Improved 3D Building Model Extraction from Stereo Pair Worldview-2 Satellite Imageries

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Keyword: 3D Building Boundary, Extraction, Stereo Pairs, Worldview-2 Satellite Imagery, Polygon Generator

Abstract: Buildings are an indispensible component in a geospatial information system. 3D building model extraction in urban areas from remote sensing data is one of the highlighted issues in photogrammetry and computer vision. 3D building information is useful, but the creation of detailed wide-area models is a very difficult and tedious task. The interest of generating 3D building information mostly lies in the methods of extracting the exterior building boundary efficiently. It is observed that state-of-the-art algorithms in the published literature are neither robust nor accurate enough to extract 3D building automatically. We have previously reported a highly automated method of extracting 3D building information from stereo pair high resolution satellite imagery (Li et al. 2011). The algorithm involves a novel way of detecting building edges in 3D space rather than the traditional edge detection techniques which are based only on 2D images. The approach set out to locate the vertices of building roof. For a start, we limit our development to high rise buildings with approximately flat rooftop. If the main corners and intermediate vertices can be found, the 3D building model can be constructed. We first manually select a rectangular area of interest which contains our building of choice. This is the only manual process at the moment. Then we compute the digital surface model (DSM) using normalized cross correlation template matching technique. In order to find the correct building edge, we go back to the two images of the stereo pair to compute the edges from the pixel values. The rooftop found from the DSM is then expanded by a few pixels until edge pixels are detected. The results of the previous report showed that there were some missing roof corners and some false roof corners extracted when true edge did not show up as an edge pixel or edges picked up were not true roof edge. In this paper, an improved algorithm will be reported to solve this problem. In this improved algorithm we employ a polygon generator and a morphological filter. A polygon will be generated from the vertices which are extracted in the previous method. Then a morphological filter will be applied on the polygon and this morphological filtered polygon is used in the corner detection process to filter out the unrelated rooftop corner pixels. The algorithm has been tested on some buildings in a WorldView-2 stereo pair. The results show that the false roof corners can be removed, and missing corners are detected. This paper will also present a brief evaluation of the rooftop height accuracy. The rooftop height accuracy from the improved system is around 1m.