
Robotic Object Recognition Using Vision and Touch

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Robotic Object Recognition Using Vision And Touch

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Advanced Tactile Sensing For Robotics Howard R Nicholls,1992-12-10 Advanced robot systems require sensory information to enable them to make decisions and to carry out actions in a versatile autonomous way Humans make considerable use of information derived through touch and an emerging domain of robot sensing is tactile sensing This book considers various aspects of tactile sensing from hardware design through to the use of tactile data in exploratory situations using a multi fingered robot hand In the first part of the book the current state of progress of tactile sensing is surveyed and it is found that the field is still in an early stage of development Next some fundamental issues in planar elasticity concerning the interaction between tactile sensors and the environment are presented Having established how the basic data can be derived from the sensors the issues of what form tactile sensors should take and how they should be used are considered This is particularly important given the infancy of this field The human tactile system is examined and then biological touch and its implications for robotics is looked at Some experiments in dextrous manipulation using a robot hand are described which apply some of these results The integration of tactile sensors into a complete system is also considered and another novel approach for using touch sensing in a flexible assembly machine is described Both basic material and new research results are provided in this book thus catering to different levels of readers The chapters by world experts in different aspects of the field are integrated well into one volume The editor and authors have produced a thorough and in depth survey of all work in robot tactile sensing making the book essential reading for all researchers in this emergent field Visual Attention and Cognition W.H. Zangemeister,H.S. Stiehl,C. Freksa,1996-09-23 The goal of this book is to put together some of the main interdisciplinary aspects that play a role in visual attention and cognition The book is aimed at researchers and students with interdisciplinary interest In the first chapter a general discussion of the influential scanpath theory and its implications for human and robot vision is presented Subsequently four characteristic aspects of the general theme are dealt with in topical chapters each of which presents some of the different viewpoints of the various disciplines involved They cover neuropsychology clinical neuroscience modeling and applications Each of the chapters opens with a synopsis tying together the individual contributions Kinematic Modeling, Identification, and Control of Robotic Manipulators Henry W. Stone,1987-09-30 The objective of this dissertation is to advance the state of the art in the kinematic modeling identification and control of robotic manipulators with rigid links in an effort to improve robot kinematic performance The positioning accuracy of commercially available industrial robotic manipulators depends upon a kinematic model which describes the robot geometry in a parametric form Manufacturing error in the machining and assembly of manipulators lead to discrepancies between the design parameters and the physical structure Improving the kinematic performance thus requires

the identification of the actual kinematic parameters of each individual robot The identified kinematic parameters are referred to as the arm signature Existing robot kinematic models such as the Denavit Hartenberg model are not directly applicable to kinematic parameter identification In this dissertation we introduce a new kinematic model called the 5 Model which is applicable to kinematic parameter identification and use it as the foundation for our development of a general technique for identifying the kinematic parameters of any robot with rigid links

Traditional and Non-Traditional Robotic Sensors Thomas C. Henderson, 2012-12-06 This book contains the written record of the NATO Advanced Research Workshop on Traditional and Non Traditional Robotic Sensors held in the Hotel Villa del Mare Maratea Italy August 28 September 1 1989 This workshop was organized under the auspices of the NATO Special Program on Sensory Systems for Robotic Control Professor Frans Groen from the University of Amsterdam and Dr Gert Hirzinger from the German Aerospace Research Establishment DLR served as members of the organizing committee for this workshop Research in the area of robotic sensors is necessary in order to support a wide range of applications including industrial automation space robotics image analysis microelectronics and intelligent sensors This workshop focused on the role of traditional and non traditional sensors in robotics In particular the following three topics were explored Sensor development and technology Multisensor integration techniques Application area requirements which motivate sensor development directions This workshop brought together experts from NATO countries to discuss recent developments in these three areas Many new directions or new directions on old problems were proposed Existing sensors should be pushed into new application domains such as medical robotics and space robotics

Pyramidal Systems for Computer Vision Virginio Cantoni, Stefano Levialdi, 2012-12-06 This book contains the proceedings of the NATO Advanced Research Workshop held in Maratea Italy May 5 9 1986 on Pyramidal Systems for Image Processing and Computer Vision We had 40 participants from 11 countries playing an active part in the workshop and all the leaders of groups that have produced a prototype pyramid machine or a design for such a machine were present Within the wide field of parallel architectures for image processing a new area was recently born and is growing healthily the area of pyramidally structured multiprocessing systems Essentially the processors are arranged in planes from a base to an apex each one of which is generally a reduced usually by a power of two version of the plane underneath these processors are horizontally interconnected within a plane and vertically connected with fathers on top planes and children on the plane below This arrangement has a number of interesting features all of which were amply discussed in our Workshop including the cellular array and hypercube versions of pyramids A number of projects in different parts of the world are reported as well as some interesting applications in computer vision tactile systems and numerical calculations

