



[Volume XL-5](#)

Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XL-5, 63-70, 2014
www.int-arch-photogramm-remote-sens-spatial-inf-sci.net/XL-5/63/2014/
doi: 10.5194/isprsarchives-XL-5-63-2014

Robust Global Motion Estimation with Matrix Completion

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Keywords: Camera orientation, Structure from motion, Epipolar geometry, Block adjustment

Abstract. In this paper we address the problem of estimating the attitudes and positions of a set of cameras in an external coordinate system. Starting from a conventional global structure-from-motion pipeline, we present some substantial advances. In order to detect outlier relative rotations extracted from pairs of views, we improve a state-of-the-art algorithm based on cycle consistency, by introducing cycle bases. We estimate the angular attitudes of the cameras by proposing a novel gradient descent algorithm based on low-rank matrix completion, that naturally copes with the case of missing data. As for position recovery, we analyze an existing technique from a theoretical point of view, providing some insights on the conditions that guarantee solvability. We provide experimental results on both synthetic and real image sequences for which ground truth calibration is provided.

[Conference Paper](#) (PDF, 4574 KB)

Citation: Arrigoni, F., Rossi, B., Malapelle, F., Fragneto, P., and Fusiello, A.: Robust Global Motion Estimation with Matrix Completion, Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XL-5, 63-70, doi:10.5194/isprsarchives-XL-5-63-2014, 2014.

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