POST-WINDSTORM DAMAGE ASSESSMENT OF BUILT-UP AREAS FROM POINT CLOUDS USING THREE-DIMENSIONAL CONVOLUTIONAL NEURAL NETWORK

M. Ebrahim Mohammadi[1] and Richard L. Wood*[1]

[1]University of Nebraska-Lincoln, Lincoln, NE 68583, USA.

*rwood@unl.edu

In the aftermath of extreme events (e.g., tornados, hurricanes, etc.), rapid and reliable identification of the damaged structures in a built-up area are crucial in the post-event data-decision making processes for tasks such as rescue or recovery operations. While it is critical to conduct efficient emergency response management, lack of classified or tagged damaged regions due to communications and accessibility limitations can complicate recovery operations, rescue efforts, and resource management. In recent decades, advances in remote sensing technologies demonstrate a great potential to perform rapid reconnaissance and damage assessments (e.g., unmanned aerial systems or UASs). UAS platforms can be deployed with only minimal ground support and can be efficiently used to collect detailed images from the damaged areas. These images not only depict the current conditions but can also be used for three-dimensional point cloud reconstructions using Structure-from-Motion (SfM). Previous studies used such post-event data collected by UASs and follow a traditional approach, creating a pipeline of operations to extract features, segment, and further assess the damage. Due to the success of 2D convolutional neural networks (CNN) in similar tasks such as classifying images, CNN architectures have been expanded and implemented for 3D data analyses. This can result in a performance on par or an improvement to traditional methods. Within this study, a damage assessment algorithm is developed to evaluate SfM point cloud data using a 3D CNN and data from damaged areas after 2017 Hurricane Harvey. The goal of this study is to provide a rapid, cost-effective, and safe solution for damage assessment of built up areas, which could be used in efficient decision making for emergency response management.