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Monocular Model-Based 3D Tracking of Rigid Objects

Vincent Lepetit and Pascal Fua

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Monocular Modelbased 3d Tracking Of Rigid Objects

Anna V. Petrovskaya



Monocular Modelbased 3d Tracking Of Rigid Objects:

Monocular Model-based 3D Tracking of Rigid Objects Vincent Lepetit, Pascal Fua, 2005 Monocular Model Based 3D Tracking of Rigid Objects reviews the different techniques and approaches that have been developed by industry and research

Model-based Visual Tracking Giorgio Panini, 2011-04-12 This book has two main goals to provide a unified and structured overview of this growing field as well as to propose a corresponding software framework the OpenTL library developed by the author and his working group at TUM Informatik The main objective of this work is to show how most real world application scenarios can be naturally cast into a common description vocabulary and therefore implemented and tested in a fully modular and scalable way through the definition of a layered object oriented software architecture The resulting architecture covers in a seamless way all processing levels from raw data acquisition up to model based object detection and sequential localization and defines at the application level what we call the tracking pipeline Within this framework extensive use of graphics hardware GPU computing as well as distributed processing allows real time performances for complex models and sensory systems

Visual Perception for Humanoid Robots David Israel González Aguirre, 2018-09-01 This book provides an overview of model based environmental visual perception for humanoid robots The visual perception of a humanoid robot creates a bidirectional bridge connecting sensor signals with internal representations of environmental objects The objective of such perception systems is to answer two fundamental questions What where is it To answer these questions using a sensor to representation bridge coordinated processes are conducted to extract and exploit cues matching robot s mental representations to physical entities These include sensor actuator modeling calibration filtering and feature extraction for state estimation This book discusses the following topics in depth Active Sensing Robust probabilistic methods for optimal high dynamic range image acquisition are suitable for use with inexpensive cameras This enables ideal sensing in arbitrary environmental conditions encountered in human centric spaces The book quantitatively shows the importance of equipping robots with dependable visual sensing Feature Extraction Recognition Parameter free edge extraction methods based on structural graphs enable the representation of geometric primitives effectively and efficiently This is done by eccentricity segmentation providing excellent recognition even on noisy low resolution images Stereoscopic vision Euclidean metric and graph shape descriptors are shown to be powerful mechanisms for difficult recognition tasks Global Self Localization Depth Uncertainty Learning Simultaneous feature matching for global localization and 6D self pose estimation are addressed by a novel geometric and probabilistic concept using intersection of Gaussian spheres The path from intuition to the closed form optimal solution determining the robot location is described including a supervised learning method for uncertainty depth modeling based on extensive ground truth training data from a motion capture system The methods and experiments are presented in self contained chapters with comparisons and the state of the art The algorithms were implemented and empirically evaluated on two humanoid robots ARMAR III A B The excellent

robustness performance and derived results received an award at the IEEE conference on humanoid robots and the contributions have been utilized for numerous visual manipulation tasks with demonstration at distinguished venues such as ICRA CeBIT IAS and Automatica

Optoelectronic Devices in Robotic Systems Oleg Sergiyenko, 2022-10-29 This book provides a wide scope of contributions related to optoelectronic device application in a variety of robotic systems for diverse purposes The contributions are focused on optoelectronic sensors and analyzing systems 3D and 2D machine vision technologies robot navigation pose estimations robot operation in cyclic procedures control schemes motion controllers and intelligent algorithms and vision systems Applications of these technologies are outlined for unmanned aerial vehicles autonomous and mobile robots industrial inspection applications cultural heritage documentation and structural health monitoring Also discussed are recent advanced research in measurement and others areas where 3D and 2D machine vision and machine control play an important role Surveys and reviews about optoelectronic and vision based applications are also included These topics are of interest to readers from a diverse group including those working in optoelectronics and electrical electronic and computer engineering

Computer Vision -- ECCV 2014 David Fleet, Tomas Pajdla, Bernt Schiele, Tinne Tuytelaars, 2014-08-14 The seven volume set comprising LNCS volumes 8689 8695 constitutes the refereed proceedings of the 13th European Conference on Computer Vision ECCV 2014 held in Zurich Switzerland in September 2014 The 363 revised papers presented were carefully reviewed and selected from 1444 submissions The papers are organized in topical sections on tracking and activity recognition recognition learning and inference structure from motion and feature matching computational photography and low level vision vision segmentation and saliency context and 3D scenes motion and 3D scene analysis and poster sessions

