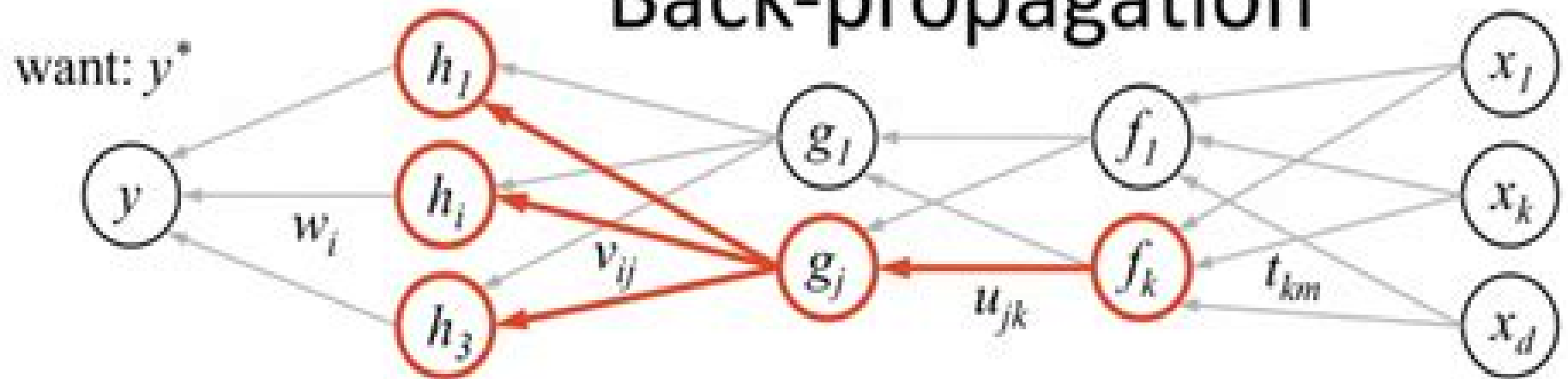


Back-propagation



1. receive new observation $x = [x_1 \dots x_d]$ and target y^*
2. **feed forward:** for each unit g_j in each layer $1 \dots L$
compute g_j based on units f_k from previous layer: $g_j = \sigma \left(u_{j0} + \sum_k u_{jk} f_k \right)$
3. get prediction y and error $(y - y^*)$
4. **back-propagate error:** for each unit g_j in each layer $L \dots 1$

(a) compute error on g_j

$$\underbrace{\frac{\partial E}{\partial g_j}}_{\text{should } g_j \text{ be higher or lower?}} = \sum_i \underbrace{\sigma'(h_i) v_{ij}}_{\text{how } h_i \text{ will change as } g_j \text{ changes}} \underbrace{\frac{\partial E}{\partial h_i}}_{\text{was } h_i \text{ too high or too low?}}$$

(b) for each u_{jk} that affects g_j

(i) compute error on u_{jk}

$$\frac{\partial E}{\partial u_{jk}} = \underbrace{\frac{\partial E}{\partial g_j}}_{\text{do we want } g_j \text{ to be higher/lower?}} \underbrace{\sigma'(g_j) f_k}_{\text{how } g_j \text{ will change if } u_{jk} \text{ is higher/lower?}}$$

(ii) update the weight

$$u_{jk} \leftarrow u_{jk} - \eta \frac{\partial E}{\partial u_{jk}}$$

Neural Networks And Back Propagation Algorithm

**Kusum Deep,Atulya Nagar,Millie
Pant,Jagdish Chand Bansal**



Neural Networks And Back Propagation Algorithm:

Backpropagation Yves Chauvin, David E. Rumelhart, 2013-02-01 Composed of three sections this book presents the most popular training algorithm for neural networks backpropagation The first section presents the theory and principles behind backpropagation as seen from different perspectives such as statistics machine learning and dynamical systems The second presents a number of network architectures that may be designed to match the general concepts of Parallel Distributed Processing with backpropagation learning Finally the third section shows how these principles can be applied to a number of different fields related to the cognitive sciences including control speech recognition robotics image processing and cognitive psychology The volume is designed to provide both a solid theoretical foundation and a set of examples that show the versatility of the concepts Useful to experts in the field it should also be most helpful to students seeking to understand the basic principles of connectionist learning and to engineers wanting to add neural networks in general and backpropagation in particular to their set of problem solving methods

