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A new Approach for an Incremental Orientation of Micro-UAV image sequences

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Abstract

Civil applications for small size unmanned aerial vehicles (UAV) have become quite important in recent years and so have accurate orientation and navigation of these devices in unknown terrain. In this work we focus on on-line compatible positioning in façade observation based on monocular low resolution still images acquired by a camera mounted on a UAV. Also, a 3D point cloud of the facade is generated. This allows further processing steps, e. g. navigation assistance, collision avoidance or the evaluation of the point cloud density, verifying completeness of the data. To be able to deal with the increasing amount of observations and unknown parameters we implement an incremental bundle adjustment based on automatically determined tie points and sliding image triplets. The tripletwise orientation allows for an efficient double cross-check of the detected feature points and hence guarantees reliable initial values for the nonlinear bundle adjustment. The initial values are estimated within a convex formulation delivering a sound basis for the incremental adjustment. Our algorithm is evaluated by means of imagery we took of the facade of the Welfenschloss in Hannover, captured from a manually flown Microdrones md4-200 micro-UAV.We compare the orientation results of our approach with an approach in which initial values for the unknown object coordinates are computed algebraically.