Computer Vision - ECCV 2020 Andrea Vedaldi, Horst Bischof, Thomas Brox, Jan-Michael Frahm, 2020-11-18 The 30 volume set comprising the LNCS books 12346 until 12375 constitutes the refereed proceedings of the 16th European Conference on Computer Vision ECCV 2020 which was planned to be held in Glasgow UK during August 23 28 2020 The conference was

held virtually due to the COVID 19 pandemic The 1360 revised papers presented in these proceedings were carefully reviewed and selected from a total of 5025 submissions The papers deal with topics such as computer vision machine learning deep neural networks reinforcement learning object recognition image classification image processing object detection semantic segmentation human pose estimation 3d reconstruction stereo vision computational photography neural networks image coding image reconstruction object recognition motion estimation Qualitative Motion Understanding Wilhelm Burger, Bir Bhanu, 2012-12-06 Mobile robots operating in real world outdoor scenarios depend on dynamic scene understanding for detecting and avoiding obstacles recognizing landmarks acquiring models and for detecting and tracking moving objects Motion understanding has been an active research effort for more than a decade searching for solutions to some of these problems however it still remains one of the more difficult and challenging areas of computer vision research Qualitative Motion Understanding describes a qualitative approach to dynamic scene and motion analysis called DRIVE Dynamic Reasoning from Integrated Visual Evidence The DRIVE system addresses the problems of a estimating the robot's egomotion b reconstructing the observed 3 D scene structure and c evaluating the motion of individual objects from a sequence of monocular images The approach is based on the FOE focus of expansion concept but it takes a somewhat unconventional route The DRIVE system uses a qualitative scene model and a fuzzy focus of expansion to estimate robot motion from visual cues to detect and track moving objects and to construct and maintain a global dynamic reference model

Image Understanding Workshop United States. Defense Advanced Research Projects Agency. Information Science and Technology Office, 1987 **Data Fusion for Sensory Information Processing Systems** James J. Clark, Alan L. Yuille, 2013-03-09 The science associated with the development of artificial sensory systems is occupied primarily with determining how information about the world can be extracted from sensory data For example computational vision is for the most part concerned with the development of algorithms for distilling information about the world and recognition of various objects in the environment e g localization ment from visual images e g photographs or video frames There are often a multitude of ways in which a specific piece of information about the world can be obtained from sensory data A subarea of research into sensory systems has arisen which is concerned with methods for combining these various information sources This field is known as data fusion or sensor fusion The literature on data fusion is extensive indicating the intense interest in this topic but is quite chaotic There are no accepted approaches save for a few special cases and many of the best methods are ad hoc This book represents our attempt at providing a mathematical foundation upon which data fusion algorithms can be constructed and analyzed The methodology that we present in this text is motivated by a strong belief in the importance of constraints in sensory information processing systems In our view data fusion is best understood as the embedding of multiple constraints on the solution to a sensory information processing problem into the solution process

Task-Directed Sensor Fusion and Planning Gregory D. Hager, 2012-12-06 If you have ever hiked up a steep hill to

reach a viewpoint you will know that sensing can involve the expenditure of effort More generally the choice of which movement an intelligent system chooses to make is usually based on information gleaned from sensors But the information required to make the motion decision may not be immediately to hand so the system first has to plan a motion whose purpose is to acquire the needed sensor information Again this conforms to our everyday experience I am in the woods and don't know which direction to go so I climb up to the ridge to get my bearings I am lost in a new town so I plan to drive to the next junction where there is sure to be a roadsign failing that I will ask someone who seems to be from the locality Why if experiences such as these are so familiar has the problem only recently been recognised and studied in Robotics One reason is that until quite recently Robotics research was dominated by work on robot arms with limited reach and fixed in a workcell

A General Model of Legged Locomotion on Natural Terrain David J. Manko, 2012-12-06 Dynamic modeling is the fundamental building block for mechanism analysis design control and performance evaluation One class of mechanism legged machines have multiple closed chains established through intermittent ground contacts Further walking on natural terrain introduces nonlinear system compliance in the forms of foot sinkage and slippage Closed chains constrain the possible motions of a mechanism while compliances affect the redistribution of forces throughout the system A General Model of Legged Locomotion on Natural Terrain develops a dynamic mechanism model that characterizes indeterminate interactions of a closed chain robot with its environment The approach is applicable to any closed chain mechanism with sufficient contact compliance although legged locomotion on natural terrain is chosen to illustrate the methodology The modeling and solution procedures are general to all walking machine configurations including bipeds quadrupeds beam walkers and hopping machines This work develops a functional model of legged locomotion that incorporates for the first time non conservative foot soil interactions in a nonlinear dynamic formulation The model was applied to a prototype walking machine and simulations generated significant insights into walking machine performance on natural terrain The simulations are original and essential contributions to the design evaluation and control of these complex robot systems While posed in the context of walking machines the approach has wider applicability to rolling locomotors cooperating manipulators multi fingered hands and prehensile agents