Neural Networks Morgan Maynard, 2020-05-06 Do You Know Why Software Engineers Study the Human Brain Software Engineers recognize that computers can process and store much more data than humans yet even supercomputers can't carry out tasks that come easily to the human brain such as facial recognition or natural language processing MIT's state of the art research facility named Centre for Brains Minds and Machines is a perfect testimonial to this fundamental interaction between the human brain and computers in today's world Hence engineers began studying the processes and structures of our human brains hoping to build a computer model of its functions Neural Networks were born These models are very simplistic but fundamentally replicate the inner structures of our own brains downright to the functions of an individual neuron In this book I show you exactly how engineers model the inner functions and structure of the human brains covering the fundamental mathematical equations and underlying concepts In particular you will learn about How to Build a Computer model of a Brain Cell or Neuron The Fundamental properties of a Neural Network Multilayer Forward Networks Using the Backpropagation algorithm to learn and adapt Counter Propagation Networks How to train a Neural network validation and testing techniques to avoid overfitting

Pattern Recognition with Neural Networks in C++ Abhijit S. Pandya, Robert B. Macy, 1995-10-17 The addition of artificial neural network computing to traditional pattern recognition has given rise to a new different and more powerful methodology that is presented in this interesting book This is a practical guide to the application of artificial neural networks Geared toward the practitioner Pattern Recognition with Neural Networks in C covers pattern classification and neural network approaches within the same framework Through the book's presentation of underlying theory and numerous practical examples readers gain an understanding that will allow them to make judicious design choices rendering neural application predictable and effective The book provides an intuitive explanation of each method for each network paradigm This discussion is supported by a rigorous mathematical approach where necessary C has emerged as a rich and descriptive

means by which concepts models or algorithms can be precisely described For many of the neural network models discussed C programs are presented for the actual implementation Pictorial diagrams and in depth discussions explain each topic Necessary derivative steps for the mathematical models are included so that readers can incorporate new ideas into their programs as the field advances with new developments For each approach the authors clearly state the known theoretical results the known tendencies of the approach and their recommendations for getting the best results from the method The material covered in the book is accessible to working engineers with little or no explicit background in neural networks However the material is presented in sufficient depth so that those with prior knowledge will find this book beneficial Pattern Recognition with Neural Networks in C is also suitable for courses in neural networks at an advanced undergraduate or graduate level This book is valuable for academic as well as practical research

Proceedings of the International Conference on Soft Computing for Problem Solving (SocProS 2011) December 20-22, 2011 Kusum Deep,Atulya Nagar,Millie Pant,Jagdish Chand Bansal,2012-04-15 The objective is to provide the latest developments in the area of soft computing These are the cutting edge technologies that have immense application in various fields All the papers will undergo the peer review process to maintain the quality of work

Neural Nets WIRN VIETRI-96 Maria Marinaro,Roberto Tagliaferri,2012-12-06 This volume contains selected papers from WIRN VIETRI 96 the 8th Italian Workshop on Neural Nets held Vietri sul Mare Salerno Italy from 23 25 May 1996 The papers cover a variety of topics related to neural networks including pattern recognition signal processing theoretical models applications in science and industry virtual reality fuzzy systems and software algorithms By providing the reader with a comprehensive overview of recent research work in this area the volume makes an invaluable contribution to the Perspectives in Neural Computing Series Neural Nets WIRN VIETRI 96 will provide invaluable reading material for anyone who needs to keep up to date with the latest developments in neural networks and related areas It will be of particular interest to academic and industrial researchers and postgraduate and graduate students

The Hitchhiker's Guide to Machine Learning Algorithms Devin Schumacher,Francis LaBounty Jr.,2023-07-26 Hello humans welcome to the world of machines Specifically machine learning algorithms We are about to embark on an exciting adventure through the vast and varied landscape of algorithms that power the cutting edge field of artificial intelligence Machine learning is changing the world as we know it From predicting stock market trends and diagnosing diseases to powering the virtual assistants in our smartphones and enabling self driving cars and picking up the slack on your online dating conversations What makes this book unique is its structure and depth With 100 chapters each dedicated to a different machine learning concept this book is designed to be your ultimate guide to the world of machine learning algorithms Whether you are a student a data science professional or someone curious about machine learning this book aims to provide a comprehensive overview that is both accessible and in depth The algorithms covered in this book span various categories including Classification Regression Learn about algorithms like Decision Trees Random Forests Support

