Parallel Processing And Artificial Intelligence

Robert Kozma,Cesare Alippi,Yoonsuck Choe,Francesco Carlo Morabito

Parallel Processing And Artificial Intelligence:

Parallel Processing for Artificial Intelligence 1 L.N. Kanal,H. Kitano,V. Kumar,C.B. Suttner,2014-06-28 Parallel processing for AI problems is of great current interest because of its potential for alleviating the computational demands of AI procedures The articles in this book consider parallel processing for problems in several areas of artificial intelligence image processing knowledge representation in semantic networks production rules mechanization of logic constraint satisfaction parsing of natural language data filtering and data mining The publication is divided into six sections The first addresses parallel computing for processing and understanding images The second discusses parallel processing for semantic networks which are widely used means for representing knowledge methods which enable efficient and flexible processing of semantic networks are expected to have high utility for building large scale knowledge based systems The third section explores the automatic parallel execution of production systems which are used extensively in building rule based expert systems systems containing large numbers of rules are slow to execute and can significantly benefit from automatic parallel execution The exploitation of parallelism for the mechanization of logic is dealt with in the fourth section While sequential control aspects pose problems for the parallelization of production systems logic has a purely declarative interpretation which does not demand a particular evaluation strategy In this area therefore very large search spaces provide significant potential for parallelism In particular this is true for automated theorem proving The fifth section considers the problem of constraint satisfaction which is a useful abstraction of a number of important problems in AI and other fields of computer science It also discusses the technique of consistent labeling as a preprocessing step in the constraint satisfaction problem Section VI consists of two articles each on a different important topic The first discusses parallel formulation for the Tree Adjoining Grammar TAG which is a powerful formalism for describing natural languages The second examines the suitability of a parallel programming paradigm called Linda for solving problems in artificial intelligence Each of the areas discussed in the book holds many open problems but it is believed that parallel processing will form a key ingredient in achieving at least partial solutions It is hoped that the contributions sourced from experts around the world will inspire readers to take on these challenging areas of inquiry   *Parallel Processing for Artificial Intelligence 2* V. Kumar,H. Kitano,C.B. Suttner,2014-06-28 With the increasing availability of parallel machines and the raising of interest in large scale and real world applications research on parallel processing for Artificial Intelligence AI is gaining greater importance in the computer science environment Many applications have been implemented and delivered but the field is still considered to be in its infancy This book assembles diverse aspects of research in the area providing an overview of the current state of technology It also aims to promote further growth across the discipline Contributions have been grouped according to their subject architectures 3 papers languages 4 papers general algorithms 6 papers and applications 5 papers The internationally sourced papers range from purely theoretical work simulation studies algorithm and architecture proposals to implemented

systems and their experimental evaluation Since the book is a second volume in the parallel processing for AI series it provides a continued documentation of the research and advances made in the field The editors hope that it will inspire readers to investigate the possiblities for enhancing AI systems by parallel processing and to make new discoveries of their own   **Parallel Processing and Parallel Algorithms** Seyed H Roosta,2012-12-06 Motivation It is now possible to build powerful single processor and multiprocessor systems and use them efficiently for data processing which has seen an explosive ex pansion in many areas of computer science and engineering One approach to meeting the performance requirements of the applications has been to utilize the most powerful single processor system that is available When such a system does not provide the performance requirements pipelined and parallel process ing structures can be employed The concept of parallel processing is a depar ture from sequential processing In sequential computation one processor is in volved and performs one operation at a time On the other hand in parallel computation several processors cooperate to solve a problem which reduces computing time because several operations can be carried out simultaneously Using several processors that work together on a given computation illustrates a new paradigm in computer problem solving which is completely different from sequential processing From the practical point of view this provides sufficient justification to investigate the concept of parallel processing and related issues such as parallel algorithms Parallel processing involves utilizing several factors such as parallel architectures parallel algorithms parallel programming lan guages and performance analysis which are strongly interrelated In general four steps are involved in performing a computational problem in parallel The first step is to understand the nature of computations in the specific application domain   **Deep Learning and Parallel Computing Environment for Bioengineering Systems** Arun Kumar Sangaiah,2019-07-26 Deep Learning and Parallel Computing Environment for Bioengineering Systems delivers a significant forum for the technical advancement of deep learning in parallel computing environment across bio engineering diversified domains and its applications Pursuing an interdisciplinary approach it focuses on methods used to identify and acquire valid potentially useful knowledge sources Managing the gathered knowledge and applying it to multiple domains including health care social networks mining recommendation systems image processing pattern recognition and predictions using deep learning paradigms is the major strength of this book This book integrates the core ideas of deep learning and its applications in bio engineering application domains to be accessible to all scholars and academicians The proposed techniques and concepts in this book can be extended in future to accommodate changing business organizations needs as well as practitioners innovative ideas Presents novel in depth research contributions from a methodological application perspective in understanding the fusion of deep machine learning paradigms and their capabilities in solving a diverse range of problems Illustrates the state of the art and recent developments in the new theories and applications of deep learning approaches applied to parallel computing environment in bioengineering systems Provides concepts and technologies that are successfully used in the implementation

