

08422 Abstracts Collection  
**Computer Vision in Camera Networks for  
Analyzing Complex Dynamic Natural Scenes**  
— Dagstuhl Event —

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**Abstract.** From 12.10. to 15.10.2008, the Dagstuhl Event was held in Schloss Dagstuhl – Leibniz Center for Informatics. During the seminar, several participants presented their current research, and ongoing work and open problems were discussed. Abstracts of the presentations given during the seminar as well as abstracts of seminar results and ideas are put together in this paper. The first section describes the seminar topics and goals in general. Links to extended abstracts or full papers are provided, if available.

**Computer Vision in Camera Networks for Analyzing  
Complex Dynamic Natural Scenes**

*Joachim Denzler (Universität Jena, DE)*

Sensor or camera networks will play an important role in future applications, from surveillance tasks for workplace safety or security in general, over driver assisting systems in automotive and last but not least intelligent homes or assisted living for the elderly. Computer vision in sensor or camera networks defines a couple of currently unsolved problems. First of all, how can we calibrate cameras distributed arbitrarily in the scene without placing artificial or natural calibration patterns in the scene? Second, how do we select and fuse the information provided by different, also multimodal sensors to solve a given problem? Finally, can we handle reconstruction, recognition and tracking tasks in complex and highly dynamic natural scenes which are in almost all cases the environment camera networks are designed for?

*Keywords:* Computer Vision, Camera Networks, Natural Scenes

*Extended Abstract:* <http://drops.dagstuhl.de/opus/volltexte/2009/1865>

### **3-D Reconstruction in Piecewise Planar Environments**

*Olaf Kähler (Universität Jena, DE )*

The structure-from-motion problem is central in applications like visual robot navigation and visual 3d modeling. Typical solutions split the problem into feature tracking and geometric reconstruction steps. Instead we present a combined solution, where the tracking step is implicitly supported by a feedback of 3d information, and the geometric reconstruction is statistically optimal in case of Gaussian noise on image intensities. Experiments confirm an increased accuracy and reliability, and despite a significant computational overhead, the combined solution still runs at 5-10 fps.

*Keywords:* Structure-from-motion, tracking, 3d reconstruction

*Joint work of:* Kähler, Olaf, Denzler, Joachim

*Extended Abstract:* <http://drops.dagstuhl.de/opus/volltexte/2009/1867>

### **Minimum Uncertainty Triangle Paths for Multi Camera Calibration**

*Ferid Bajramovic (Universität Jena, DE )*

Multi camera systems become increasingly important in computer vision. For many applications, however, the system has to be calibrated, i.e. the intrinsic and extrinsic parameters of the cameras have to be determined. We present a method for calibrating the extrinsic parameters without any scene knowledge or user interaction. In particular, we assume known intrinsic parameters and one image from each camera as input.

*Keywords:* Multi camera, calibration, uncertainty

*Joint work of:* Bajramovic, Ferid; Denzler, Joachim

*Extended Abstract:* <http://drops.dagstuhl.de/opus/volltexte/2009/1863>

### **Active Self Calibration of a Multi Sensor System**

*Marcel Brückner (Universität Jena, DE )*

The combination of a multi camera system with different sensor types like PMD cameras or motion sensors is called multi sensor system.

Such systems offer many different application scenarios, e.g. motion studies of animals and sportsmen, 3D reconstruction or object tracking tasks. In order to work properly, each of this applications needs an accurately calibrated multi sensor system. Calibration consists of estimating the intrinsic parameters of each camera and determining the relative poses (rotation and translation) between the sensors. The second step is known as extrinsic calibration and forms the focus of this work. Self-calibration of a multi sensor system is desirable since a manual calibration is a time consuming and difficult task.

*Keywords:* Relative pose, extrinsic calibration, multi sensor system, common field of view

*Joint work of:* Brückner, Marcel; Denzler, Joachim

*Extended Abstract:* <http://drops.dagstuhl.de/opus/volltexte/2009/1864>

## **Automated Evaluation of 3D Reconstruction Results for Benchmarking View Planning**

*Christoph Munkelt (Fraunhofer Institut - Jena, )*

To obtain complete 3D object reconstructions using optical measurements, several views of the object are necessary. The task of determining good sensor positions to achieve a 3D reconstruction with low error, high completeness and few required views is called the Next Best View (NBV) problem. Solving the NBV problem is an important task for automated 3D reconstruction. However, comparison of different planning methods has been difficult, since only few dedicated test methods exist. We present an extension to our NBV benchmark framework, that allows for faster, automated evaluation of large result data sets. We show that the method introduces insignificant error, while considerably reducing evaluation runtime and increasing robustness.