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based largely on the longevity of the product This concept can be extended by various methods of improvement including optimizing the initial creation structures which can lead to a more desired product and extend the product s time on the market Design and Optimization of Mechanical Engineering Products is an essential research source that explores the structure and processes used in creating goods and the methods by which these goods are improved in order to continue competitiveness in the consumer market Featuring coverage on a broad range of topics including modeling and simulation new product development and multi criteria decision making this publication is targeted toward students practitioners researchers engineers and academicians

Sustainable Development in AI, Blockchain, and E-Governance

Applications Kumar, Rajeev, Abdul Hamid, Abu Bakar, Binti Ya'akub, Dato' Dr Noor Inayah Binti, Sharan, Hari Om, Kumar, Sandeep, 2024-02-09 In the age of immediate technical expansion our world faces a multifaceted challenge ensuring the sustainability of our digital transformation Governments and organizations have wholeheartedly embraced innovative technologies such as artificial intelligence blockchain and e governance but in doing so they have encountered a complex web of issues These range from cybersecurity concerns in an increasingly digitalized world to the need for intelligent systems capable of managing automation infrastructure and interconnected environments Sustainable Development in AI Blockchain and E Governance Applications offers a forward thinking approach that harnesses the synergy between intelligent systems machine learning deep learning and blockchain methods It explores data driven decision making automation infrastructure autonomous transportation and the creation of connected buildings all aimed at crafting a sustainable digital future By delving into topics like machine learning for smart parking disease classification through neural networks and the Internet of Things IoT for smarter cities this book equips academic scholars with the tools they need to navigate the complex terrain of technology and governance Academic scholars and researchers in technology governance and sustainability will find this book to be an indispensable resource It caters to those seeking a comprehensive understanding of current and future trends in the integration of intelligent systems with cybersecurity applications

Smart Agricultural Services Using Deep Learning, Big Data, and IoT

Gupta, Amit Kumar, Goyal, Dinesh, Singh, Vijander, Sharma, Harish, 2020-10-30 The agricultural sector can benefit immensely from developments in the field of smart farming However this research area focuses on providing specific fixes to particular situations and falls short on implementing data driven frameworks that provide large scale benefits to the industry as a whole Using deep learning can bring immense data and improve our understanding of various earth sciences and improve farm services to yield better crop production and profit Smart Agricultural Services Using Deep Learning Big Data and IoT is an essential publication that focuses on the application of deep learning to agriculture While highlighting a broad range of topics including crop models cybersecurity and sustainable agriculture this book is ideally designed for engineers programmers software developers agriculturalists farmers policymakers researchers academicians and students

The Fundamentals of Computational Intelligence: System

Approach Mikhail Z. Zgurovsky, Yuriy P. Zaychenko, 2016-07-01 This monograph is dedicated to the systematic presentation of main trends technologies and methods of computational intelligence CI The book pays big attention to novel important CI technology fuzzy logic FL systems and fuzzy neural networks FNN Different FNN including new class of FNN cascade neo fuzzy neural networks are considered and their training algorithms are described and analyzed The applications of FNN to the forecast in macroeconomics and at stock markets are examined The book presents the problem of portfolio optimization under uncertainty the novel theory of fuzzy portfolio optimization free of drawbacks of classical model of Markovitz as well as an application for portfolios optimization at Ukrainian Russian and American stock exchanges The book also presents the problem of corporations bankruptcy risk forecasting under incomplete and fuzzy information as well as new methods based on fuzzy sets theory and fuzzy neural networks and results of their application for bankruptcy risk forecasting are presented and compared with Altman method This monograph also focuses on an inductive modeling method of self organization the so called Group Method of Data Handling GMDH which enables to construct the structure of forecasting models almost automatically The results of experimental investigations of GMDH for forecasting at stock exchanges are presented The final chapters are devoted to theory and applications of evolutionary modeling EM and genetic algorithms The distinguishing feature of this monograph is a great number of practical examples of CI technologies and methods application for solution of real problems in technology economy and financial sphere in particular forecasting classification pattern recognition portfolio optimization bankruptcy risk prediction under uncertainty which were developed by authors and published in this book for the first time All CI methods and algorithms are presented from the general system approach and analysis of their properties advantages and drawbacks that enables practitioners to choose the most adequate method for their own problems solution

