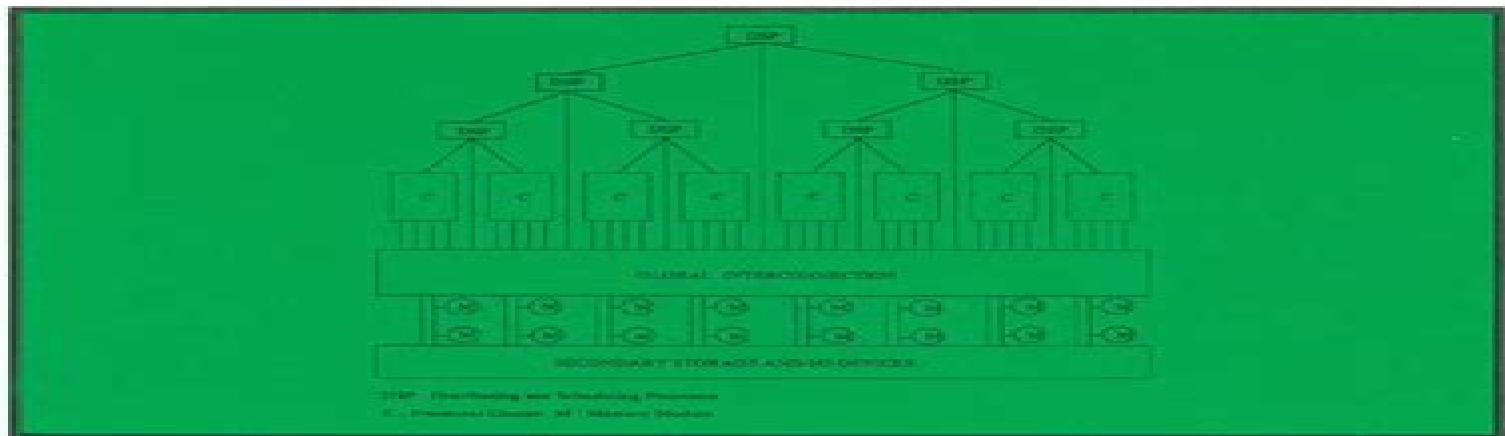# Parallel Architectures and Parallel Algorithms for Integrated Vision Systems

Alok N. Choudhary

Janak H. Patel

Parallel Architectures And Parallel Algorithms For Integrated Vision Systems

Minjie Lin

Parallel Architectures And Parallel Algorithms For Integrated Vision Systems:

Parallel Architectures and Parallel Algorithms for Integrated Vision Systems Alok N. Choudary,J.H. Patel,2012-12-06 Computer vision is one of the most complex and computationally intensive problem Like any other computationally intensive problems parallel pro cessing has been suggested as an approach to solving the problems in com puter vision Computer vision employs algorithms from a wide range of areas such as image and signal processing advanced mathematics graph theory databases and artificial intelligence Hence not only are the comput ing requirements for solving vision problems tremendous but they also demand computers that are efficient to solve problems exhibiting vastly dif ferent characteristics With recent advances in VLSI design technology Single Instruction Multiple Data SIMD massively parallel computers have been proposed and built However such architectures have been shown to be useful for solving a very limited subset of the problems in vision Specifically algorithms from low level vision that involve computations closely mimicking the architec ture and require simple control and computations are suitable for massively parallel SIMD computers An Integrated Vision System IVS involves com putations from low to high level vision to be executed in a systematic fashion and repeatedly The interaction between computations and information dependent nature of the computations suggests that architectural require ments for computer vision systems can not be satisfied by massively parallel SIMD computers   *Parallel Architectures and Parallel Algorithms for Integrated Vision Systems* Alok N Choudary,J H Patel,1990-09-30 Computer vision has been regarded as one of the most complex and computationally intensive problems An integrated vision system IVS is a system that uses vision algorithms from all levels of processing to perform for a high level application e g object recognition This thesis addresses several issues in parallel architectures and parallel algorithms for integrated vision systems First a model of computation for IVSs is presented The model captures computational requirements defines spatial and temporal data dependencies between tasks and shows what types of interactions may occur between tasks from different levels of processing The model is used to develop features and capabilities of a parallel architecture suitable for IVSs A multiprocessor architecture for IVSs called NETRA is presented NETRA is highly flexible without the use of complex interconnection schemes NETRA is recursively defined hierarchical architecture whose leaf nodes consist of clusters processors connected with a programmable crossbar with a selective broadcast capability Hence it is easily scalable from small to large systems Homogeneity of NETRA permits fault tolerance and graceful degradation under faults Several refinements in the architecture over the original design are also proposed Performance of several vision algorithms when they are mapped on one cluster is presented It is shown that SIMD MIMD and systolic algorithms can be easily mapped onto processor clusters and almost linear speedups are possible An extensive analysis of inter cluster communication strategies in NETRA is presented A methodology to evaluate performance of algorithms on NETRA is described Performance analysis of parallel algorithms when mapped across clusters is presented The parameters are derived from the characteristics of the parallel algorithms which are

