Damage Assessment for Disaster Relief Efforts Based on Multi-Source Remote Sensing Data

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THEME: DISA – Natural disasters monitoring, warning and response

KEY WORDS: Disaster Mitigation, Multi-Source Data, LiDAR, Optical Imagery, Network Analysis, Routing

ABSTRACT:

Multi-source remote sensing data provides a significant source of geospatial information which is of use in disaster mitigation planning. Integrated COTS software packages allow us e. g. to leverage imagery and LiDAR tools in conjunction for damage assessment or other scenarios.

This case study demonstrates an approach to help emergency responders route ground teams. It is based on the generation of multi-source data layers as inputs to network analyst workflows. Background is the 2010 earthquake of Port-au-Prince / Haiti. Both LiDAR data and WorldView-2 images were collected to map the disaster zone.

Characteristic of an area of dense urbanization, the majority of ground surfaces are roads, and standing buildings and debris are largely separable on the basis of elevation classes. Thus the layers DSM, DTM, buildings, and debris were extracted from the LiDAR data point cloud. The LiDAR-based feature height information was fused with WorldView-2 imagery to extract the road network, using object-based feature extraction.

For the specific case of Haiti, the distribution of blue tarps, used as accommodations for refugees, roughly delineated camps of refugees. Pure blue tarp pixel spectra were selected from the WorldView-2 imagery as a reference for a supervised classification. The output was spatially analysed to produce a density map of blue tarps.

Analogous, a debris density map was generated and combined with the road network to construct an intact road system. Moderate density debris was used as a cost-increase barrier feature of the network dataset, and high density debris was used as a total obstruction barrier feature.

Based on this information, several hypothetical routing scenarios were analyzed. For one, potential helicopter landing zones were computed from the LiDAR-derived products and added as facility features to the network analyst. Routes from the helicopter landing zones to refugee concentration access points were solved using closest facility logic.