of today s intelligent data centric critical systems and multi media Cloud Big data *Parallel Processing for Artificial Intelligence* Laveen N. Kanal,1994 Parallel processing for AI problems is of great current interest because of its potential for alleviating the computational demands of AI procedures The articles in this book consider parallel processing for problems in several areas of artificial intelligence image processing knowledge representation in semantic networks production rules mechanization of logic constraint satisfaction parsing of natural language data filtering and data mining The publication is divided into six sections The first addresses parallel computing for processing and understanding images The second discusses parallel processing for semantic networks which are widely used means for representing knowledge methods which enable efficient and flexible processing of semantic networks are expected to have high utility for building large scale knowledge based systems The third section explores the automatic parallel execution of production systems which are used extensively in building rule based expert systems systems containing large numbers of rules are slow to execute and can significantly benefit from automatic parallel execution The exploitation of parallelism for the mechanization of logic is dealt with in the fourth section While sequential control aspects pose problems for the parallelization of production systems logic has a purely declarative interpretation which does not demand a particular evaluation strategy In this area therefore very large search spaces provide significant potential for parallelism In particular this is true for automated theorem proving The fifth section considers the problem of constraint satisfaction which is a useful abstraction of a number of important problems in AI and other fields of computer science It also discusses the technique of consistent labeling as a preprocessing step in the constraint satisfaction problem Section VI consists of two articles each on a different important topic The first discusses parallel formulation for the Tree Adjoining Grammar TAG which is a powerful formalism for describing natural languages The second examines the suitability of a parallel programming paradigm called Linda for solving problems in artificial intelligence Each of the areas discussed in the book holds many open problems but it is believed that parallel processing will form a key ingredient in achieving at least partial solutions It is hoped that the contributions sourced from experts around the world will inspire readers to take on these challenging areas of inquiry **Advances in Edge Computing: Massive Parallel Processing and Applications** F. Xhafa,A.K. Sangaiah,2020-03-10 The rapid advance of Internet of Things IoT technologies has resulted in the number of IoT connected devices growing exponentially with billions of connected devices worldwide While this development brings with it great opportunities for many fields of science engineering business and everyday life it also presents challenges such as an architectural bottleneck with a very large number of IoT devices connected to a rather small number of servers in Cloud data centers and the problem of data deluge Edge computing aims to alleviate the computational burden of the IoT for the Cloud by pushing some of the computations and logics of processing from the Cloud to the Edge of the Internet It is becoming commonplace to allocate tasks and applications such as data filtering classification semantic enrichment and data aggregation to this layer but to prevent this new layer from itself

becoming another bottleneck for the whole computing stack from IoT to the Cloud the Edge computing layer needs to be capable of implementing massively parallel and distributed algorithms efficiently This book Advances in Edge Computing Massive Parallel Processing and Applications addresses these challenges in 11 chapters Subjects covered include Fog storage software architecture IoT based crowdsourcing the industrial Internet of Things privacy issues smart home management in the Cloud and the Fog and a cloud robotic solution to assist medical applications Providing an overview of developments in the field the book will be of interest to all those working with the Internet of Things and Edge computing