then used to evaluate the alternative communication strategies in NETRA The effects of communication interference on the performance of algorithms are studied It is observed that if communication speeds are matched with the computation speeds almost linear speedups are possible when algorithms are mapped across clusters Finally several techniques to perform data decomposition and static and dynamic load balancing for IVS algorithms are described These techniques can be used to perform load balancing for intermediate and high level data dependent vision algorithms They are shown to perform well using them on an implementation of a motion estimation system on a hypercube multiprocessor Abstract shortened with permission of author   Efficient Dynamic Simulation of Robotic Mechanisms Kathryn Lilly,2012-12-06 Efficient Dynamic Simulation of Robotic Mechanisms presents computationally efficient algorithms for the dynamic simulation of closed chain robotic systems In particular the simulation of single closed chains and simple closed chain mechanisms is investigated in detail Single closed chains are common in many applications including industrial assembly operations hazardous remediation and space exploration Simple closed chain mechanisms include such familiar configurations as multiple manipulators moving a common load dexterous hands and multi legged vehicles The efficient dynamics simulation of these systems is often required for testing an advanced control scheme prior to its implementation to aid a human operator during remote teleoperation or to improve system performance In conjunction with the dynamic simulation algorithms efficient algorithms are also derived for the computation of the joint space and operational space inertia matrices of a manipulator The manipulator inertia matrix is a significant component of any robot dynamics formulation and plays an important role in both simulation and control The efficient computation of the inertia matrix is highly desirable for real time implementation of robot dynamics algorithms Several alternate formulations are provided for each inertia matrix Computational efficiency in the algorithm is achieved by several means including the development of recursive formulations and the use of efficient spatial transformations and mathematics All algorithms are derived and presented in a convenient tabular format using a modified form of spatial notation a six dimensional vector notation which greatly simplifies the presentation and analysis of multibody dynamics Basic definitions and fundamental principles required to use and understand this notation are provided The implementation of the efficient spatial transformations is also discussed in some detail As a means of evaluating efficiency the number of scalar operations multiplications and additions required for each algorithm is tabulated after its derivation Specification of the computational complexity of each algorithm in this manner makes comparison with other algorithms both easy and convenient The algorithms presented in Efficient Dynamic Simulation of Robotic Mechanisms are among the most efficient robot dynamics algorithms available at this time In addition to computational efficiency special emphasis is also placed on retaining as much physical insight as possible during algorithm derivation The algorithms are easy to follow and understand whether the reader is a robotics novice or a seasoned specialist   **Scientific and Technical Aerospace Reports** ,1993   *The Age of Spiritual Machines* Ray Kurzweil,2000-01-01 NATIONAL BESTSELLER Bold

futurist Ray Kurzweil author of The Singularity Is Near offers a framework for envisioning the future of machine intelligence a book for anyone who wonders where human technology is going next The New York Times Book Review Kurzweil offers a thought provoking analysis of human and artificial intelligence and a unique look at a future in which the capabilities of the computer and the species that invented it grow ever closer BILL GATES Imagine a world where the difference between man and machine blurs where the line between humanity and technology fades and where the soul and the silicon chip unite This is not science fiction This is the twenty first century according to Ray Kurzweil the restless genius The Wall Street Journal ultimate thinking machine Forbes and inventor of the most innovative and compelling technology of our era In his inspired hands life in the new millennium no longer seems daunting Instead it promises to be an age in which the marriage of human sensitivity and artificial intelligence fundamentally alters and improves the way we live More than just a list of predictions Kurzweil s prophetic blueprint for the future guides us through the inexorable advances that will result in Computers exceeding the memory capacity and computational ability of the human brain with human level capabilities not far behind Relationships with automated personalities who will be our teachers companions and lovers Information fed straight into our brains along direct neural pathways Eventually the distinction between humans and computers will have become sufficiently blurred that when the machines claim to be conscious we will believe them **Proceedings of the 1988 International Conference on Parallel Processing** ,1988 *Monthly Catalog of United States Government Publications* ,1991 **Monthly Catalogue, United States Public Documents** ,1991 **Proceedings of the 1988 International Conference on Parallel Processing** Faye A. Briggs,1988 *Netra* National Aeronautics and Space Administration (NASA),2018-07-09 Computer vision is regarded as one of the most complex and computationally intensive problems An integrated vision system IVS is considered to be a system that uses vision algorithms from all levels of processing for a high level application such as object recognition A model of computation is presented for parallel processing for an IVS Using the model desired features and capabilities of a parallel architecture suitable for IVSs are derived Then a multiprocessor architecture called NETRA is presented This architecture is highly flexible without the use of complex interconnection schemes The topology of NETRA is recursively defined and hence is easily scalable from small to large systems Homogeneity of NETRA permits fault tolerance and graceful degradation under faults It is a recursively defined tree type hierarchical architecture where each of the leaf nodes consists of a cluster of processors connected with a programmable crossbar with selective broadcast capability to provide for desired flexibility A qualitative evaluation of NETRA is presented Then general schemes are described to map parallel algorithms onto NETRA Algorithms are classified according to their communication requirements for parallel processing An extensive analysis of inter cluster communication strategies in NETRA is presented and parameters affecting performance of parallel algorithms when mapped on NETRA are discussed Finally a methodology to evaluate performance of algorithms on NETRA is described Choudhary Alok N and Patel Janak H and Ahuja Narendra

