks for communication and control. **Theory and Practice of Natural Computing**

David Fagan 2018-12-05 This book constitutes the refereed proceedings of the 7th International Conference on Theory and Practice of Natural Computing, TPNC 2017, held in Dublin, Ireland, in December 2018. The 35 full papers presented in this book, together with one invited talk, were carefully reviewed and selected from 69 submissions. The papers are organized around the following topical sections: applications of natural computing as algorithms, bioinformatics, control, cryptography, design, economics. The more
Analog VLSI Neural Networks Yoshiyasu Takefuji
2012-12-06 This book brings together in one place important contributions and state-of-the-art research in the rapidly advancing area of analog VLSI neural networks. The book serves as an excellent reference, providing insights into some of the most important issues in analog VLSI neural networks research efforts.

Mathematical Perspectives on Neural Networks Paul Smolensky 2013-05-13 Recent years have seen an explosion of new mathematical results on learning and processing in neural networks. This body of results rests on a breadth of mathematical background which even few specialists possess. In a format intermediate between a textbook and a collection of research articles, this book has been assembled to present a sample of these results, and to fill in the necessary background, in such areas as computability theory, computational complexity theory, the theory of analog computation, stochastic processes, dynamical systems, control.

An Analog Computing Approach to Structural Analysis and Optimal Design Through Artificial Neural Networks Biao Fu 1993
theory, time-series analysis, Bayesian analysis, regularization theory, information theory, computational learning theory, and mathematical statistics. Mathematical models of neural networks display an amazing richness and diversity. Neural networks can be formally modeled as computational systems, as physical or dynamical systems, and as statistical analyzers. Within each of these three broad perspectives, there are a number of particular approaches. For each of 16 particular mathematical perspectives on neural networks, the contributing authors provide introductions to the background mathematics, and address questions such as: * Exactly what mathematical systems are used to model neural networks from the given perspective? * What formal questions about neural networks can then be addressed? * What are typical results that can be obtained? and * What are the outstanding open problems? A distinctive feature of this volume is that for each perspective presented in one of the contributed chapters, the first editor has provided a moderately detailed summary of the formal results and the requisite mathematical concepts. These summaries are presented in four chapters that tie together the 16 contributed chapters: three develop a coherent view of the three general perspectives -- computational, dynamical, and statistical; the other assembles these three perspectives into a unified overview of the neural networks field.

**VLSI for Artificial Intelligence and Neural Networks** Jose G. Delgado-Frias 2012-12-06 This book is an edited selection of the papers presented at the International Workshop on VLSI for Artificial Intelligence and Neural Networks which was held at the University of Oxford in September 1990. Our thanks go to all the contributors and especially to the programme committee for all their hard work. Thanks are also due to the ACM-SIGARCH, the IEEE Computer Society, and the IEE for publicizing the event and to
Artificial intelligence and neural network algorithms/computing have increased in complexity as well as in the number of applications. This in turn has posed a tremendous need for a larger computational power than can be provided by conventional scalar processors which are oriented towards numeric and data manipulations. Due to the artificial intelligence requirements (symbolic manipulation, knowledge representation, non-deterministic computations and dynamic resource allocation) and neural network computing approach (non-programming and learning), a different set of constraints and demands are imposed on the computer architectures for these applications.

Artificial Neural Networks and Machine Learning --
1999. The 91 revised papers presented were carefully reviewed and selected for inclusion in the book. This volume is devoted to applications of biologically inspired artificial neural networks in various engineering disciplines. The papers are organized in parts on artificial neural nets simulation and implementation, image processing, and engineering applications.

**Current Trends in Theoretical Computer Science** Gheorghe Păun 2004
This book is based on columns and tutorials published in the Bulletin of the European Association for Theoretical Computer Science (EATCS) during the period 2000–2003. It presents many of the most active current research lines in theoretical computer science. The material appears in two volumes, OC Algorithms and Complexity and OC Formal Models and Semantics, reflecting the traditional division of the field. The list of contributors includes many of the well-known researchers in theoretical computer science. Most of the articles are reader-friendly and do not presuppose much knowledge of the area in question. Therefore, the book constitutes very suitable supplementary reading material for various courses and seminars in computer science. Contents: Vol 1: Algorithms; Computational Complexity; Distributed Computing; Natural Computing; Vol 2: Formal Specification; Logic in Computer Science; Concurrency; Formal Language Theory.

