ISPRS Working Group III/5 – Image Sequence Analysis

Annual Report 2009

1. State of Science and Technology of Working Group Topics

Goals:
Image sequence analysis is playing an important role in many fields of close-range photogrammetry, computer vision, machine vision and robot vision for many years. With the development of modern, flexible digital sensors, automatic methods for analyzing and evaluating image sequences are also entering the fields of aerial photogrammetry and remote sensing. Examples of the application of image sequence analysis in photogrammetry and remote sensing are 2D/3D object tracking, ego-motion determination, detection and characterization of dynamic processes, deformation measurements, monocular or stereoscopic mapping of the environment of a UAV or an autonomous robot, mobile mapping, biomedical motion analysis, and many others.
However, recent research has shown that a pure transition of methods mainly designed for the analysis of (close-range) video streams to the aforementioned applications is not possible due to different camera characteristics, varying frame rates, other platforms and, in general, very challenging environments. Further theoretical and experimental developments accompanied by thorough validations are thus necessary to better exploit the huge information content of image sequences.

Terms of Reference:
- Studying camera and camera network calibration from image sequences including cameras with non-standard geometry and variable framerate
- Studying ego-motion determination for navigation, georeferencing and object reconstruction
- Studying detection, reconstruction, classification and tracking of single and multiple objects in image sequences
- Studying event reconstruction from image sequences as well as single and multiple video streams
- Investigating the quality assessment of calibration, orientation and object detection using image sequences
- Benchmarking of calibration, orientation and object detection techniques using image sequences

2. Accomplishments of Working Group during the current year

IEEE / ISPRS Joint Urban Remote Sensing Event 2009, 20-22 May 2009, Shanghai, China
http://www.urban-remote-sensing-2009.org.cn/
Organization of session on “Urban Mapping”

ISPRS Hannover Workshop 2009, 2-5 June 2009, Hannover, Germany
http://www.ipi.uni-hannover.de/ipi-workshop.html
Co-organize a session on “Object detection and characterization using passive and active sensors”

CMRT09 “Object Extraction for 3D City Models, Road Databases and Traffic Monitoring - Concepts, Algorithms and Evaluation”, 3-4 September 2009, Paris, France
http://www.cmrt09.bv.tum.de/
The workshop took place in Paris from Thursday 3rd September to Friday 4th September 2009. It was held in conjunction with the ISPRS workshop “Laserscanning 2009” which took place at the same venue on September 1 and 2. Both workshops were hosted by the Laboratoire Matis of the French Institut Géographique National (IGN) and by the Société Française de Photogrammétrie et de Télédétection (SFPT). The pricing policy of the local organizers encouraged participants to attend both events. There were 115 participants to CMRT09, with 75 attending also the Laserscanning 2009 workshop.

CMRT09 was organized by the ISPRS Working Groups III/4, “Complex Scene Analysis and 3D Reconstruction“, and III/5, “Image Sequence Analysis“. In their call for papers, the conference chairs, Nicolas Paparoditis (IGN/MATIS, St. Mandé), Uwe Stilla (TU Munich) and Franz Rottensteiner (University of Hannover), had invited prospected authors to submit scientific papers on topics related to the terms of reference of the two Working Groups. Altogether 60 full papers were submitted by authors coming from 20 different countries. Following the standards set by previous workshops of ISPRS Commission III, these papers had to undergo a rigorous double-blind peer review. Each paper was reviewed at least by two members of the Scientific Committee. This reviewing process resulted in the acceptance of 38 contributions by authors coming from 14 countries, which corresponds to a rejection rate of 37%. As a consequence, the scientific quality of the workshop was very high. The accepted papers were published in the *International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences (IAPRS)*, Volume 38, Part 3/W4. They were available at the conference both as hardcopies and on CD-ROM. The proceedings can are also available via the conference website.

There was a single track of 6 oral sessions with altogether 22 presentations. Each presenter had 25 minutes. This time frame was used for in-depth presentations and for intense discussions. In addition, there was a well-attended poster session with 16 contributions in the afternoon of September 3.

