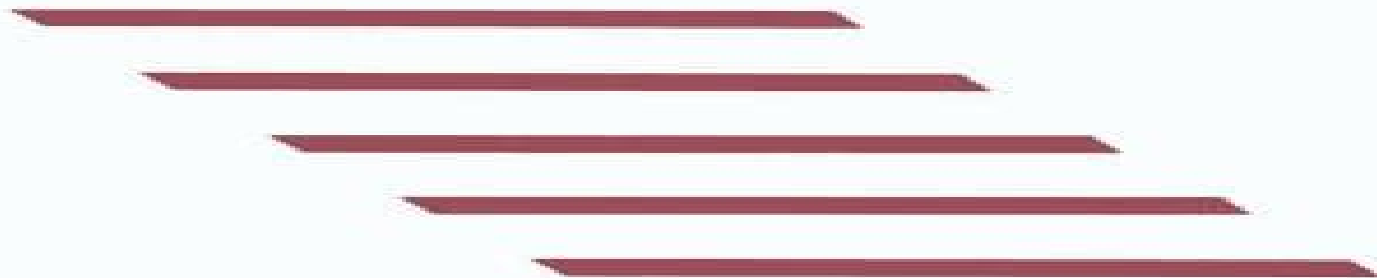

Parallel Computation and Computers for Artificial Intelligence

edited by

Janusz S. Kowalik



Parallel Computation And Computers For Artificial Intelligence

F. Xhafa,A.K. Sangaiah



Parallel Computation And Computers 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 of the 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 *Vector Models for Data-parallel Computing* Guy E. Blelloch, 1990 Mathematics of Computing Parallelism *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 AAI-94 , 1994-08 AAI proceedings describe innovative concepts techniques perspectives and observations that present promising research directions in artificial intelligence

Natural and Artificial Parallel Computation 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 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

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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 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

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 Computing Roman Trobec, Marián Vajteršic, Peter Zinterhof, 2009-06-18 The use of parallel programming and architectures is essential for simulating and solving problems in modern computational practice There has been rapid progress in microprocessor architecture interconnection technology and software development which are influencing directly the rapid growth of parallel and distributed computing However in order to make these benefits usable in practice this development must be accompanied by progress in the design analysis and application aspects of parallel algorithms In particular new approaches from parallel numerics are important for solving complex computational problems on parallel and or distributed systems The contributions to this book are focused on topics most concerned in the trends of today's parallel computing These range from parallel algorithmics programming tools network computing to future parallel computing Particular attention is paid to parallel numerics linear algebra differential equations numerical integration number theory and their applications in computer simulations which together form the kernel of the monograph We expect that the book will be of interest to scientists working on parallel computing doctoral students teachers engineers and mathematicians dealing with numerical applications and computer simulations of natural phenomena

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 expansion 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 processing structures can be employed. The concept of parallel processing is a departure from sequential processing. In sequential computation, one processor is involved 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, parallel programming languages, 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.

Designing Efficient Algorithms for Parallel Computers Michael Jay Quinn, 1987. Mathematics of Computing Parallelism. **Introduction to Parallel Computing** Zbigniew J. Czech, 2016. A comprehensive guide for students and practitioners to parallel computing models, processes, metrics, and implementation in MPI and OpenMP.

Parallel and High-Performance Computing in Artificial Intelligence Mukesh Raghuwanshi, Pradnya Borkar, Rutvij H. Jhaveri, Roshani Raut, 2025-05-20. Parallel and High Performance Computing in Artificial Intelligence explores high performance architectures for data intensive applications as well as efficient analytical strategies to speed up data processing and applications in automation, machine learning, deep learning, healthcare, bioinformatics, natural language processing, NLP, and vision intelligence. The book's two major themes are high performance computing (HPC) architecture and techniques and their application in artificial intelligence. Highlights include HPC use cases, application programming interfaces (APIs), and applications. Parallelization techniques, HPC for machine learning, implementation of parallel computing with AI in big data analytics, HPC with AI in healthcare systems, AI in industrial automation. Coverage of HPC architecture and techniques includes multicore architectures, parallel computing techniques, and APIs as well as dependence analysis for parallel computing. The book also covers hardware acceleration techniques, including those for GPU acceleration to power big data systems. As AI is increasingly being integrated into HPC applications, the book explores emerging and practical applications in such domains as healthcare, agriculture, bioinformatics, and industrial automation. It illustrates technologies and methodologies to boost the velocity and scale of AI analysis for fast discovery. Data scientists and researchers can benefit from the book's discussion on AI-based HPC applications that can process higher volumes of data, provide more realistic simulations, and guide more accurate predictions. The book also focuses on deep learning and edge computing methodologies with HPC and presents recent research on methodologies and applications of HPC in AI.

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 Advances in Parallel Computing Technologies and Applications D. Jude Hemanth, Mohamed Elhosney, Tu N. Nguyen, Sairamesh Lakshmanan, 2021 Recent developments in parallel computing mean that the use of machine learning techniques and intelligence to handle the huge volume of available data have brought the faster solutions offered by advanced technologies to various fields of application This book presents the proceedings of the Virtual International Conference on Advances in Parallel Computing Technologies and Applications ICAPTA 2021 hosted in Justice Basheer Ahmed Sayeed College for women formerly S I E T Women s College Chennai India and held online as a virtual event on 15 and 16 April 2021 The aim of the conference was to provide a forum for sharing knowledge in various aspects of parallel computing in communications systems and networking including cloud and virtualization solutions management technologies and vertical application areas It also provided a platform for scientists researchers practitioners and academicians to present and discuss the most recent innovations and trends as well as the concerns and practical challenges encountered in this field Included here are 52 full length papers selected from over 100 submissions based on the reviews and comments of subject experts Topics covered include parallel computing in communication machine learning intelligence for parallel computing and parallel computing for software services in theoretical and practical aspects Providing an overview of the latest developments in the field the book will be of interest to all those whose work involves the use of parallel computing technologies **Parallel Computing** Christian Bischof, 2008 ParCo2007 marks a quarter of a century of the international conferences on parallel computing that started in Berlin in 1983 The aim of the conference is to give an overview of the developments applications and future trends in high performance computing for various platforms *Fast Fourier Transform Algorithms for Parallel Computers* Daisuke Takahashi, 2019-10-05 Following an introduction to the basis of the fast Fourier transform FFT this book focuses on the

implementation details on FFT for parallel computers FFT is an efficient implementation of the discrete Fourier transform DFT and is widely used for many applications in engineering science and mathematics Presenting many algorithms in pseudo code and a complexity analysis this book offers a valuable reference guide for graduate students engineers and scientists in the field who wish to apply FFT to large scale problems Parallel computation is becoming indispensable in solving the large scale problems increasingly arising in a wide range of applications The performance of parallel supercomputers is steadily improving and it is expected that a massively parallel system with hundreds of thousands of compute nodes equipped with multi core processors and accelerators will be available in the near future Accordingly the book also provides up to date computational techniques relevant to the FFT in state of the art parallel computers Following the introductory chapter Chapter 2 introduces readers to the DFT and the basic idea of the FFT Chapter 3 explains mixed radix FFT algorithms while Chapter 4 describes split radix FFT algorithms Chapter 5 explains multi dimensional FFT algorithms Chapter 6 presents high performance FFT algorithms and Chapter 7 addresses parallel FFT algorithms for shared memory parallel computers In closing Chapter 8 describes parallel FFT algorithms for distributed memory parallel computers

VLSI & Parallel Computing for Pattern Recognition & Artificial Intelligence N. Ranganathan, 1995 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

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