**Encyclopedia of Complexity and Systems Science**
2009-06-26 This encyclopedia provides an authoritative single source for understanding and applying the concepts of complexity theory together with the tools and measures for analyzing complex systems in all fields of science and engineering. It links fundamental concepts of mathematics and computational sciences to
applications in the physical sciences, engineering, biomedicine, economics and the social sciences. 

*Circuit Complexity and Neural Networks* Ian Parberry 1994

Neural networks usually work adequately on small problems but can run into trouble when they are scaled up to problems involving large amounts of input data. *Circuit Complexity and Neural Networks* addresses the important question of how well neural networks scale - that is, how fast the computation time and number of neurons grow as the problem size increases. It surveys recent research in circuit complexity (a robust branch of theoretical computer science) and applies this work to a theoretical understanding of the problem of scalability. Most research in neural networks focuses on learning, yet it is important to understand the physical limitations of the network before the resources needed to solve a certain problem can be calculated. One of the aims of this book is to compare the complexity of neural networks and the complexity of conventional computers, looking at the computational ability and resources (neurons and time) that are a necessary part of the foundations of neural network learning.

*Circuit Complexity and Neural Networks* contains a significant amount of background material on conventional complexity theory that will enable neural network scientists to learn about how complexity theory applies to their discipline, and allow complexity theorists to see how their discipline applies to neural networks.

*Space-Time Computing with Temporal Neural Networks* James E. Smith 2017-05-18

Understanding and implementing the brain's computational paradigm is the one true grand challenge facing computer researchers. Not only are the brain's computational capabilities far beyond those of conventional computers, its energy efficiency is truly remarkable. This book, written from the perspective of a computer designer and targeted at computer researchers, is intended to give both background and lay out a course of action for studying...
the brain's computational paradigm. It contains a mix of concepts and ideas drawn from computational neuroscience, combined with those of the author. As background, relevant biological features are described in terms of their computational and communication properties. The brain's neocortex is constructed of massively interconnected neurons that compute and communicate via voltage spikes, and a strong argument can be made that precise spike timing is an essential element of the paradigm. Drawing from the biological features, a mathematics-based computational paradigm is constructed. The key feature is spiking neurons that perform communication and processing in space-time, with emphasis on time. In these paradigms, time is used as a freely available resource for both communication and computation. Neuron models are first discussed in general, and one is chosen for detailed development. Using the model, single-neuron computation is first explored. Neuron inputs are encoded as spike patterns, and the neuron is trained to identify input pattern similarities. Individual neurons are building blocks for constructing larger ensembles, referred to as "columns". These columns are trained in an unsupervised manner and operate collectively to perform the basic cognitive function of pattern clustering. Similar input patterns are mapped to a much smaller set of similar output patterns, thereby dividing the input patterns into identifiable clusters. Larger cognitive systems are formed by combining columns into a hierarchical architecture. These higher level architectures are the subject of ongoing study, and progress to date is described in detail in later chapters. Simulation plays a major role in model development, and the simulation infrastructure developed by the author is described.

Cellular Neural Networks and Visual Computing Leon O. Chua 2005-08-22 Cellular Nonlinear/Neural Network (CNN) technology is both a revolutionary concept and an experimentally proven new
computing paradigm. Analogic cellular computers based on CNNs are set to change the way analog signals are processed. This unique undergraduate level textbook includes many examples and exercises, including CNN simulator and development software accessible via the Internet. It is an ideal introduction to CNNs and analogic cellular computing for students, researchers and engineers from a wide range of disciplines. Although its prime focus is on visual computing, the concepts and techniques described in the book will be of great interest to those working in other areas of research including modeling of biological, chemical and physical processes. Leon Chua, co-inventor of the CNN, and Tamás Roska are both highly respected pioneers in the field.

