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Bodo Rosenhahn (Eds.)

Outdoor and Large-Scale Real-World Scene Analysis

15th International Workshop
on Theoretical Foundations of Computer Vision
Dagstuhl Castle, Germany, June 26 - July 1, 2011
Revised Selected Papers

Volume Editors

Frank Dellaert

Georgia Institute of Technology, College of Computing Building
Atlanta, GA 30332-0280, USA
E-mail: frank@cc.gatech.edu

Jan-Michael Frahm

University of North Carolina at Chapel Hill, Department of Computer Science
Chapel Hill, NC 27599, USA
E-mail: jmf@cs.unc.edu

Marc Pollefeys

ETH Zurich, CVG - Institute of Visual Computing
8092 Zurich, Switzerland
E-mail: marc.pollefeys@inf.ethz.ch

Laura Leal-Taixé

Bodo Rosenhahn
Leibniz Universität, Institute for Information Processing (TNT)
30167 Hannover, Germany
E-mail: rosenhahn@tnt.uni-hannover.de

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Preface

The topic of the 15th Workshop on Theoretical Foundations of Computer Vision was *Outdoor and Large-Scale Real-World Scene Analysis*, which covers all aspects, applications, and open problems regarding the performance or design of computer vision algorithms capable of working in outdoor set-ups and/or large-scale environments. Developing these methods is important for driver assistance, city modeling and reconstruction, virtual tourism, telepresence, and motion capture. With this workshop we aimed to attain several objectives, outlined below.

The first objective of the workshop was to take stock of the performance of existing state-of-the-art computer vision algorithms and to define metrics and benchmark datasets on which to evaluate them. It is imperative that we push existing algorithms, which are currently benchmarked or tested with artificial or indoor set-ups, toward *real* applications. Methods of interest are 3D reconstruction, optic flow computation, motion capture, surveillance, object recognition, and tracking. These need to be dragged out of the lab and into the real world. Over the last few years the computer vision community has recognized this problem and several groups are increasingly concentrating on the analysis of uncontrolled scenes. Examples include reconstructing large city models from online image collections such as Flickr, or human tracking and behavior recognition in TV footage or video from arbitrary outdoor scenes. An outcome we envision is the definition of appropriate metrics, benchmark sequences, and the definition of a *grand-challenge problem* that exposes algorithms to all the difficulties associated with large-scale outdoor scenes while simultaneously mobilizing the research community.

The second objective, then, was to define what the open problems are and which aspects of outdoor and large-scale scene analysis make the problem currently intractable. In uncontrolled, outdoor settings many problems start to arise, among them harsh viewing conditions, changing lighting conditions, and artifacts from wind, rain, clouds, or temperature etc. In addition, large-scale modeling, i.e., spanning city-scale areas, contains difficult challenges of data association and self-consistency that simply do not appear in smaller data-sets. Failure of basic building-block algorithms seems likely or even inevitable, requiring system-level approaches in order to be robust to failure. One of the difficulties lies in the fact that the observer loses complete control over the scene, which can become arbitrary complex. This also brings with it the challenge of describing the scene in terms other than purely geometric, i.e., perform true scene *understanding* at multiple spatial and temporal scales. Finally, outdoor scenes are dynamic and changing over time, requiring event learning and understanding as well as integrating behavior recognition. In this regard, we brought in participants from industry in order to ground the challenges discussed in real-world, useful applications.

The third and final objective was to discuss strategies that address these challenges, by bringing together a diverse set of international researchers with people interested in the applications, e.g., arising from photogrammetry, geoinformatics, driver-assistance systems, or human motion analysis. Although these people work in different fields and communities, they are unified by their goal of dealing with images and/or video from outdoor scenes and uncontrolled settings. In the workshop we allowed for an exchange of different modeling techniques and experiences researchers have collected. We allowed time for working groups during the workshop that connect people and whose goals are to develop ideas/roadmaps; additionally, we allowed young researchers to connect with senior researchers, and in general allowed for an exchange between researchers who would usually not meet otherwise.

We are grateful to the team at Castle Dagstuhl for supporting our workshop. We would like to thank all participants for their encouraging presentations, lively discussions, and contributions for this book. The published papers were carefully selected after a blind per-review process and reflect major topics presented at the seminar.

June 2012

Frank Dellaert
Jan-Michael Frahm
Marc Pollefeys
Laura Leal-Taixé
Bodo Rosenhahn

Organization

The 15th Workshop Theoretic Foundations of Computer Vision, titled “Outdoor and Large-Scale Real-World Scene Analysis,” was organized by Frank Dellaert, Jan-Michael Frahm, Marc Pollefeys, and Bodo Rosenhahn.