The main topic of the workshop was the automated extraction of topographic objects from remotely sensed data. The presentations were dedicated to new developments both in data processing, where methods from Computer Vision are adopted by the Photogrammetric community, and in sensor technology.

The workshop started with a keynote by Josiane Zerubia from INRIA Sophia Antipolis Mediterranee. In her excellent presentation she showed applications of Marked Point Processes for automated object extraction from high-resolution image data.

The first technical session, chaired by Markus Gerke, dealt with the automatic extraction of roads from data acquired by various sensors. It included one contribution on the semi-automatic recognition of road markings from Video data. The other presentations were dedicated to the extraction of roads and to the modeling of street surfaces using laser scanner data and aerial imagery. The second oral session which was the first of two sessions on building extraction was chaired by Franz Rottensteiner. It consisted of presentations on automated building extraction from aerial imagery and laserscanner data. There were papers on primary data acquisition, on the decomposition of 2D ground plans for 3D building reconstruction, and on methods for map updating. Nicolas Champion (IGN) presented the results of the EuroSDR test on change detection for automated updating of cadastral maps.

On Friday morning, Uwe Stilla was the chair of the oral session on SAR. There was a focus on TerraSAR-X data and on the theoretical foundations of the TanDEM-X mission, with contributions on image improvement and change detection, building height estimation by SAR interferometry, building extraction by fusion of optical and SAR paper and, finally, SAR simulations for ray tracing based on 3D models. The SAR session was followed by the oral session on Traffic and Navigation, chaired by Matthias Butenuth. There were two contributions on the recognition of vehicles and the estimation of velocities from aerial images and one paper on the on-line analysis and registration of oblique-view lidar data for navigation purposes.

The session on Street Scenes was chaired by Stefan Hinz. The three presentations of this session were closely related to the field of computer vision. The topics were positioning in urban scenes using images retrieved from a data base by means of matching procedures, text recognition and the recognition of road signs in terrestrial scenes. The last oral session of CMRT09, chaired by Caroline Baillard, was the second session on buildings, with a focus on terrestrial scenes and façades. There was one contribution on the combined segmentation of images and point clouds generated by image matching. The remainder of the presentations dealt with the improved generation of façade texture for building models, with the segmentation of façade parts, and with façade reconstruction from mobile Lidar mapping.

The local organisation of the workshop was excellent, and so was the catering. The conference fee included Lunch at the conference venue, which will be remembered by all the workshop participants for its high culinary standard. The same thing can be said about the social event on Thursday evening: The participants could enjoy French Haute Cuisine on a boat trip on the Seine while watching the wonderful sights of Paris by night.

Performed tests, distributed datasets

We plan to provide datasets on our homepage to perform tests. The datasets will contain image sequences, reference data and additional meta data. Current data sets are:

- http://vision.middlebury.edu/flow/
  We highly encourage you to use this database if you are planning to test your optical flow algorithms
- http://www.mi.auckland.ac.nz/index.php?option=com_content&view=article&id=44&Itemid=67
  This web site of the .enpeda.. (Environmental Perception and Driver Assistance) project offers sets of geometrically rectified stereo image sequences for the purpose of comparative performance evaluation of stereo vision, optic flow, motion analysis, or further techniques in computer vision

3. Working Group News

Planned activities

- 2010, 10-12 February
  Co-organizing workshop Eurocow 2010
  http://www.ideg.es/page.php?id=787
- 2010, 1-3 September
  Reviews and co-organizing of Commission III Symposium in Paris, France.
  http://pcv2010.ign.fr/
- 2011, September
  Organize a conference on Photogrammetric Image Analysis (PIA11) in conjunction with the other working groups of Commission III, follow up of the PIA07 conference in 2007 to be held in Munich, Germany
  http://www.pia11.bv.tum.de/
- 2012, 25 August – 1 September
  Organize sessions at the ISPRS congress in Melbourne, Australia
  http://www.isprs2012-melbourne.org/

Uwe Stilla, Chris Mc Glone, Stefan Hinz, Matthias Butenuth