Computer Vision -- ECCV 2012. Workshops and Demonstrations Andrea Fusiello, Vittorio Murino, Rita Cucchiara, 2012-09-26 The three volume set LNCS 7583 7584 and 7585 comprises the Workshops and Demonstrations which took place in connection with the European Conference on Computer Vision ECCV 2012 held in Firenze Italy in October 2012 The total of 179 workshop papers and 23 demonstration papers was carefully reviewed and selected for inclusion in the proceedings They where held at workshops with the following themes non rigid shape analysis and deformable image alignment visual analysis and geo localization of large scale imagery Web scale vision and social media video event categorization tagging and retrieval re identification biological and computer vision interfaces where computer vision meets art consumer depth cameras for computer vision unsolved problems in optical flow and stereo estimation what s in a face color and photometry in computer vision computer vision in vehicle technology from earth to mars parts and attributes analysis and retrieval of tracked events and motion in imagery streams action recognition and pose estimation in still images higher order models and global constraints in computer vision information fusion in computer vision for concept recognition 2 5D sensing technologies in motion the quest for 3D benchmarking facial image analysis technologies

Towards Dependable Robotic Perception Anna V. Petrovskaya, 2011 Reliable perception is required in

order for robots to operate safely in unpredictable and complex human environments. However, reliability of perceptual inference algorithms has been poorly studied so far. These algorithms capture uncertain knowledge about the world in the form of probabilistic belief distributions. A number of Monte Carlo and deterministic approaches have been developed but their efficiency depends on the degree of smoothness of the beliefs. In the real world, the smoothness assumption often fails, leading to unreliable perceptual inference results. Motivated by concrete robotics problems, we propose two novel perceptual inference algorithms that explicitly consider local non-smoothness of beliefs and adapt to it. Both of these algorithms fall into the category of iterative divide and conquer methods and hence scale logarithmically with desired accuracy. The first algorithm is termed Scaling Series. It is an iterative Monte Carlo technique coupled with annealing. Local non-smoothness is accounted for by sampling strategy and by annealing schedule. The second algorithm is termed GRAB, which stands for Guaranteed Recursive Adaptive Bounding. GRAB is an iterative adaptive grid algorithm which relies on bounds. In this case, local non-smoothness is captured in terms of local bounds and grid resolution. Scaling Series works well for beliefs with sharp transitions but without many discontinuities. GRAB is most appropriate for beliefs with many discontinuities. Both of these algorithms far outperform the prior art in terms of reliability, efficiency, and accuracy. GRAB is also able to guarantee that a quality approximation of the belief is produced. The proposed algorithms are evaluated on a diverse set of real robotics problems: tactile perception, autonomous driving, and mobile manipulation. In tactile perception, we localize objects in 3D starting with very high initial uncertainty and estimating all 6 degrees of freedom. The localization is performed based on tactile sensory data. Using Scaling Series, we obtain highly accurate and reliable results in under 1 second. Improved tactile object localization contributes to manufacturing applications where tactile perception is widely used for workpiece localization. It also enables robotic applications in situations where vision can be obstructed, such as rescue robotics and underwater robotics. In autonomous driving, we detect and track vehicles in the vicinity of the robot based on 2D and 3D laser range finders. In addition to estimating position and velocity of vehicles, we also model and estimate their geometric shape. The geometric model leads to highly accurate estimates of pose and velocity for each vehicle. It also greatly simplifies association of data which are often split up into separate clusters due to occlusion. The proposed Scaling Series algorithm greatly improves reliability and ensures that the problem is solved within tight real-time constraints of autonomous driving. In mobile manipulation, we achieve highly accurate robot localization based on commonly used 2D laser range finders using the GRAB algorithm. We show that the high accuracy allows robots to navigate in tight spaces and manipulate objects without having to sense them directly. We demonstrate our approach on the example of simultaneous building navigation, door handle manipulation, and door opening. We also propose hybrid environment models which combine high-resolution polygons for objects of interest with low-resolution occupancy grid representations for the rest of the environment. High accuracy indoor localization contributes directly to home office mobile robotics as well as to future robotics applications in construction.

