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REGION-BASED 3D SURFACE RECONSTRUCTION USING IMAGES ACQUIRED BY LOW-COST UNMANNED AERIAL SYSTEMS

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Abstract. Accurate 3D surface reconstruction of our environment has become essential for an unlimited number of emerging applications. In the past few years, Unmanned Aerial Systems (UAS) are evolving as low-cost and flexible platforms for geospatial data collection that could meet the needs of aforementioned application and overcome limitations of traditional airborne and terrestrial mobile mapping systems. Due to their payload restrictions, these systems usually include consumer-grade imaging and positioning sensor which will negatively impact the quality of the collected geospatial data and reconstructed surfaces. Therefore, new surface reconstruction surfaces are needed to mitigate the impact of using low-cost sensors on the final products. To date, different approaches have been proposed to for 3D surface construction using overlapping images collected by imaging sensor mounted on moving platforms. In these approaches, 3D surfaces are mainly reconstructed based on dense matching techniques. However, generated 3D point clouds might not accurately represent the scanned surfaces due to point density variations and edge preservation problems. In order to resolve these problems, a new region-based 3D surface renostruction trchnique is introduced in this paper. This approach aims to generate a 3D photo-realistic model of individually scanned surfaces within the captured images. This approach is initiated by a Semi-Global dense Matching procedure is carried out to generate a 3D point cloud from the scanned area within the collected images. The generated point cloud is then segmented to extract individual planar surfaces. Finally, a novel region-based texturing technique is implemented for photorealistic reconstruction of the extracted planar surfaces. Experimental results using images collected by a camera mounted on a low-cost UAS demonstrate the feasibility of the proposed approach for photorealistic 3D surface reconstruction.

Conference paper (PDF, 1260 KB)

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