Computer-Aided Mechanical Assembly Planning Luis S. Homem de Mello, Sukhan Lee, 2012-12-06 Some twenty years have elapsed since the first attempts at planning were made by researchers in artificial intelligence These early programs concentrated on the development of plans for the solution of puzzles or toy problems like the rearrangement of stacks of blocks These early programs provided the foundation for the work described in this book the automatic generation of plans for industrial assembly As one reads about the complex and sophisticated planners in the current generation it is important to keep in mind that they are addressing real world problems Although these systems may become the toy systems of tomorrow they are providing a solid foundation for future more general and more advanced planning tools As demonstrated by the papers in this book the field of computer aided mechanical assembly

planning is maturing It now may include geometric descriptions of parts extracted from or compatible with CAD programs constraints related to part interference and the use of tools fixtures and jigs required for the assembly the nature of connectors matings and other relations between parts number of turnovers required during the assembly handling and gripping requirements for various parts automatic identification of subassemblies This is not an exhaustive list but it serves to illustrate the complexity of some of the issues which are discussed in this book Such issues must be considered in the design of the modern planners as they produce desirable assembly sequences and precedence relations for assembly

Perturbation Techniques for Flexible Manipulators Anthony R. Fraser, Ron W. Daniel, 2012-12-06 A manipulator or robot consists of a series of bodies links connected by joints to form a spatial mechanism Usually the links are connected serially to form an open chain The joints are either revolute rotary or prismatic telescopic various combinations of the two giving a wide variety of possible configurations Motive power is provided by pneumatic hydraulic or electrical actuation of the joints The robot arm is distinguished from other active spatial mechanisms by its reprogrammability Therefore the controller is integral to any description of the arm In contrast with many other controlled processes e.g. batch reactors it is possible to model the dynamics of a manipulator very accurately Unfortunately for practical arm designs the resulting models are complex and a considerable amount of research effort has gone into improving their numerical efficiency with a view to real time solution 32 41 51 61 77 87 91 In recent years improvements in electric motor technology coupled with new designs such as direct drive arms have led to a rapid increase in the speed and load carrying capabilities of manipulators However this has meant that the flexibility of the nominally rigid links has become increasingly significant Present generation manipulators are limited to a load carrying capacity of typically 5-10% of their own weight by the requirement of rigidity For example the Cincinnati Milicron T3R3 robot weighs more than 1800 kg but has a maximum payload capacity of 23 kg Measurement of Image Velocity David J. Fleet, 2012-12-06 Measurement of Image Velocity presents a computational framework for computing motion information from sequences of images Its specific goal is the measurement of image velocity or optical flow the projection of 3-D object motion onto the 2-D image plane The formulation of the problem emphasizes the geometric and photometric properties of image formation and the occurrence of multiple image velocities caused for example by specular reflections shadows or transparency The method proposed for measuring image velocity is based on the phase behavior in the output of velocity tuned filters Extensive experimental work is used to show that phase can be a reliable source of pure image translation small geometric deformation smooth contrast variations and multiple local velocities Extensive theoretical analysis is used to explain the robustness of phase with respect to deviations from image translation and to detect situations in which phase becomes unstable The results indicate that optical flow may be extracted reliably for computing egomotion and structure from motion The monograph also contains a review of other techniques and frequency analysis applied to image sequences and it discusses the closely related topics of zero crossing tracking gradient based methods and the

measurement of binocular disparity The work is relevant to those studying machine vision and visual perception

Integration, Coordination and Control of Multi-Sensor Robot Systems Hugh F. Durrant-Whyte, 2012-12-06

Overview Recent years have seen an increasing interest in the development of multi sensory robot systems The reason for this interest stems from a realization that there are fundamental limitations on the reconstruction of environment descriptions using only a single source of sensor information If robot systems are ever to achieve a degree of intelligence and autonomy they must be capable of using many different sources of sensory information in an active and dynamic manner The observations made by the different sensors of a multi sensor system are always uncertain usually partial occasionally spurious or incorrect and often geographically or geometrically incomparable with other sensor views The sensors of these systems are characterized by the diversity of information that they can provide and by the complexity of their operation It is the goal of a multi sensor system to combine information from all these different sources into a robust and consistent description of the environment

Advances in Autonomous Robotics Systems Michael Mistry, Aleš Leonardis, Mark Witkowski, Chris Melhuish, 2014-08-23 This book constitutes the refereed proceedings of the 15th Conference on Advances in Autonomous Robotics TAROS 2014 held in Birmingham UK in September 2014 The 23 revised full papers presented together with 9 extended abstracts were carefully reviewed and selected from 48 submissions The overall program covers various aspects of robotics including navigation planning sensing and perception flying and swarm robots ethics humanoid robotics human robot interaction and social robotics

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

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Robotic Object Recognition Using Vision And Touch Introduction

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