inspection and maintenance of buildings Based on the success of the proposed perceptual inference algorithms in the concrete robotics problems it is our hope that this thesis will serve as a starting point for further development of highly reliable perceptual inference methods

Computational Science - ICCS 2018 Yong Shi, Haohuan Fu, Yingjie Tian, Valeria V. Krzhizhanovskaya, Michael Harold Lees, Jack Dongarra, Peter M. A. Sloot, 2018-06-11 The three volume set LNCS 10860 10861 10862 constitutes the proceedings of the 18th International Conference on Computational Science ICCS 2018 held in Wuxi China in June 2018 The total of 155 full and 66 short papers presented in this book set was carefully reviewed and selected from 404 submissions The papers were organized in topical sections named Part I ICCS Main Track Part II Track of Advances in High Performance Computational Earth Sciences Applications and Frameworks Track of Agent Based Simulations Adaptive Algorithms and Solvers Track of Applications of Matrix Methods in Artificial Intelligence and Machine Learning Track of Architecture Languages Compilation and Hardware Support for Emerging Manycore Systems Track of Biomedical and Bioinformatics Challenges for Computer Science Track of Computational Finance and Business Intelligence Track of Computational Optimization Modelling and Simulation Track of Data Modeling and Computation in IoT and Smart Systems Track of Data Driven Computational Sciences Track of Mathematical Methods and Algorithms for Extreme Scale Track of Multiscale Modelling and Simulation Part III Track of Simulations of Flow and Transport Modeling Algorithms and Computation Track of Solving Problems with Uncertainties Track of Teaching Computational Science Poster Papers

Image Analysis Arnt-Borre Salberg, Jon Yngve Hardeberg, Robert Jenssen, 2009-07-14 This volume contains the papers presented at the Scandinavian Conference on Image Analysis SCIA 2009 which was held at the Radisson SAS Scandinavian Hotel Oslo Norway June 15 18 SCIA 2009 was the 16th in the biennial series of conferences which has been organized in turn by the Scandinavian countries Sweden Finland D mark and Norway since 1980 The event itself has always attracted participants and author contributions from outside the Scandinavian countries making it an international conference The conference included a full day of tutorials and several keynote talks provided by world renowned experts The program covered high quality scientific contributions within image analysis human and action analysis pattern and object recognition color imaging and quality medical and biomedical applications face and head analysis computer vision and multispectral color analysis The papers were carefully selected based on at least two reviews Among 154 submissions 79 were accepted leading to an acceptance rate of 51% Since SCIA was arranged as a single track event 30 papers were presented in the oral sessions and 49 papers were presented in the poster sessions A separate session on multispectral color science was organized in cooperation with the 11th Symposium of Multispectral Color Science MCS 2009 Since 2009 was proclaimed the International Year of Astronomy by the United Nations General Assembly the conference also contained a session on the topic Image and Pattern Analysis in Astronomy and Astrophysics SCIA has a reputation of having a friendly environment in addition to high quality scientific contributions We focused on maintaining this reputation by designing a technical and social

program that we hope the participants found interesting and inspiring for new research ideas and network extensions We thank the authors for submitting their valuable work to SCIA

Artificial Intelligence and Soft Computing, Part I Leszek Rutkowski,Rafal Scherer,Ryszard Tadeusiewicz,Lotfi A. Zadeh,Jacek M. Zurada,2010-06 This volume constitutes the proceedings of the 10th International Conference on Artificial Intelligence and Soft Computing ICAISC 2010 held in Zakopane Poland in June 13 17 2010 The articles are organized in topical sections on Fuzzy Systems and Their Applications Data Mining Classification and Forecasting Image and Speech Analysis Bioinformatics and Medical Applications Volume 6113 together with Neural Networks and Their Applications Evolutionary Algorithms and Their Applications Agent System Robotics and Control Various Problems aof Artificial Intelligence Volume 6114