*Keywords:* Next Best View, View Planning, Optical 3D Reconstruction, Benchmarking

*Joint work of:* Munkelt, Christoph; Denzler, Joachim

*Extended Abstract:* <http://drops.dagstuhl.de/opus/volltexte/2009/1859>

## **Evaluating Guided KLT Tracking for Next Best View Planning in 3D Reconstruction**

*Michael Trummer (Universität Jena, DE )*

This report considers the task of 3D reconstruction within a Next Best View (NBV) planning approach. Particular attention is given to the possibilities of extending the well-known Kanade-Lucas-Tomasi (KLT) tracker for the application within a controlled planning framework. The benefit of the tracker's extensions to the planning procedure is evaluated quantitatively.

*Keywords:* 3d reconstruction, KLT tracking, sensor planning, Next Best View

*Joint work of:* Trummer, Michael; Denzler, Joachim

*Extended Abstract:* <http://drops.dagstuhl.de/opus/volltexte/2009/1862>

## Generic Object Recognition

*Doaa Hegazy (Universität Jena, DE )*

The object recognition problem has challenged the computer vision community for long time due to the huge change in the scale, occlusion and lighting conditions which have a great effect on the appearance of the objects. The problem of generic object recognition (GOR) has the previously mentioned difficulties in addition to the intra-class and inter-class variability problems. Despite the difficulties of the generic object recognition problem many approaches appeared trying to provide a solution to this problem. We present our model for 2D generic object recognition which achieves good performance on difficult object category datasets. Moreover, we present a model for generic 3D object recognition from range images.

*Keywords:* Generic object recognition, Boosting, Range images

*Joint work of:* Hegazy, Doaa; Denzler, Joachim

*Extended Abstract:* <http://drops.dagstuhl.de/opus/volltexte/2009/1866>

## Theory of Learning with Few Examples and Object Localization

*Erik Rodner (Universität Jena, DE )*

Visual object localization and categorization is still a big challenge for current research and gets even more difficult when confronted with few training examples. Therefore we will present a Bayesian concept to enhance state-of-the-art machine learning techniques even when dealing with just a single view of an object category.

Furthermore an object localization approach is presented, which can serve as a baseline for researchers within the area of object localization.

*Keywords:* Object detection, one-shot learning, knowledge transfer

*Joint work of:* Rodner, Erik; Denzler, Joachim

*Extended Abstract:* <http://drops.dagstuhl.de/opus/volltexte/2009/1861>

## Model-based Surface Defect Detection and Condition Monitoring in Wire Ropes

*Esther Platzer (Universität Jena, DE )*

Wire ropes are exposed to huge external powers everyday. Therefore strict rules for a regular visual inspection exist.

Many approaches for textural defect detection in textiles or other materials exist. However, until today no real possibility to control rope attributes like lay length or diameter over the whole rope course exist. To meet this drawback we present an automatic inspection approach based on a geometric rope model. The parameters of the rope model are estimated over time given raw 2-d image data and local surface defects are located by comparison of the real data with a 2-d projection of the ideal model.

*Keywords:* Defect detection, visual inspection, analysis-by-synthesis

*Joint work of:* Platzer, Esther; Denzler, Joachim

*Extended Abstract:* <http://drops.dagstuhl.de/opus/volltexte/2009/1860>

## **Universal Image Statistics as a Basis for Esthetic Perception**

*Michael Koch (Universität Jena, DE)*

In the last decades many neuroscientists have started to investigate the perception of nature and art by the human visual system.

Natural scenes lead to an esthetically pleasing perception, therefore scientists have begun to research the reasons to understand the processing principles of the human visual system.

*Keywords:* Esthetic, Aesthetic, PCA, Power Spectrum, Principal Component Analysis

*Joint work of:* Koch, Michael; Denzler, Joachim; Redies, Christoph

*Extended Abstract:* <http://drops.dagstuhl.de/opus/volltexte/2009/1868>