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Photogrammetric Image Analysis

Automated extraction of objects from remotely sensed data has become an important topic of research in photogrammetry, computer vision, remote sensing, and geoinformation science. The need to discuss recent developments in methodological research and the potential of various data sources has formed the background for the latest edition of the ISPRS Conference on *Photogrammetric Image Analysis (PIA)* which was organized by the Department of Photogrammetry and Remote Sensing, Technische Universität München (TUM), and held at the TUM main campus between October 5 and 7, 2011 (see also the workshop report by Boris Jutzi in PFG issue 1/2012). This was the fourth workshop of that series, following the successful events in 1999, 2003 and 2007, all of them hosted by the Department of Photogrammetry and Remote Sensing at TUM, which has become a constant in the calendar of photogrammetry and remote sensing and has continually attracted about 120 participants from all around the world.

In parallel to the workshop, a call for papers was distributed to experts in the field of photogrammetric image analysis to submit papers to this special issue of PFG. The topics of the conference and, consequently, of this special issue, were related to the four ISPRS working groups (WG) co-operating in the organisation of the scientific program of the conference, namely WG I/2 "LIDAR, SAR and Optical Sensors" WG III/1 "Pose Estimation and Surface Reconstruction", WG III/4 "Complex Scene Analysis and 3D Reconstruction" and WG III/5 "Image Sequence Analysis". As a result, five papers (out of 10 submitted contributions) which have undergone a rigorous peer review process are published in this special issue of PFG.

The first paper, submitted by Jochen Meidow, is about a method for efficient least squares adjustment of multiple loops in sequences. Dead reckoning, i.e., relative orientation for sequences, suffers from inevitable drift. The latter can often be strongly reduced by constraints induced by closing loops. Meidow's method can deal with multiple loops simultaneously in a statistically optimal way. Additionally, the employed minimal representation without singularities leads to an efficient implementation. Results for 2D image mosaicking and 3D trajectory determination clearly demonstrate the method's potential.

In the second paper, Dorota Iwaszczuk et al. describe a technique for the orientation of images using 3D building models as ground control. Their method is based on a matching process that detects correspondences between the edges of a building model and image edges, using random sample consensus (RANSAC) to distinguish correct matches from incorrect ones. The experiments presented by the authors show that their method delivers promising results for infrared images taken from a helicopter.

The third paper written by Hui Ju et al. deals with another aspect of image registration, namely with the precise alignment of airborne laserscanner (ALS) data and optical (aerial or satellite) imagery. Based on an analysis of the shortcomings of existing methods, they develop a new technique consisting of two steps: First, the optical and an ALS intensity image are coarsely aligned using a method based on the fast fourier transform. The transformation thus established is improved by homologous points obtained by scale and rotation invariant region descriptor matching. Initial results of the authors show that pixel level accuracy can be achieved by their method.

The fourth paper written by Daniel Muhle et al. focuses on identifying correspondences for matching 3D point clouds. The proposed algorithm is based on the basic principles of matching by utilizing distinctive feature descriptions and extends them in a way that they can be used to identify corresponding 3D points in sparsely populated and varying point clouds. The investigations show that a reliable matching of 3D points is possible and that the position uncertainty of a 3D point does not

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seem to have a strong influence on the matching quality.

In the last contribution, Matthias Plaue et al. address the extraction of pedestrian trajectories and the according local density fields from videos in order to support the macroscopic modelling of human crowds. The results of an experiment conducted by the authors show that the proposed technique yields both spatially as well as temporally smooth density fields close to the standard definition of density at all scales.

In summary, both the workshop and the selection of papers of this special issue show a number of trends. (1) The use of image sequences, be it from airborne or from (mobile or fixed) terrestrial platforms, is gaining more and more attention in the community. This induces work both on the orientation of such sequences, which requires automation due to the sheer amount of images to be dealt with, and on tasks related to the detection of both static and moving objects. (2) The use of UAVs as aerial platforms capable of closing the "scale gap" between aerial and terrestrial image acquisition is becoming more and more common. As a consequence of the limitations of Micro-UAVs with respect to the payload they can carry, methods capable of dealing with images of lower quality than standard aerial imagery need to be investigated. (3) Methods conceptionally capable of delivering results in real time become important, especially in the field of video surveillance. (4) Modern photogrammetric research tries to tackle problems that were out of scope of 'traditional' photogrammetry, e.g. detection and tracking of pedestrians, or the derivation of behavioural patterns from tracked pedestrians in crowds. (5) Computer vision continues to have a strong impact on the current directions of photogrammetric research.

Finally, we would like to sincerely thank everybody involved in the preparation of this special issue. We are very grateful to all staff at Technische Universität München for their invaluable help in organizing the workshop, to the workshop participants who have made the meeting a success, and to the authors of this special issue for making available their excellent papers, and for keeping a tough timeline. We thank the editor-in-chief of PFG, Wolfgang Kresse, and his team for all the freedom we have had when assembling this special issue and for the help they extended to us in the technical preparation.

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This PFG-issue includes seven other articles that relate to all three topics of PFG, photogrammetry, remote sensing, and geoinformation science. Hernández-Lopez et al. present a study about the radiometric calibration of Leica's ADS40. Immitzer et al. evaluate the new spectral channels of WorldView-2 for tree specification (in German). Lausch et al. investigate the influence of scale on the classification of hyperspectral image data. Mannel & Price show that multi-seasonal imagery of a multi-spectral camera leads to better classification results than imagery data from a hyperspectral camera with significantly more bands, but recorded at the same time. Arroyo Ohori et al. address an often encountered issue of geometry data and present a new method for repairing errors in planar partitions like cadastral parcels or land use coverages. Cavegn & Nebiker demonstrate a new method for the automatic mapping of road signs (in German). A report about the new spatial data infrastructure of the Austrian civil air traffic control Austro Control finalizes the suite of articles (also in German).

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