Computer Vision - ECCV 2022 Workshops Leonid Karlinsky,Tomer Michaeli,Ko Nishino,2023-02-14 The 8 volume set comprising the LNCS books 13801 until 13809 constitutes the refereed proceedings of 38 out of the 60 workshops held at the 17th European Conference on Computer Vision ECCV 2022 The conference took place in Tel Aviv Israel during October 23 27 2022 the workshops were held hybrid or online The 367 full papers included in this volume set were carefully reviewed and selected for inclusion in the ECCV 2022 workshop proceedings They were organized in individual parts as follows Part I W01 AI for Space W02 Vision for Art W03 Adversarial Robustness in the Real World W04 Autonomous Vehicle Vision Part II W05 Learning With Limited and Imperfect Data W06 Advances in Image Manipulation Part III W07 Medical Computer Vision W08 Computer Vision for Metaverse W09 Self Supervised Learning What Is Next Part IV W10 Self Supervised Learning for Next Generation Industry LevelAutonomous Driving W11 ISIC Skin Image Analysis W12 Cross Modal Human Robot Interaction W13 Text in Everything W14 BioImage Computing W15 Visual Object Oriented Learning Meets Interaction Discovery Representations and Applications W16 AI for Creative Video Editing and Understanding W17 Visual Inductive Priors for Data Efficient Deep Learning W18 Mobile Intelligent Photography and Imaging Part V W19 People Analysis From Face Body and Fashion to 3D Virtual Avatars W20 Safe Artificial Intelligence for Automated Driving W21 Real World Surveillance Applications and Challenges W22 Affective Behavior Analysis In the Wild Part VI W23 Visual Perception for Navigation in Human Environments The JackRabbit Human Body Pose Dataset and Benchmark W24 Distributed Smart Cameras W25 Causality in Vision W26 In Vehicle Sensing and Monitorization W27 Assistive Computer Vision and Robotics W28 Computational Aspectsof Deep Learning Part VII W29 Computer Vision for Civil and Infrastructure Engineering W30 AI Enabled Medical Image Analysis Digital Pathology and Radiology COVID19 W31 Compositional and Multimodal Perception Part VIII W32 Uncertainty Quantification for Computer Vision W33 Recovering 6D Object Pose W34 Drawings and Abstract Imagery Representation and Analysis W35 Sign Language Understanding W36 A Challenge for Out of Distribution Generalization in Computer Vision W37 Vision With Biased or Scarce Data W38 Visual Object Tracking Challenge

Intelligent Video Event Analysis and Understanding Jianguo Zhang,Ling Shao,Lei Zhang,Graeme A. Jones,2011-01-19 With the vast development of Internet capacity and speed as well as

wide adoption of media technologies in people's daily life a large amount of videos have been surging and need to be efficiently processed or organized based on interest. The human visual perception system could without difficulty interpret and recognize thousands of events in videos despite high level of video object clutters, different types of scene context, variability of motion scales, appearance changes, occlusions, and object interactions. For a computer vision system, it has been very challenging to achieve automatic video event understanding for decades. Broadly speaking, those challenges include robust detection of events under clutter, event interpretation under complex scenes, multi-level semantic event inference, putting events in context, and multiple cameras event inference from object interactions etc. In recent years, steady progress has been made towards better models for video event categorisation and recognition, e.g. from modelling events with bag of spatial-temporal features to discovering event context from detecting events using a single camera to inferring events through a distributed camera network and from low-level event feature extraction and description to high-level semantic event classification and recognition. Nowadays, text-based video retrieval is widely used by commercial search engines. However, it is still very difficult to retrieve or categorise a specific video segment based on their content in a real multimedia system or in surveillance applications.

Advances in Data Science and Optimization of Complex Systems Hoai An Le Thi, Hoai Minh Le, Quang Thuan Nguyen, 2025-06-04. This proceeding set contains 81 selected full papers presented at the International Conference on Applied Mathematics and Computer Science ICAMCS 2024 which was held on December 20-21, 2024 in Hanoi, Vietnam, in honor of Professors Pham Dinh Tao and Le Thi Hoai An for the 40th birthday of DC Difference of Convex functions programming and DCA/DC Algorithm. The book covers theoretical and algorithmic as well as practical issues connected with several domains of Applied Mathematics and Computer Science, especially Optimization and Data Science. The present part I of the 2-volume set includes articles devoted to Mathematical programming and optimization, DC Programming, DCA, Operations research, and decision making, Economics, Finance, Engineering, Systems, Autonomous systems, Information theory, and Information security. Researchers and practitioners in related areas will find a wealth of inspiring ideas and useful tools and techniques for their own work.