**Cellular Neural Networks and Visual Computing** Leon O. Chua 2002-05-30 Cellular Nonlinear/neural Network (CNN) technology is both a revolutionary concept and an experimentally proven new computing paradigm. Analogic cellular computers based on CNNs are set to change the way analog signals are processed and are paving the way to an analog computing industry. This unique undergraduate level textbook includes many examples and exercises, including CNN simulator and development software accessible via the Internet. It is an ideal introduction to CNNs and analogic cellular computing for students, researchers and engineers from a wide range of disciplines. Although its prime focus is on visual computing, the concepts and techniques described in the book will be of great interest to those working in other areas of research including modeling of biological, chemical and physical processes. Leon Chua, co-inventor of the CNN, and Tamás Roska are both highly respected pioneers in the field.

**Neural Information Processing** Tom Gedeon 2019-12-10 The three-volume set of LNCS 11953, 11954, and 11955 constitutes the proceedings of the 26th International Conference on Neural Information Processing, ICONIP 2019, held in Sydney, Australia, in December 2019. The 173 full papers presented were carefully reviewed and selected from 645 submissions. The papers address the emerging topics of theoretical research, empirical studies, and
applications of neural information processing techniques across different domains. The third volume, LNCS 11955, is organized in topical sections on semantic and graph based approaches; spiking neuron and related models; text computing using neural techniques; time-series and related models; and unsupervised neural models.

**Neural Networks and Analog Computation** Hava T. Siegelmann 2012-12-06

The theoretical foundations of Neural Networks and Analog Computation conceptualize neural networks as a particular type of computer consisting of multiple assemblies of basic processors interconnected in an intricate structure. Examining these networks under various resource constraints reveals a continuum of computational devices, several of which coincide with well-known classical models. On a mathematical level, the treatment of neural computations enriches the theory of computation but also explicated the computational complexity associated with biological networks, adaptive engineering tools, and related models from the fields of control theory and nonlinear dynamics. The material in this book will be of interest to researchers in a variety of engineering and applied sciences disciplines. In addition, the work may provide the base of a graduate-level seminar in neural networks for computer science students.

**Analog Computation, Artificial Neural Networks and Convex Quadratic Optimization** Sushil Kumar Verma 1994

**Neural Networks** Søren Brunak 1990

Both specialists and laymen will enjoy reading this book. Using a lively, non-technical style and images from everyday life, the authors present the basic principles behind computing and computers. The focus is on those aspects of computation that concern networks of numerous small computational units, whether biological neural networks or artificial electronic devices.

**The Handbook of Brain Theory and Neural Networks** Michael A. Arbib 2003

This second edition
presents the enormous progress made in recent years in the many subfields related to the two great questions: how does the brain work? and, How can we build intelligent machines? This second edition greatly increases the coverage of models of fundamental neurobiology, cognitive neuroscience, and neural network approaches to language. (Midwest).

**Machines, Computations, and Universality** Maurice Margenstern 2003-06-29 In the first part of the present volume of LNCS, the reader will find the invited talks given at the MCU 2001 conference. In the second part, he/she will find the contributions that were presented at the conference after selection. In both cases, papers are arranged in the alphabetical order of the authors. MCU 2001 is the third conference in theoretical computer science, Machines, computations and universality, formerly, Machines et calculs universels. Both previous conferences, MCU’95 and MCU’98, were organized by Maurice Margenstern in Paris and in Metz (France), respectively. From the very beginning, MCU conferences have been an international scientific event. For the third conference, in order to stress that aspect, it was decided to hold it outside France. Moldova was chosen thanks to the close cooperation between the present chairmen of MCU 2001. MCU 2001 also aims at high scientific standards. We hope that the present volume will convince the reader that the tradition of previous conferences have been upheld by this one. Cellular automata and molecular computing are well represented in this volume. And this is also the case for quantum computing, formal languages, and the theory of automata. MCU 2001 does not fail its tradition of providing our community with important results on Turing machines.