FUNDAMENTALS OF MACHINE LEARNING TECHNIQUES Mr. Dayakar Babu Kancharla, Ishita

Arora, Maher Ali Rusho, Tasriqul Islam, 2024-01-10 Machine learning is a subfield of computing science that evolved both from the knowledge obtained through the process of learning how to classify data based on that understanding and also from the understanding gained through the process of learning the computational based concepts of Artificial Intelligence or AI Machine learning also known as ML is a common abbreviation for the field To put it another way machine learning is the process of training computers to learn on their own via their interactions with data without being explicitly taught to do so This is accomplished through the use of artificial neural networks Both humans and animals may claim to be the first to conceptualize what we now call learning There are a lot of similarities to be discovered between the way that machines learn and the way animals learn In point of fact many of the methods that are now used in machine learning were first created to imitate the foundations of animal and human learning using computer representations This was done to further the field of artificial intelligence The basic scientific concept of habituation for instance outlines the process by which an animal progressively ceases reacting to a stimulus that has been repeatedly shown to the animal If a dog is taught to perform a

range of tasks such as rolling over sitting picking up objects etc it is considered to be an outstanding example of animal learning since it is capable of considerable learning if it is trained to do so If a dog is taught to execute a number of tasks such as rolling over sitting picking up items etc it is considered to be an excellent example of animal learning Many people believe that dogs are the best representatives of animal intelligence As opposed to the preceding example of successful learning there aren't many real world applications of machine learning that we can point to as evidence that it's a helpful notion in the current world This is in contrast to the earlier demonstration of successful learning Virtual personal assistants traffic predictions using GPS navigation surveillance of multiple cameras by AI to detect crime or unusual behavior of people social media uses ML for face recognition and news feed personalization search engine result refinement e mail spam filtering where a machine memorize all the previously labeled spam e mails by the user and a lot more applications are just some of the many places where ML is widely used Other applications include a lot more applications By using all of these applications it has become abundantly evident that making use of knowledge and experience that one already has will result in a more efficient learning process The close link that ML has to computational statistics which also plays a vital role makes the process of making predictions more simpler and more straightforward Everyone is entitled to wonder why does a machine need to learn something and there is no wrong answer to this question There are just a few compelling arguments in favor of the need of machine learning The fact that we just said that the development of learning capabilities in robots may help us better understand how animals and people gain information should not come as a surprise to anybody

FUNDAMENTAL CONCEPTS OF MACHINE LEARNING Prof. Gaikwad Anil Pandurang, Prof. Krutika Balram Kakpure, Prof. Swayam Shashank Shah, Prof. Kulkarni Satish Gunderao, 2023-06-06 The term machine learning refers to a variety of computer technologies that make use of previous data in order to either enhance performance or develop more accurate predictions The term was coined by British computer scientist Stuart Russell The collective term for these many modes of instruction is deep learning In the context of this situation the term experience refers to the historical knowledge that has been amassed and is now accessible to the student This knowledge is what is supposed to be referred to as experience The vast majority of the time this information is stored in the form of electronic data that may be investigated when it is necessary to do so This data may be collected in the form of digitized human labeled training sets or it could be received in the form of any other kind of information that is gained by coming into touch with the environment When it comes to determining how accurate the predictions of a learner are the things that count the most are the kind of the object that is being anticipated as well as the quantity of that item that is being forecasted An example of a learning challenge would be to find a way to properly predict the topic of papers that have not been read by looking at a limited number of documents that have been selected at random and tagged with themes This might be accomplished by looking at a small number of documents that have been categorized In this scenario the student is challenged with coming up with a solution to the issue

of how to accurately identify the topic of articles that have not yet been read If there are more persons involved in the sample then the task should in principle be simpler to finish However the level of difficulty of the assignment also relies on the quality of the labels that were applied to the papers in the sample This will make the work more or less challenging Because of this the task might either become much simpler or significantly more challenging This is because some of the labels could not be completely correct and it also is depending on the number of subjects that can be accessed The process of machine learning calls for the development of prediction algorithms that are capable of producing outcomes that are both accurate and efficient

Implementation of Back-propagation Neural Networks with Matlab Jamshid Nazari,O. K. Ersoy,1992
Abstract The artificial neural network back propagation algorithm is implemented in Matlab language This implementation is compared with several other software packages The effect of reducing the number of iterations in the performance of the algorithm is studied The speed of the back propagation program mbackprop written in Matlab language is compared with the speed of several other back propagation programs which are written in the C language The speed of the Matlab program mbackprop is also compared with the C program quickprop which is a variant of the back propagation algorithm It is shown that the Matlab program mbackprop is about 4 5 to 7 times faster than the C programs