Parallel Processing for Artificial Intelligence 3 J. Geller,H. Kitano,C.B. Suttner,1997-02-10 The third in an informal series of books about parallel processing for Artificial Intelligence this volume is based on the assumption that the computational demands of many AI tasks can be better served by parallel architectures than by the currently popular workstations However no assumption is made about the kind of parallelism to be used Transputers Connection Machines farms of workstations Cellular Neural Networks Crays and other hardware paradigms of parallelism are used by the authors of this collection The papers arise from the areas of parallel knowledge representation neural modeling parallel non monotonic reasoning search and partitioning constraint satisfaction theorem proving parallel decision trees parallel programming languages and low level computer vision The final paper is an experience report about applications of massive parallelism which can be said to capture the spirit of a whole period of computing history This volume provides the reader with a snapshot of the state of the art in Parallel Processing for Artificial Intelligence **Parallel Computation and Computers for Artificial Intelligence** J.S. Kowalik,2012-12-06 It has been widely recognized that artificial intelligence computations offer large potential for distributed and parallel processing Unfortunately not much is known about designing parallel AI algorithms and efficient easy to use parallel computer architectures for AI applications The field of parallel computation and computers for AI is in its infancy but some significant ideas have appeared and initial practical experience has become available The purpose of this book has been to collect in one volume contributions from several leading researchers and pioneers of AI that represent a sample of these ideas and experiences This sample does not include all schools of thought nor contributions from all leading researchers but it covers a relatively wide variety of views and topics and in this sense can be helpful in assessing the state ofthe art We hope that the book will serve at least as a pointer to more specialized literature and that it will stimulate interest in the area of parallel AI processing It has been a great pleasure and a privilege to cooperate with all contributors to this volume They have my warmest thanks and gratitude Mrs Birgitta Knapp has assisted me in the editorial task and demonstrated a great deal of skill and patience Janusz S Kowalik vii INTRODUCTION Artificial intelligence AI computer programs can be very time consuming   Parallel and High Performance Computing Robert Robey,Yuliana Zamora,2021-08-24 Parallel and High Performance Computing offers techniques guaranteed to boost your code s effectiveness Summary Complex calculations like training deep learning models or running large scale simulations can take

an extremely long time Efficient parallel programming can save hours or even days of computing time Parallel and High Performance Computing shows you how to deliver faster run times greater scalability and increased energy efficiency to your programs by mastering parallel techniques for multicore processor and GPU hardware About the technology Write fast powerful energy efficient programs that scale to tackle huge volumes of data Using parallel programming your code spreads data processing tasks across multiple CPUs for radically better performance With a little help you can create software that maximizes both speed and efficiency About the book Parallel and High Performance Computing offers techniques guaranteed to boost your code s effectiveness You ll learn to evaluate hardware architectures and work with industry standard tools such as OpenMP and MPI You ll master the data structures and algorithms best suited for high performance computing and learn techniques that save energy on handheld devices You ll even run a massive tsunami simulation across a bank of GPUs What s inside Planning a new parallel project Understanding differences in CPU and GPU architecture Addressing underperforming kernels and loops Managing applications with batch scheduling About the reader For experienced programmers proficient with a high performance computing language like C C or Fortran About the author Robert Robey works at Los Alamos National Laboratory and has been active in the field of parallel computing for over 30 years Yuliana Zamora is currently a PhD student and Siebel Scholar at the University of Chicago and has lectured on programming modern hardware at numerous national conferences Table of Contents PART 1 INTRODUCTION TO PARALLEL COMPUTING 1 Why parallel computing 2 Planning for parallelization 3 Performance limits and profiling 4 Data design and performance models 5 Parallel algorithms and patterns PART 2 CPU THE PARALLEL WORKHORSE 6 Vectorization FLOPs for free 7 OpenMP that performs 8 MPI The parallel backbone PART 3 GPUS BUILT TO ACCELERATE 9 GPU architectures and concepts 10 GPU programming model 11 Directive based GPU programming 12 GPU languages Getting down to basics 13 GPU profiling and tools PART 4 HIGH PERFORMANCE COMPUTING ECOSYSTEMS 14 Affinity Truce with the kernel 15 Batch schedulers Bringing order to chaos 16 File operations for a parallel world 17 Tools and resources for better code   *AAAI-94* ,1994-08 AAAI proceedings describe innovative concepts techniques perspectives and observations that present promising research directions in artificial intelligence   **Scaling Up Machine Learning** Ron Bekkerman,Mikhail Bilenko,John Langford,2012 This integrated collection covers a range of parallelization platforms concurrent programming frameworks and machine learning settings with case studies   *Parallel Processing and Artificial Intelligence* Mike Reeve,Steven Ericsson Zenith,1989-09-28 Comprises papers based on an international conference held at Imperial College London July 1989 Topics covered include neural networks robotics image understanding parallel implementations of logic languages and parallel implementation of Lisp Many of the papers here detail use of the INMOS transputer and the Communicating Process Architecture on which INMOS was founded But the theme is application of parallelism in a general way especially in artificial intelligence   **Artificial Intelligence in the Age of Neural Networks and Brain Computing** Robert Kozma,Cesare

