[Option 2]

Automated Terrain Data Generation for Urban Flood Risk Mapping Using c-GAN and BBDM

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Abstract: Flood risk maps are used in urban flooding to understand the spatial extent and depth of inundation damage. To construct these maps, hydrodynamic modeling capable of simulating flood waves is necessary. Flood waves are typically fast, and inundation patterns can significantly vary depending on the terrain, making it essential to accurately represent the terrain of the flood source in flood wave analysis. Recently, methods using UAVs for terrain data construction through Structure-from-Motion or LiDAR have been utilized. These methods are crucial for UAV operations, and thus, still require a lot of time and manpower, and are limited when UAV operations are not possible. Therefore, for efficient nationwide monitoring, this study developed a model that can automatically generate terrain data by estimating depth information from a single image using c-GAN (Conditional Generative Adversarial Networks) and BBDM (Brownian Bridge Diffusion Model). The training, utilization, and validation datasets employed images from the ISPRS (2018) and directly aerial photographed image sets from five locations in the territory of the Republic of Korea. Compared to the ground truth of the test data set, it is considered sufficiently usable as terrain data for flood wave analysis, capable of generating highly accurate and precise terrain data with high reproducibility.

Key words: Terrain Data, c-GAN, BBDM, Terrain Data Automation, High-Resolution Terrain Reproduction