Research Advances in the Integration of Big Data and Smart Computing Mallick, Pradeep Kumar,2015-10-13 The volume complexity and irregularity of computational data in modern algorithms and simulations necessitates an unorthodox approach to computing Understanding the facets and possibilities of soft computing algorithms is necessary for the accurate and timely processing of complex data Research Advances in the Integration of Big Data and Smart Computing builds on the available literature in the realm of Big Data while providing further research opportunities in this dynamic field This publication provides the resources necessary for technology developers scientists and policymakers to adopt and implement new paradigms in computational methods across the globe The chapters in this publication advance the body of knowledge on soft computing techniques through topics such as transmission control protocol for mobile ad hoc networks feature extraction comparative analysis of filtering techniques big data in economic policy and advanced dimensionality reduction methods

Deep Learning and Neural Networks: Concepts, Methodologies, Tools, and Applications Management Association, Information Resources,2019-10-11 Due to the growing use of web applications and communication devices the use of data has increased throughout various industries It is necessary to develop new techniques for managing data in order to ensure adequate usage Deep learning a subset of artificial intelligence and machine learning has been recognized in various real world applications such as computer vision image processing and pattern recognition The deep learning approach has opened new opportunities that can make such real life applications and tasks easier and more efficient Deep Learning and Neural Networks Concepts Methodologies Tools and Applications is a vital reference source that trends in data analytics and potential technologies that will facilitate insight in various domains of science industry business and consumer applications It also explores the latest

concepts algorithms and techniques of deep learning and data mining and analysis Highlighting a range of topics such as natural language processing predictive analytics and deep neural networks this multi volume book is ideally designed for computer engineers software developers IT professionals academicians researchers and upper level students seeking current research on the latest trends in the field of deep learning **Artificial Neural Networks** K. Mäkisara,O. Simula,J. Kangas,T. Kohonen,2014-06-28 This two volume proceedings compiles a selection of research papers presented at the ICANN 91 The scope of the volumes is interdisciplinary ranging from mathematics and engineering to cognitive sciences and biology European research is well represented Volume 1 contains all the orally presented papers including both invited talks and submitted papers Volume 2 contains the plenary talks and the poster presentations *Machine Learning Mastery: Deep Learning and Natural Language Processing Integration* Dr.Talluri.Sunil Kumar,Dr.Sagar Yeruva,2024-07-24 Dr Talluri Sunil Kumar Professor Department of CSE CyS DS and AI DS VNR Vignana Jyothi Institute of Engineering and Technology Hyderabad Telangana India Dr Sagar Yeruva Associate Professor Department of CSE AIML IoT VNR Vignana Jyothi Institute of Engineering and Technology Hyderabad Telangana India Adaptive and Natural Computing Algorithms Bernadete Ribeiro,2005-03-08 The papers in this volume present theoretical insights and report practical applications both for neural networks genetic algorithms and evolutionary computation In the field of natural computing swarm optimization bioinformatics and computational biology contributions are no less compelling A wide selection of contributions report applications of neural networks to process engineering robotics and control Contributions also abound in the field of evolutionary computation particularly in combinatorial and optimization problems Many papers are dedicated to machine learning and heuristics hybrid intelligent systems and soft computing applications Some papers are devoted to quantum computation In addition kernel based algorithms able to solve tasks other than classification represent a revolution in pattern recognition bridging existing gaps Further topics are intelligent signal processing and computer vision New Backpropagation Algorithm with Type-2 Fuzzy Weights for Neural Networks Fernando Gaxiola,Patricia Melin,Fevrier Valdez,2016-06-09 In this book a neural network learning method with type 2 fuzzy weight adjustment is proposed The mathematical analysis of the proposed learning method architecture and the adaptation of type 2 fuzzy weights are presented The proposed method is based on research of recent methods that handle weight adaptation and especially fuzzy weights The internal operation of the neuron is changed to work with two internal calculations for the activation function to obtain two results as outputs of the proposed method Simulation results and a comparative study among monolithic neural networks neural network with type 1 fuzzy weights and neural network with type 2 fuzzy weights are presented to illustrate the advantages of the proposed method The proposed approach is based on recent methods that handle adaptation of weights using fuzzy logic of type 1 and type 2 The proposed approach is applied to a cases of prediction for the Mackey Glass for 17 and Dow Jones time series and recognition of person with iris biometric measure In some experiments noise was applied in

different levels to the test data of the Mackey Glass time series for showing that the type 2 fuzzy backpropagation approach obtains better behavior and tolerance to noise than the other methods. The optimization algorithms that were used are the genetic algorithm and the particle swarm optimization algorithm and the purpose of applying these methods was to find the optimal type 2 fuzzy inference systems for the neural network with type 2 fuzzy weights that permit to obtain the lowest prediction error.

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