Neural Information Processing Minho Lee, Akira Hirose, Zeng-Guang Hou, Rhee Man Kil, 2013-10-29. The three-volume set LNCS 8226, LNCS 8227, and LNCS 8228 constitutes the proceedings of the 20th International Conference on Neural Information Processing (ICONIP 2013) held in Daegu, Korea, in November 2013. The 180 full and 75 poster papers presented together with 4 extended abstracts were carefully reviewed and selected from numerous submissions. These papers cover all major topics of theoretical research, empirical study, and applications of neural information processing research. The specific topics covered are as follows: cognitive science and artificial intelligence, learning theory, algorithms and architectures, computational neuroscience and brain imaging, vision, speech and signal processing, control, robotics, and hardware technologies, and novel approaches and applications.

Pattern Recognition Fred A. Hamprecht, Christoph Schnörr, Bernd Jähne, 2007-09-22. This book constitutes the refereed proceedings

of the 29th Symposium of the German Association for Pattern Recognition DAGM 2007 It covers image filtering restoration and segmentation shape analysis and representation categorization and detection computer vision and image retrieval machine learning and statistical data analysis biomedical data analysis motion analysis and tracking stereo and structure from motion as well as 3D view registration and surface modeling *Augmented Reality* Soha Maad,2010-01-01 Virtual Reality VR and Augmented Reality AR tools and techniques supply virtual environments that have key characteristics in common with our physical environment Viewing and interacting with 3D objects is closer to reality than abstract mathematical and 2D approaches Augmented Reality AR technology a more expansive form of VR is emerging as a cutting edge technology that integrates images of virtual objects into a real world In that respect Virtual and Augmented reality can potentially serve two objectives reflecting realism through a closer correspondence with real experience and extending the power of computer based technology to better reflect abstract experience With the growing amount of digital data that can be stored and accessed there is a rising need to harness this data and transform it into an engine capable of developing our view and perception of the world and of boosting the economic activity across domain verticals Graphs pie charts and spreadsheet are not anymore the unique medium to convey the world Advanced interactive patterns of visualization and representations are emerging as a viable alternative with the latest advances in emerging technologies such as AR and VR And the potential and rewards are tremendous This book discusses the opportunities and challenges facing the development of this technology *Computer Vision - ACCV 2016 Workshops* Chu-Song Chen,Jiwen Lu,Kai-Kuang Ma,2017-03-14 The three volume set consisting of LNCS 10116 10117 and 10118 contains carefully reviewed and selected papers presented at 17 workshops held in conjunction with the 13th Asian Conference on Computer Vision ACCV 2016 in Taipei Taiwan in November 2016 The 134 full papers presented were selected from 223 submissions LNCS 10116 contains the papers selected **Computer Vision Systems** Mei Chen,Bastian Leibe,Bernd Neumann,2013-07-11 This book constitutes the refereed proceedings of the 9th International Conference on Computer Vision Systems ICVS 2013 held in St Petersburg Russia July 16 18 2013 Proceedings The 16 revised papers presented with 20 poster papers were carefully reviewed and selected from 94 submissions The papers are organized in topical sections on image and video capture visual attention and object detection self localization and pose estimation motion and tracking 3D reconstruction features learning and validation *Computer Vision - ECCV 2008* David Forsyth,Philip Torr,Andrew Zisserman,2008-10-14 The four volume set comprising LNCS volumes 5302 5303 5304 5305 constitutes the refereed proceedings of the 10th European Conference on Computer Vision ECCV 2008 held in Marseille France in October 2008 The 243 revised papers presented were carefully reviewed and selected from a total of 871 papers submitted The four books cover the entire range of current issues in computer vision The papers are organized in topical sections on recognition stereo people and face recognition object tracking matching learning and features MRFs segmentation computational photography and active reconstruction **Human Motion -**

Understanding, Modeling, Capture and Animation Ahmed Elgammal, Bodo Rosenhahn, Reinhard Klette, 2007-11-15 This book constitutes the refereed proceedings of the Second Workshop on Human Motion HumanMotion 2007 held in Rio de Janeiro Brazil October 2007 in conjunction with ICCV 2007 The 22 revised full papers presented were carefully reviewed and selected from 38 submissions The papers are organized in topical sections on motion capture and pose estimation body and limb tracking and segmentation and activity recognition

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