

# Flood Risk Mapping Using Landsat Image and Unity 3D Engine

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## ABSTRACT:

This research proposes a methodology for the flood risk mapping using the Landsat image and the unity 3D engine. In the first step, the land cover map was generated from the given Landsat image by the clustering algorithm. Then, the 3D land cover map was constructed using the generated land cover map and the given DEM (Digital Elevation Model). Finally, the flood was simulated on the constructed 3D land cover map using the unity 3D engine. This research contributes to develop the flood risk mapping technique by using the Landsat image and the unity 3D engine.

## INTRODUCTION

Development of the flood simulation mapping technique is useful for real-time monitoring the flooded areas or the flood risk areas. However, it is the difficult task for developing this technique because the flood simulation can be well carried out based on the 3D simulation models. In general, the satellite images are useful for monitoring the land use changes in the huge areas because the earth observation satellites can acquire the satellite image such as the Landsat image that has the size with 170 km × 185 km(USGS, 2017). In addition, the unity 3D engine has been widely used in developing the simulation model due to its advantages (Gang et al., 2017). This research utilized the Landsat image and the Unity 3D engine for developing the flood simulation mapping technique.

## METHODOLOGY

This research has the multiple steps for developing the flood risk mapping technique using the given Landsat image and the unity 3D engine. First of all, the 2D land cover map was generated from the given Landsat image by using the clustering algorithm. Then, the 3D land cover map was constructed using the constructed 2D land cover map and the given DEM (Digital Elevation Model). Finally, the flood risk mapping technique is developed by simulating the flooding on the 3D land cover map by the unity 3D engine. Figure 1 shows the flow chart for showing the development of the flood risk mapping technique.

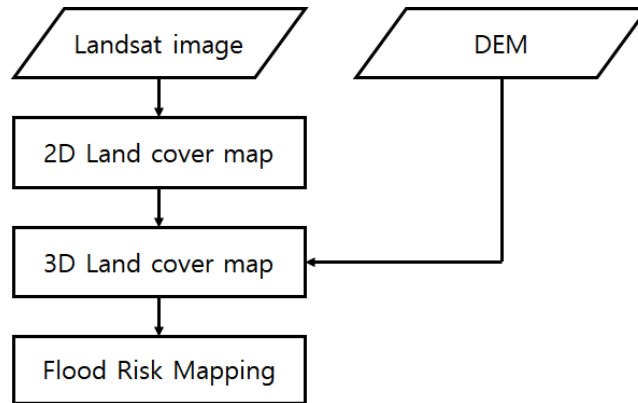


Figure 1. Flow chart for showing the development of the flood risk mapping technique

The clustering algorithm is widely used technique for mapping the land covers because it does not require the training samples (Choung, 2014). In this research, we employed the ISODATA (Iterative Self-Organizing Data Analysis Technique Algorithm) clustering, the most widely used clustering algorithm, was employed for generating the 2D land cover map using the given Landsat image. Figure 2 shows the original Landsat image and the generated 2D land cover map using the given Landsat image by the ISODATA clustering.

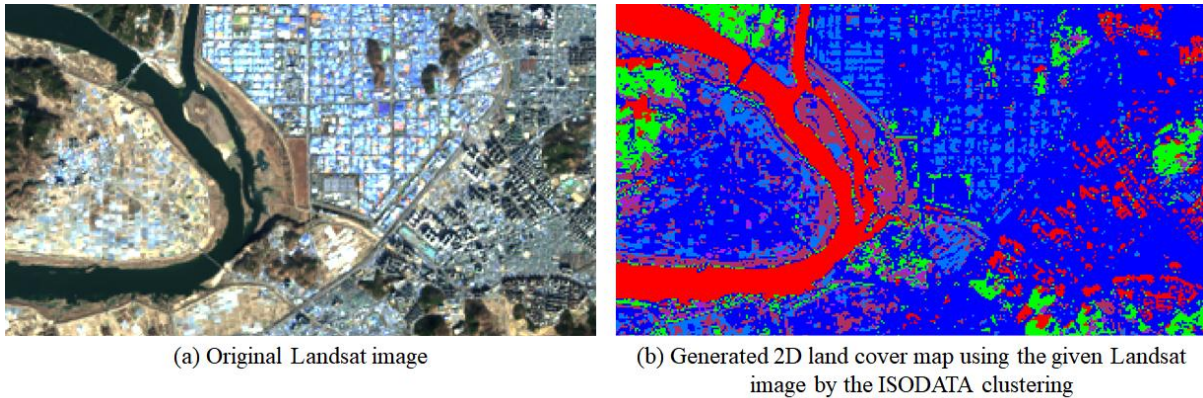


Figure 2. Original Landsat image and 2D land cover map generated using the Landsat image by the ISODATA clustering

As seen in Figure 2, the misclassification errors occurred in the 2D land cover map generated by the ISODATA clustering. The further steps would be employed for removing these errors in the future research. The next step was to construct the 3D land cover map by integrating the 2D land cover map and the given DEM (spatial resolution: 200 m). Figure 3 shows the constructed 3D land cover map by integrating the 2D land cover map and the DEM.