**Theory and Practice of Natural Computing** Adrian-Horia Dediu 2014-12-05 This book constitutes the refereed proceedings of the Third International Conference, TPNC 2014, held in Granada, Spain, in December 2014. The 22 revised full papers presented in this book were
carefully reviewed and selected from 47 submissions. The papers are organized in topical sections on nature-inspired models of computation; synthesizing nature by means of computation; nature-inspired materials; and information processing in nature.

**Adaptive and Natural Computing Algorithms**

Andrei Dobnikar 2011-03-03

The two-volume set LNCS 6593 and 6594 constitutes the refereed proceedings of the 10th International Conference on Adaptive and Natural Computing Algorithms, ICANNGA 2010, held in Ljubljana, Slovenia, in April 2010. The 83 revised full papers presented were carefully reviewed and selected from a total of 144 submissions. The first volume includes 42 papers and a plenary lecture and is organized in topical sections on neural networks and evolutionary computation.

**Learning with Recurrent Neural Networks**

Barbara Hammer 2007-10-03

Folding networks, a generalisation of recurrent neural networks to tree structured inputs, are investigated as a mechanism to learn regularities on classical symbolic data, for example. The architecture, the training mechanism, and several applications in different areas are explained. Afterwards a theoretical foundation, proving that the approach is appropriate as a learning mechanism in principle, is presented: Their universal approximation ability is investigated - including several new results for standard recurrent neural networks such as explicit bounds on the required number of neurons and the super Turing capability of sigmoidal recurrent networks. The information theoretical learnability is examined - including several contribution to distribution dependent learnability, an answer to an open question posed by Vidyasagar, and a generalisation of the recent luckiness framework to function classes. Finally, the complexity of training is considered - including new results on the loading problem for standard feedforward networks with an arbitrary multilayered architecture, a correlated number of neurons and
training set size, a varying number of hidden neurons but fixed input dimension, or the sigmoidal activation function, respectively.

**Neosentience** Bill Seaman
2011-01-12 Coined by artist and media researcher Bill Seaman, “neosentience” describes a new branch of scientific inquiry related to artificial intelligence. This volume explores the groundbreaking work of Seaman and chaos physicist Otto E. Rossler in exploring the potential of an intelligent robotic entity possessed of a form of sentience that ever-more-closely resembles that of a human being. Individual chapters approach the concept from a range of disciplines, including psychology, neuroscience, linguistics, and the arts. Neosentience is a burgeoning area of interest, and this book encourages readers to reflect on how we experience and interpret the world, how memory works, and what it is to be human. ‘Although the manuscript’s subject might fit within the domains of Artificial Intelligence, Artificial Life, consciousness and mind studies, the approach to these topics comes from a poetic/scientific point of view within which its originality becomes apparent. Both authors have directly or indirectly contributed to the field of arts and profusely written on correlated subjects and its intersection with the domains of science and technology. This gives to the book a unique approach, which is insightful, speculative and substantial at the same time. This intuitive side of the manuscript owes to that fecund conjunction between arts and science.’

Guto Nobrega More information The study addressed in this “book” puts forward a project that is twofold. Firstly, it discusses the conceptual basis within which it would be possible for the construction of a “neosentient” system, a machine endowed with the capacity to perceive or feel things in the world, as if manifesting a proto form of (artificial) consciousness. Secondly, it hypothesizes about the rising of benevolence through the interaction/intra-action, between “neosentient” machines and their
environment, which include us, human beings, as inhabitants. The manuscript tackles its task in a very particular manner as it interrelates a constellation of ideas in order to address key research agendas on the fields of language, aesthetics, philosophy, biology, physics, science, technology, mind and consciousness to name some. The goal of the book is not to define the structure within which such an engine could be built, it does not bring into light the blueprint of such an, but it nails down key concepts from a broad range of topics, mapping a path for future research, reinforcing this way the sense of feasibility of its enterprise. In doing so, the book illuminates trajectories, ramifications or even non-directly correlated ideas that would pass unnoticed to the reader’s mind, were not by the authors generously bringing into play sets of key scholars, theories, discoveries, even speculative ideas.

