

Multiple Image Matching for the Generation of Digital Surface Models with Feature Line Constraints

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Abstract

Digital Surface Model (DSM) is an important component in three dimensional Geospatial Information Systems. Therefore, using multiple images to generate DSM is a significant task. We may first generate high quality 3D point clouds by matching multiple images. Then, DSM can be derived. Surface discontinuity should be taken into account in the model generation from point clouds. Feature lines in the images provide a valuable clue for the detection of surface discontinuity such as in the area of building boundaries. Thus, 3D break lines might be determined by incorporating the point clouds and image feature lines. In this research, we extract break lines first followed by the inclusion of those lines as constraints to better shape the building boundary.

The proposed method includes four major steps: (1) feature extraction, (2) multiple image matching, (3) extraction of break lines, and (4) generation of DSM with line constraints. In the first step, we use Canny edge detector to obtain edge features. For each feature point, geometrically constrained cross-correlation algorithm is employed for multiple image matching. After image matching, we analyze the 3D points to examine if they belong to a feature line. If they are composed as an edge both in image space and object space, it will be selected as a 3D break line that is to be used as a constraint in the surface modeling. The final step is to generate DSM using line constraint and Delaunay triangulation. The experimental results indicate that the proposed method may improve the accuracy of the generated DSM.

Keywords: feature line constrain, multiple image matching, DSM generation