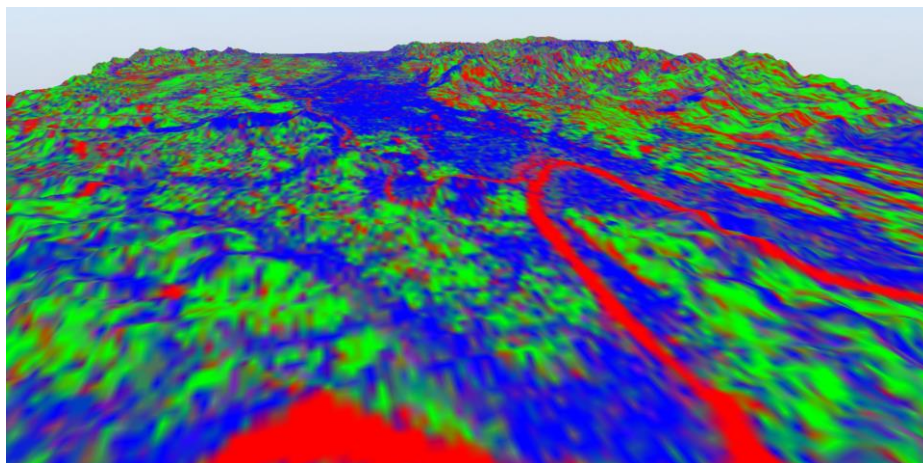


Figure 3. 3D land cover map by integrating the 2D land cover map and the DEM

Finally, the flood risk mapping technique was developed by simulating the flooding on the 3D land cover map by the unity 3D engine. Figure 4 shows one section of the flood simulation carried out on the 3D land cover map.

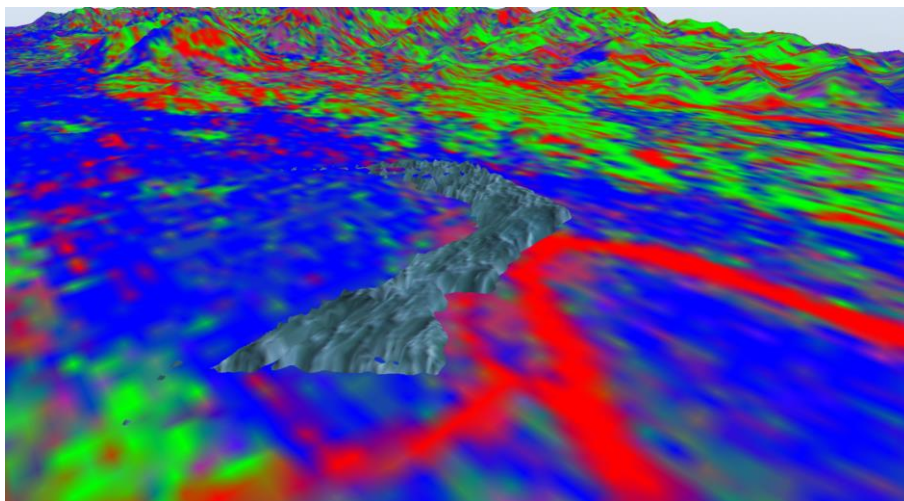


Figure 4. One section of the flood simulation carried out on the 3D land cover map

As seen in Figure 4, monitoring the flooded areas on the 3D land cover map is available. In addition, the changes of the flooded areas also can be observed by using the proposed methodology.

#### **STUDY AREA AND DATA**

The river basins of the Nakdong River were selected as the study area in this research due to the DEM of this area was also available. The Landsat image acquired in the study area was taken in December 26, 2014 because the selected Landsat image was less affected by the atmospheric conditions such as cloud.

#### **RESULTS AND CONCLUSIONS**

Developing the flood risk mapping technique is essential for estimating and monitoring the flooded areas when floods occurred. This research contributes to develop the flood risk mapping technique using the Landsat image and the unity 3D engine. In the future works, the additional methods would be employed for improving the accuracy of the 2D land cover map.

#### **ACKNOWLEDGEMENT**

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