

# Deep Learning of Point Clouds for Landslide Detection

Chi-Chuan Lo<sup>1</sup>, Yu-Ching Liu<sup>1</sup>, Fuan Tsai<sup>\*1</sup>

<sup>1</sup> Center for Space and Remote Sensing Research, National Central University, Taiwan

Taiwan is located in a seismic zone and is a tropical region, so earthquakes and rainfall are frequent. These are all important triggering factors of landslides, especially in mountainous areas. Every year numerous landslides in these regions and some of the landslides occurred repeatedly at the same area, causing significant hazards and sometimes catastrophic disasters. This research focuses on developing effective deep learning models for detecting newly occurred and incremental landslides from multi-temporal point clouds produced with high resolution optical satellite images or LiDAR. The developed deep learning model employing the PointNet++ 3D semantic segmentation algorithm for efficient point cloud segmentation based on the geometric and spectral characteristics of point cloud data. By comparing pre- and post-stage data, the study aims to accurately identify the locations of new landslides and the changes caused by incremental landslides, i.e. new landslides occurring on existing landslide affected locations. Experimental results demonstrate that the developed deep learning scheme can effectively detect new and incremental landslides in the mountainous areas of Taiwan, and can be helpful for hazard mitigation support.

**Keywords:** Point cloud Segmentation, Deep Learning, Landslide Detection