**Simultaneous Relative Geometric Orientation and**

**Pseudo DEM Generation from Uncorrected Satellite Images**

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**ABSTRACT**

Uncorrected satellite images, either geometrically or orthorectified, present difficulties in utilization due to positional errors and relief displacements. To correct these images, ground control points and digital elevation model data are required. However, these data demand significant cost of acquisition. It is not appropriate to rely on such data for geometric rectification of the rapidly increasing volume of satellite imagery. It is crucial to develop techniques that can quickly resolve positional errors between satellite images and extract three-dimensional spatial information without any external data sources. It is noteworthy that three-dimensional spatial information can facilitate the generation of orthorectified result image. In this study, we propose a method of simultaneously estimating relative geometric orientation from uncorrected satellite images and generating pseudo DEM by extracting three-dimensional spatial coordinates of dense tiepoints. Our method is based on bundle adjustment using tiepoints between satellite images. The bundle adjustment is based on the rational function model and simultaneously estimates adjustment parameters and ground coordinates of tiepoints. For experiments, we used 29 KOMPSAT-3/3A satellite images of the Seoul area in South Korea. To verify the proposed method, we started with two images and added one image at a time, accumulating the estimation result. The result showed a high level of modeling accuracy. In all cases, the error maintained a value of less than 1.45 pixels, even with the maximum number of images. The pseudo DEM accurately estimated relatively higher elevation value in areas with high-rise buildings and mountainous terrain compared to flat ares. Additionally, The orthorectified result images created from the pseudo DEM resolved the relief displacement errors present in the uncorrected images. Finally, the feasibility of simultaneous relative orientation and ground coordinates estimation using multiple satellite images without ground control points was confirmed.

**Keywords:** Satellite Relative Orientation, DEM, RPC, Bundle Adjustment, Tie Point