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FULLY AUTOMATED IMAGE ORIENTATION IN THE ABSENCE OF TARGETS

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Abstract. Automated close-range photogrammetric network orientation has traditionally been associated with the use of coded targets in the object space to allow for an initial relative orientation (RO) and subsequent spatial resection of the images. Over the past decade, automated orientation via feature-based matching (FBM) techniques has attracted renewed research attention in both the photogrammetry and computer vision (CV) communities. This is largely due to advances made towards the goal of automated relative orientation of multi-image networks covering untargetted (markerless) objects. There are now a number of CV-based algorithms, with accompanying open-source software, that can achieve multi-image orientation within narrow-baseline networks. From a photogrammetric standpoint, the results are typically disappointing as the metric integrity of the resulting models is generally poor, or even unknown, while the number of outliers within the image matching and triangulation is large, and generally too large to allow relative orientation (RO) via the commonly used coplanarity equations. On the other hand, there are few examples within the photogrammetric research field of automated markerless camera calibration to metric tolerances, and these too are restricted to narrow-baseline, low-convergence imaging geometry. The objective addressed in this paper is markerless automatic multi-image orientation, maintaining metric integrity, within networks that incorporate wide-baseline imagery. By wide-baseline we imply convergent multi-image configurations with convergence angles of up to around 90 °. An associated aim is provision of a fast, fully automated process, which can be performed without user intervention. For this purpose, various algorithms require optimisation to allow parallel processing utilising multiple PC cores and graphics processing units (GPUs).

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