MULTI-PLATFORM VERY HIGH RESOLUTION PHOTOGRAMMETRY – A NEW BECHMARK DATASET FOR THE SCIENTIFIC AND NMCA COMMUNITIES

F. Nex[1], M.Gerke[2], F. Remondino[1]

[1] 3D Optical Metrology Unit, Bruno Kessler Foundation, Trento, Italy – <franex, remondino>@fbk.eu, http://www.3dom.fbk.eu
[2] ITC, University of Twente, The Netherlands - m.gerke@utwente.nl, http://www.itc.nl

Commission I

KEY WORDS: Multi-platform, UAV, Oblique Imagery, Dense Matching, 3D Mapping, Benchmark

ABSTRACT:

In the last decade, the introduction of UAV platforms and multi-head oblique image systems mounted on manned airplanes has allowed the collection of more detailed and complete information compared to traditional image acquisition flights. These new typologies of data are closing the gap between terrestrial and aerial imaging, becoming the starting point for new research and the development of new applications. A closer integration of multi-platform and multi-perspective aerial and close-range photogrammetry is expected in the near future as well. The integration will be helpful for a broad range of applications, like city modelling, where a seamless geometric representation of different resolution is desired. Another example is cultural heritage documentation, where for instance a selection of buildings is modelled in very high detail from terrestrial and multi-view oblique UAV-images, but the larger surrounding area is covered by airborne high resolution multi-view images.
Although a combination of these different kind of images seems attractive, an automatic and rigorous geometric processing of datasets captured from different imaging platforms, at different scale and covering different perspectives of the target object, is only treated sporadically in research so far.
The success of other benchmark tests being performed in the research community, like the Middlebury test on dense image matching (http://vision.middlebury.edu/stereo), the ISPRS WGIII/4 test on urban object detection and 3D building reconstruction (http://www2.isprs.org/commissions/comm3/wg4/results.html), the ISPRS WGI/4 test on DEM generation from high resolution satellite imagery (http://www2.isprs.org/commissions/comm1/wg4/benchmark-test.html) or the EuroSDR test on DSM generation (http://www.ifp.uni-stuttgart.de/eurosdr/ImageMatching/index.en.html), shows that the provision of common datasets, in combination with a scientific task, allows researchers to objectively compare their own methods with those of others and to identify common problems and open challenges.
Inspired from these concepts - supported by ISPRS and EuroSDR and in collaboration with Bochum University of Applied Science, Aerometrics and Aerowest - a new benchmark for the research and NMCA communities was created, consisting of different typologies of images over the same (built-up) area. The aims of the project are to (1) provide data on two different areas, focusing on different terrain and building style and epochs and (2) assess the accuracy and reliability of the current methods in the calibration/orientation as well as integration of those data for dense point clouds generation and feature extraction. In particular the project consist of:
1. Airborne oblique images, covering all 4 cardinal and the nadir direction: the images were acquired with a IGI PentaCam camera by AeroWest (overlap 80/80%) with a GSD of 10cm (nadir views);
2. UAV images, consisting of nadir and oblique images: the images were acquired by Aerometrics with a DJI S800 platform and a Sony Nex7 camera. The average GSD is 1-2 cm;
3. Terrestrial images (of some selected buildings), acquired with a Sony Nex7, the same as mounted on the drone, and an average GSD smaller than 1 cm.
4. Ground truth data in form of Ground Control Points (GNSS and total station surveying), Terrestrial Laser Scanning (TLS) and Airborne Laser Scanning (ALS).
The evaluation of the orientation results will be performed using primarily check points. The oriented images will then allow the generation of dense point clouds using one data source solely or a combination. Delivered point clouds will be compared to ground truth data (cloud differences, plane fitting, cross-sections, etc.).
Since the data will be open, other research topics, like investigation into radiometry of multi-view images (BRDF) or semantic analysis is expected and appreciated as well, but in the beginning it will not be part of the benchmark as such.
The data will be released at the end of 2014 and more info is available at http://www2.isprs.org/benchmark.html. Interested scientists can request the data and submit their results and those will be tested against reference data and published on the project webpage, if desired.

Figure 1: The two test areas over the city of Dortmund (Germany), showing different types of built-up structures. The yellow area highlights the area covered with oblique images, the red area depicts the UAV and terrestrial acquisitions.

Figure 2: Examples of the available images: PentaCam oblique (a), UAV (b) and terrestrial (c).

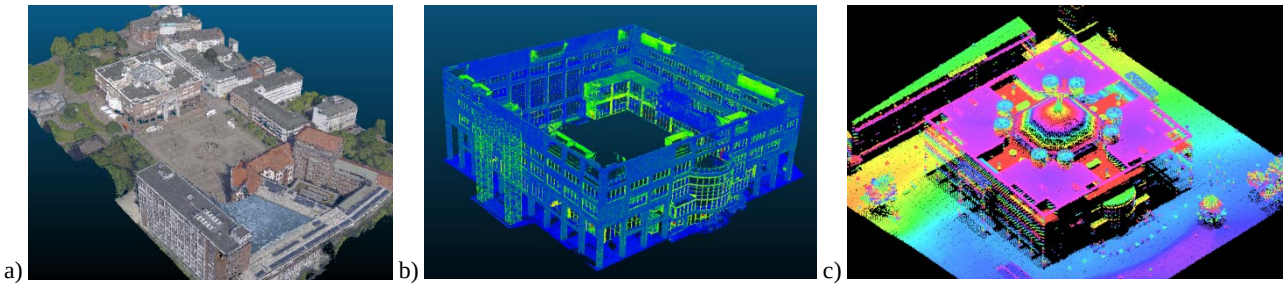

Figure 3: Initial dense point cloud from the PentaCam dataset, processed with Pix4Dmapper (a), the reference TLS (b) and ALS (c) data.