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Organizers

Frank Dellaert	Georgia Institute of Technology, USA
Jan-Michael Frahm	University of North Carolina, Chapel Hill, USA
Marc Pollefeys	ETH Zürich, Switzerland
Bodo Rosenhahn	Leibniz Universität Hannover, Germany

Edited in Cooperation with

Laura Leal-Taixé	Leibniz Universität Hannover, Germany
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Participants

Steffen Abraham	Robert Bosch GmbH - Hildesheim, Germany
Sameer Agarwal	Google - Seattle, USA
Ioannis Brilakis	Georgia Institute of Technology, USA
Gabriel Brostow	University College London, UK
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Radek Grzeszczuk	NRC - Palo Alto, USA
Johan Hedborg	Linköping University, Sweden
Christian Heipke	Leibniz Universität Hannover, Germany
Thomas Helten	MPI für Informatik - Saarbrücken, Germany

VIII Organization

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Kshitij Marwah	MIT - Cambridge, USA
Helmut Mayer	Universität der Bundeswehr - München, Germany
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Gerard Pons-Moll	Leibniz Universität Hannover, Germany
Dan Raviv	Technion - Haifa, Israel
Ralf Reulke	HU Berlin, Germany
Bodo Rosenhahn	Leibniz Universität Hannover, Germany
Torsten Sattler	RWTH Aachen, Germany
Silvio Savarese	University of Michigan, USA
Andreas Schilling	Universität Tübingen, Germany
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Thorsten Thormählen	MPI für Informatik - Saarbrücken, Germany
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Henning Zimmer	Universität des Saarlandes, Germany

Table of Contents

Exploiting Pedestrian Interaction via Global Optimization and Social Behaviors	1
<i>Laura Leal-Taixé, Gerard Pons-Moll, and Bodo Rosenhahn</i>	
An Evaluation Framework for Stereo-Based Driver Assistance	27
<i>Nicolai Schneider, Stefan Gehrig, David Pfeiffer, and Konstantinos Banitsas</i>	
Real-World Stereo-Analysis Evaluation	52
<i>Sandino Morales, Simon Hermann, and Reinhard Klette</i>	
Pyramid Transform and Scale-Space Analysis in Image Analysis	78
<i>Yoshihiko Mochizuki and Atsushi Imiya</i>	
Towards Feature-Based Situation Assessment for Airport Apron Video Surveillance	110
<i>Ralf Dragon, Michele Fenzi, Wolf Siberski, Bodo Rosenhahn, and Jörn Ostermann</i>	
Generalized Subgraph Preconditioners for Large-Scale Bundle Adjustment	131
<i>Yong-Dian Jian, Doru C. Balcan, and Frank Dellaert</i>	
Achievements and Challenges in Recognizing and Reconstructing Civil Infrastructure	151
<i>Ioannis Brilakis, Fei Dai, and Stefania-Christina Radopoulou</i>	
Equi-affine Invariant Geometries of Articulated Objects	177
<i>Dan Raviv, Alexander M. Bronstein, Michael M. Bronstein, Ron Kimmel, and Nir Sochen</i>	
Towards Fast Image-Based Localization on a City-Scale	191
<i>Torsten Sattler, Bastian Leibe, and Leif Kobbelt</i>	
Perspective and Non-perspective Camera Models in Underwater Imaging – Overview and Error Analysis	212
<i>Anne Sedlazeck and Reinhard Koch</i>	
An Introduction to Random Forests for Multi-class Object Detection . . .	243
<i>Juergen Gall, Nima Razavi, and Luc Van Gool</i>	
Segmentation and Classification of Objects with Implicit Scene Context	264
<i>Jan D. Wegner, Bodo Rosenhahn, and Uwe Sörgel</i>	

Dense 3D Reconstruction from Wide Baseline Image Sets	285
<i>Helmut Mayer, Jan Bartelsen, Heiko Hirschmüller, and Andreas Kuhn</i>	
Data-Driven Manifolds for Outdoor Motion Capture	305
<i>Gerard Pons-Moll, Laura Leal-Taixé, Juergen Gall, and Bodo Rosenhahn</i>	
On Performance Analysis of Optical Flow Algorithms	329
<i>Daniel Kondermann, Steffen Abraham, Gabriel Brostow, Wolfgang Förstner, Stefan Gehrig, Atsushi Imiya, Bernd Jähne, Felix Kloese, Marcus Magnor, Helmut Mayer, Rudolf Mester, Tomas Pajdla, Ralf Reulke, and Henning Zimmer</i>	
Camera-Based Fall Detection on Real World Data	356
<i>Glen Debard, Peter Karsmakers, Mieke Deschodt, Ellen Vlaeyen, Eddy Dejaeger, Koen Milisen, Toon Goedemé, Bart Vanrumste, and Tinne Tuytelaars</i>	
Semantic Structure from Motion: A Novel Framework for Joint Object Recognition and 3D Reconstruction	376
<i>Sid Yingze Bao and Silvio Savarese</i>	
Hierarchical Surface Reconstruction from Multi-resolution Point Samples	398
<i>Ronny Klowsky, Patrick Mücke, and Michael Goesele</i>	
Traffic Observation and Situation Assessment	419
<i>Ralf Reulke, Dominik Rueß, Kristian Manthey, and Andreas Luber</i>	
Author Index	443