Seamless Fusion of LiDAR and Aerial Imagery for Building Extraction

Although many efforts have been made on the fusion of Light Detection and Ranging (LiDAR) and aerial imagery for the extraction of houses, little research on taking advantage of a building's geometric features, properties, and structures for assisting the further fusion of the two types of data has been made. For this reason, this paper develops a seamless fusion between LiDAR and aerial imagery on the basis of aspect graphs, which utilize the features of houses, such as geometry, structures, and shapes. First, 3-D primitives, standing for houses, are chosen, and their projections are represented by the aspects. A hierarchical aspect graph is then constructed using aerial image processing in combination with the results of LiDAR data processing. In the aspect graph, the note represents the face aspect and the arc is described by attributes obtained by the formulated coding regulations, and the coregistration between the aspect and LiDAR data is implemented. As a consequence, the aspects and/or the aspect graph are interpreted for the extraction of houses, and then the houses are fitted using a planar equation for creating a digital building model (DBM). The experimental field, which is located in Wytheville, VA, is used to evaluate the proposed method. The experimental results demonstrated that the proposed method is capable of effectively extracting houses at a successful rate of 93%, as compared with another method, which is 82% effective when LiDAR spacing is approximately 7.3 by 7.3 ft². The accuracy of 3-D DBM is higher than the method using only single LiDAR data.