REMOTE SENSING TECHNIQUES FOR 3D BUILDING IN ULAANBAATAR CITY

Enkhjargal. N[1,2], Usukhbayar. G[2], A. Galmandakh[3] and Ochirkhuyag. L[2,4]*

[1] *Policy research center, City government, Ulaanbaatar, Mongolia, enhjargaln@gmail.com*

[2] *Mongolian Geo-spatial Association, P.O.Box-24, Post Office-38, Ulaanbaatar 15141, Mongolia info@geomedeelel.mn*

[3] *Mongolian Cadastre Association, Ulaanbaatar, Mongolia, galmandakhb@yahoo.com*

[4] *Institute of Geography and Geo-ecology, MAS, Ulaanbaatar 15170 Mongolia*

Abstract: Remote sensing (RS) techniques are rapidly developing in different subjects. Unmanned Aerial Vehicle (UAV)s can capture maps with high spatial resolution and use them in cadastral information systems. Depending on the characteristics of the drone-based sensor, we use it in our respective studies. For example: Aerial mapping equipment and its accessories using multi-channel unmanned aerial vehicles (Drone, UAV) of the spectrum for mapping in the visible light, near-violet, medium and short-wave infrared range (350-2500 nanometers) of electromagnetic waves mapping. Using information from the regions above the spectrum, we map the terrain into envelopes and object classifications. In this study, we are focusing on create 3D building model based on remote sensing imagery is an important research problem and an economic solution to large-scale city modeling, compared with reconstruction from LiDAR data and multi-view imagery. However, several challenges such as the partial invisibility of building footprints and facades, the serious shadow effect, and the extreme variance of building height in largescale areas, have restricted the existing monocular image based building reconstruction studies to certain application scenes, i.e., modeling simple low-rise buildings from near nadir images. There are several ways of generating building footprints. These include manual digitization by using tools to draw outline of each building. However, it is a labor intensive and time consuming process. The model uses the MaskRCNN model architecture implemented using ArcGIS API for Python, and to learn the geometric property of oblique images, the key components of a 3D building model and their relations via four semantic-related and three offset-related tasks. The network outputs are further integrated by a prior knowledge based 3D model optimization method to produce the final 3D building models. Results on a public 3D reconstruction dataset and a novel released dataset demonstrate that our method improves the height estimation performance by over 40% and the segmentation F1-score by 2% - 4% compared with current state-of-the-art. The main steps of this work include: building footprints, point cloud generation, and 3D modelling. After improving the initial values of interior and exterior parameters at first step, an efficient image matching technique such as Semi Global Matching (SGM) is applied on UAV images and a dense point cloud is generated. Then, a mesh model of points is calculated using Delaunay 2.5D triangulation and refined to obtain an accurate model of building. Finally, a texture is assigned to mesh in order to create a realistic 3D model. The resulting model has provided enough details of building based on visual assessment.

Keyword: remote sensing, GIS, 3D models, point cloud