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## DETECTION OF CRITICAL CAMERA CONFIGURATIONS FOR STRUCTURE FROM MOTION

M. Michelini and H. Mayer

Institute of Applied Computer Science Bundeswehr University Munich, Munich, Germany

Keywords: Critical configurations, structure from motion, motion degeneracy, image triplets, image sets, 3D reconstruction

**Abstract.** This paper deals with the detection of critical, i.e., poor or degenerate camera configurations, with a poor or undefined intersection geometry between views. This is the basis for a calibrated Structure from Motion (SfM) approach employing image triplets for complex, unordered image sets, e.g., obtained by combining terrestrial images and images from small Unmanned Aerial Systems (UAS). Poor intersection geometry results from a small ratio between the baseline length and the depth of the scene. If there is no baseline between views, the intersection geometry becomes undefined. Our approach can detect image pairs without or with a very weak baseline (motion degeneracy). For the detection we have developed various metrics and evaluated them by means of extensive experiments with about 1500 image pairs. The metrics are based on properties of the reconstructed 3D points, such as the roundness of the error ellipsoid. The detection of weak baselines is formulated as a classification problem using the metrics as features. Machine learning techniques are applied to improve the classification. By taking into account the critical camera configurations during the iterative composition of the image set, a complete, metric 3D reconstruction of the whole scene could be achieved also in this case. We sketch our approach for the orientation of unordered image sets and finally demonstrate that the approach is able to produce very accurate and reliable orientations.

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