Volume XL-3

Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XL-3, 231-238, 2014
www.int-arch-photogramm-remote-sens-spatial-inf-sci.net/XL-3/231/2014/
doi:10.5194/isprsarchives-XL-3-231-2014

Photogrammetric DSM denoising

F. Nex[1] and M. Gerke[2]

[1]FBK, 3DOM (3D Optical Metrology), Trento, Italy

[2]University of Twente, Faculty of Geo-Information Science and Earth Observation (ITC), Department of Earth Observation Science, P.O. Box 217, 7500AE Enschede, the Netherlands

Keywords: Image Matching, DSM, Markov Random Field, graph-cuts, smoothing

Abstract. Image matching techniques can nowadays provide very dense point clouds and they are often considered a valid alternative to LiDAR point cloud. However, photogrammetric point clouds are often characterized by a higher level of random noise compared to LiDAR data and by the presence of large outliers. These problems constitute a limitation in the practical use of photogrammetric data for many applications but an effective way to enhance the generated point cloud has still to be found.

In this paper we concentrate on the restoration of Digital Surface Models (DSM), computed from dense image matching point clouds. A photogrammetric DSM, i.e. a 2.5D representation of the surface is still one of the major products derived from point clouds. Four different algorithms devoted to DSM denoising are presented: a standard median filter approach, a bilateral filter, a variational approach (TGV: Total Generalized Variation), as well as a newly developed algorithm, which is embedded into a Markov Random Field (MRF) framework and optimized through graph-cuts. The ability of each algorithm to recover the original DSM has been quantitatively evaluated. To do that, a synthetic DSM has been generated and different typologies of noise have been added to mimic the typical errors of photogrammetric DSMs. The evaluation reveals that standard filters like median and edge preserving smoothing through a bilateral filter approach cannot sufficiently remove typical errors occurring in a photogrammetric DSM. The TGV-based approach much better removes random noise, but large areas with outliers still remain. Our own method which explicitly models the degradation properties of those DSM outperforms the others in all aspects.

Conference Paper (PDF, 2629 KB)

Citation: Nex, F. and Gerke, M.: Photogrammetric DSM denoising, Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XL-3, 231-238, doi:10.5194/isprsarchives-XL-3-231-2014, 2014.

Bibtex EndNote Reference Manager XML