Unspecified Center NAG1 613   Image Understanding Workshop ,1990   *Transputer Applications and Systems '94* A. De Gloria,M. R. Jane,D. Marini,1994 Proceedings Parallel Computing   **The Role of Computers in Research and Development at Langley Research Center** ,1994   **Parallel Computing** E. D'Hollander,1996 Hardbound The aim of this volume is to give an overview of the state of the art of the development application and future trends in parallel computing The emphasis is on the applications of all types of parallel computers which is reflected by the invited and contributed papers and posters included in these proceedings The following topic areas are covered Applications Various aspects of the application of parallel computers including simulation flow calculations sorting image processing industrial computing financial applications optimisation linear algebra Software Software engineering for application development including programming environments object oriented methods data parallelism languages compilers monitoring and debugging operating systems scheduling load balancing threads Hardware Systolic processors networks communication performance measurement and analysis Industrial   **Intelligent Robotic Systems: Theory, Design and Applications** Kimon P. Valavanis,George N. Saridis,2012-12-06 Since the late 1960s there has been a revolution in robots and industrial automation from the design of robots with no computing or sensorycapabilities first generation to the design of robots with limited computational power and feedback capabilities second generation and the design of intelligent robots third generation which possess diverse sensing and decision making capabilities The development of the theory of intelligent machines has been developed in parallel to the advances in robot design This theory is the natural outcome of research and development in classical control 1950s adaptive and learning control 1960s self organizing control 1970s and intelligent control systems 1980s The theory of intelligent machines involves utilization and integration of concepts and ideas from the diverse disciplines of science engineering and mathematics and fields like artificial intelligence system theory and operations research The main focus and motivation is to bridge the gap between diverse disciplines involved and bring under a common cover several generic methodologies pertaining to what has been defined as machine intelligence Intelligent robotic systems are a specific application of intelligent machines They are complex computer controlled robotic systems equipped with a diverse set of visual and non visual sensors and possess decision making and problem solving capabilities within their domain of operation Their modeling and control is accomplished via analytical and heuristic methodologies and techniques pertaining to generalized system theory and artificial intelligence Intelligent Robotic Systems Theory Design and Applications presents and justifies the fundamental concepts and ideas associated with the modeling and analysis of intelligent robotic systems Appropriate for researchers and engineers in the general area of robotics and automation Intelligent Robotic Systems is both a solid reference as well as a text for a graduate level course in intelligent robotics machines   **Dissertation Abstracts International** ,1992-04   **Engineering Documents Center Index** University of Illinois at Urbana-Champaign. Engineering Documents Center,1989   Parallel and Distributed Computing Handbook Albert

Y. Zomaya,1996 With over 1 000 pages and a wealth of illustrations and data tables this handbook offers readers the first information source with the scope to encompass the parallel and distributed computing revolution Written by an international team of experts the book summarizes the current state of the art interprets the most promising trends and spotlights commercial applications   **1993 Computer Architectures for Machine Perception** Magdy A. Bayoumi,Larry S. Davis,Kimon Valavanis,1993 Proceedings of the Computer Architectures for Machine Perception Workshop held Dec 15 17 1993 in New Orleans Louisiana Papers came from several communities computer architecture pattern recognition image processing and analysis computer vision and VLSI No index Annotation copyright Book N   *Proceedings* ,1993

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