Alippi,Yoonsuck Choe,Francesco Carlo Morabito,2018-10-30 Artificial Intelligence in the Age of Neural Networks and Brain Computing demonstrates that existing disruptive implications and applications of AI is a development of the unique attributes of neural networks mainly machine learning distributed architectures massive parallel processing black box inference intrinsic nonlinearity and smart autonomous search engines The book covers the major basic ideas of brain like computing behind AI provides a framework to deep learning and launches novel and intriguing paradigms as future alternatives The success of AI based commercial products proposed by top industry leaders such as Google IBM Microsoft Intel and Amazon can be interpreted using this book Developed from the 30th anniversary of the International Neural Network Society INNS and the 2017 International Joint Conference on Neural Networks IJCNN Authored by top experts global field pioneers and researchers working on cutting edge applications in signal processing speech recognition games adaptive control and decision making Edited by high level academics and researchers in intelligent systems and neural networks *Artificial Intelligence Hardware Design* Albert Chun-Chen Liu,Oscar Ming Kin Law,2021-08-23 ARTIFICIAL INTELLIGENCE HARDWARE DESIGN Learn foundational and advanced topics in Neural Processing Unit design with real world examples from leading voices in the field In Artificial Intelligence Hardware Design Challenges and Solutions distinguished researchers and authors Drs Albert Chun Chen Liu and Oscar Ming Kin Law deliver a rigorous and practical treatment of the design applications of specific circuits and systems for accelerating neural network processing Beginning with a discussion and explanation of neural networks and their developmental history the book goes on to describe parallel architectures streaming graphs for massive parallel computation and convolution optimization The authors offer readers an illustration of in memory computation through Georgia Tech s Neurocube and Stanford s Tetris accelerator using the Hybrid Memory Cube as well as near memory architecture through the embedded eDRAM of the Institute of Computing Technology the Chinese Academy of Science and other institutions Readers will also find a discussion of 3D neural processing techniques to support multiple layer neural networks as well as information like A thorough introduction to neural networks and neural network development history as well as Convolutional Neural Network CNN models Explorations of various parallel architectures including the Intel CPU Nvidia GPU Google TPU and Microsoft NPU emphasizing hardware and software integration for performance improvement Discussions of streaming graph for massive parallel computation with the Blaize GSP and Graphcore IPU An examination of how to optimize convolution with UCLA Deep Convolutional Neural Network accelerator filter decomposition Perfect for hardware and software engineers and firmware developers Artificial Intelligence Hardware Design is an indispensable resource for anyone working with Neural Processing Units in either a hardware or software capacity **Parallel Architectures, Algorithms and Programming** Hong Shen,Yingpeng Sang,2020-01-25 This book constitutes the refereed proceedings of the 10th International Symposium on Parallel Architectures Algorithms and Programming PAAP 2019 held in Guangzhou China in December 2019 The 39 revised full papers and 8 revised short papers