**Computational Mathematics, Modelling and Algorithms** J. C. Misra 2003 This comprehensive volume introduces educational units dealing with important topics in Mathematics, Modelling and Algorithms. Key Features: Illustrative examples and exercises Comprehensive bibliography

**Artificial Neural Networks - ICANN 2006** Stefanos Kollias 2006-09-11 The two-volume set LNCS 4131 and LNCS 4132 constitutes the refereed proceedings of the 16th International Conference on Artificial Neural Networks, ICANN 2006. The set presents 208 revised full papers, carefully reviewed and selected from 475 submissions. This first volume presents 103 papers, organized in topical sections on feature selection and dimension reduction for regression, learning algorithms, advances in neural network learning methods, ensemble learning, hybrid architectures, and more.

**Alternative Computers** 1989 Examines the role of analog computers, neural-network strategies, how to compute with light, and super computer research.
Brunak 1990 Both specialists and laymen will enjoy reading this book. Using a lively, non-technical style and images from everyday life, the authors present the basic principles behind computing and computers. The focus is on those aspects of computation that concern networks of numerous small computational units, whether biological neural networks or artificial electronic devices.

Nonlinear Circuits and Systems with Memristors
Fernando Corinto 2020-10-31
This book presents a new approach to the study of physical nonlinear circuits and advanced computing architectures with memristor devices. Such a unified approach to memristor theory has never been systematically presented in book form. After giving an introduction on memristor-based nonlinear dynamical circuits (e.g., periodic/chaotic oscillators) and their use as basic computing analogue elements, the authors delve into the nonlinear dynamical properties of circuits and systems with memristors and present the flux-charge analysis, a novel method for analyzing the nonlinear dynamics starting from writing Kirchhoff laws and constitutive relations of memristor circuit elements in the flux-charge domain. This analysis method reveals new peculiar and intriguing nonlinear phenomena in memristor circuits, such as the coexistence of different nonlinear dynamical behaviors, extreme multistability and bifurcations without parameters. The book also describes how arrays of memristor-based nonlinear oscillators and locally-coupled neural networks can be applied in the field of analog computing architectures, for example for pattern recognition. The book will be of interest to scientists and engineers involved in the conceptual design of physical memristor devices and systems, mathematical and circuit models of physical processes, circuits and networks design, system engineering, or data processing and system analysis.

Neural Networks: Computers With Intuition
Benny Elley
Lautrup 1990-05-01
Both specialists and laymen will
enjoy reading this book. Using a lively, non-technical style and images from everyday life, the authors present the basic principles behind computing and computers. The focus is on those aspects of computation that concern networks of numerous small computational units, whether biological neural networks or artificial electronic devices.

**Artificial Neural Networks and Machine Learning -- ICANN 2013** Valeri Mladenov 2013-09-04 The book constitutes the proceedings of the 23rd International Conference on Artificial Neural Networks, ICANN 2013, held in Sofia, Bulgaria, in September 2013. The 78 papers included in the proceedings were carefully reviewed and selected from 128 submissions. The focus of the papers is on following topics: neurofinance graphical network models, brain machine interfaces, evolutionary neural networks, neurodynamics, complex systems, neuroinformatics, neuroengineering, hybrid systems, computational biology, neural hardware, bioinspired embedded systems, and collective intelligence.

**Computable Analysis** Klaus Weihrauch 2012-12-06 Merging fundamental concepts of analysis and recursion theory to a new exciting theory, this book provides a solid fundament for studying various aspects of computability and complexity in analysis. It is the result of an introductory course given for several years and is written in a style suitable for graduate-level and senior students in computer science and mathematics. Many examples illustrate the new concepts while numerous exercises of varying difficulty extend the material and stimulate readers to work actively on the text.

**Limitations and Future Trends in Neural Computation** 2003