presented were carefully reviewed and selected from 121 submissions The papers deal with research results and development activities in all aspects of parallel architectures algorithms and programming techniques **Neural Network Parallel Computing** Yoshiyasu Takefuji,2012-12-06 Neural Network Parallel Computing is the first book available to the professional market on neural network computing for optimization problems This introductory book is not only for the novice reader but for experts in a variety of areas including parallel computing neural network computing computer science communications graph theory computer aided design for VLSI circuits molecular biology management science and operations research The goal of the book is to facilitate an understanding as to the uses of neural network models in real world applications Neural Network Parallel Computing presents a major breakthrough in science and a variety of engineering fields The computational power of neural network computing is demonstrated by solving numerous problems such as N queen crossbar switch scheduling four coloring and k colorability graph planarization and channel routing RNA secondary structure prediction knight s tour spare allocation sorting and searching and tiling Neural Network Parallel Computing is an excellent reference for researchers in all areas covered by the book Furthermore the text may be used in a senior or graduate level course on the topic *Parallel Computing: Technology Trends* I. Foster,G.R. Joubert,L. Kučera,2020-03-25 The year 2019 marked four decades of cluster computing a history that began in 1979 when the first cluster systems using Components Off The Shelf COTS became operational This achievement resulted in a rapidly growing interest in affordable parallel computing for solving compute intensive and large scale problems It also directly lead to the founding of the Parco conference series Starting in 1983 the International Conference on Parallel Computing ParCo has long been a leading venue for discussions of important developments applications and future trends in cluster computing parallel computing and high performance computing ParCo2019 held in Prague Czech Republic from 10 13 September 2019 was no exception Its papers invited talks and specialized mini symposia addressed cutting edge topics in computer architectures programming methods for specialized devices such as field programmable gate arrays FPGAs and graphical processing units GPUs innovative applications of parallel computers approaches to reproducibility in parallel computations and other relevant areas This book presents the proceedings of ParCo2019 with the goal of making the many fascinating topics discussed at the meeting accessible to a broader audience The proceedings contains 57 contributions in total all of which have been peer reviewed after their presentation These papers give a wide ranging overview of the current status of research developments and applications in parallel computing **Parallel Processing for Artificial Intelligence** V. Kumar,1985 <u>Natural and Artificial Parallel Computation</u> Michael A. Arbib,John Alan Robinson,1990 These eleven contributions by leaders in the fields of neuroscience artificial intelligence and cognitive science cover the phenomenon of parallelism in both natural and artificial systems from the neural architecture of the human brain to the electronic architecture of parallel computers The brain s complex neural architecture not only supports higher mental processes such as learning perception and thought but also supervises the body

s basic physiological operating system and oversees its emergency services of damage control and self repair By combining sound empirical observation with elegant theoretical modeling neuroscientists are rapidly developing a detailed and convincing account of the organization and the functioning of this natural living parallel machine At the same time computer scientists and engineers are devising imaginative parallel computing machines and the programming languages and techniques necessary to use them to create superb new experimental instruments for the study of all parallel systems Michael A Arbib is Professor of Computer Science Neurobiology and Physiology at the University of Southern California J Alan Robinson is University Professor at Syracuse University Contents Natural and Artificial Parallel Computation M A Arbib J A Robinson The Evolution of Computing R E Gomory The Nature of Parallel Programming P Brinch Hansen Toward General Purpose Parallel Computers D May Applications of Parallel Supercomputers G E Fox Cooperative Computation in Brains and Computers M A Arbib Parallel Processing in the Primate Cortex P Goldman Rakic Neural Darwinism G M Edelman G N Reeke Jr How the Brain Rewires Itself M Merzenich Memory Based Reasoning D Waltz Natural and Artificial Reasoning J A Robinson   *Scheduling for Parallel Processing* Maciej Drozdowski,2010-03-14 Overview and Goals This book is dedicated to scheduling for parallel processing Presenting a research eld as broad as this one poses considerable dif culties Scheduling for parallel computing is an interdisciplinary subject joining many elds of science and te nology Thus to understand the scheduling problems and the methods of solving them it is necessary to know the limitations in related areas Another dif culty is that the subject of scheduling parallel computations is immense Even simple search in bibliographical databases reveals thousands of publications on this topic The versity in understanding scheduling problems is so great that it seems impossible to juxtapose them in one scheduling taxonomy Therefore most of the papers on scheduling for parallel processing refer to one scheduling problem resulting from one way of perceiving the reality Only a few publications attempt to arrange this eld of knowledge systematically In this book we will follow two guidelines One guideline is a distinction tween scheduling models which comprise a set of scheduling problems solved by dedicated algorithms Thus the aim of this book is to present scheduling models for parallel processing problems de ned on the grounds of certain scheduling models and algorithms solving the scheduling problems Most of the scheduling problems are combinatorial in nature Therefore the second guideline is the methodology of computational complexity theory Inthisbookwepresentfourexamplesofschedulingmodels Wewillgodeepinto the models problems and algorithms so that after acquiring some understanding of them we will attempt to draw conclusions on their mutual relationships

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