UNIVERSITY TRANSPORTATION CENTER

RESEARCH BRIEF

PROJECT TITLE: **Fusion of Airborne and Terrestrial Sensed Data for Real-time Monitoring of Traffic Networks**

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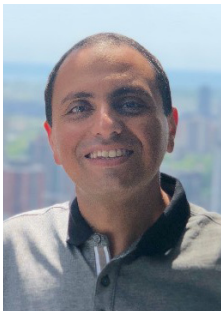
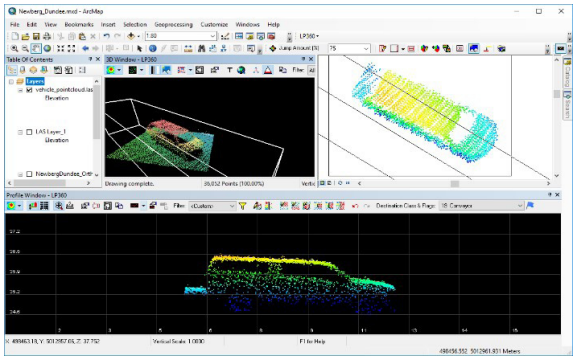
INSTITUTION: SINGLE-INSTITUTION PROJECT
ESTIMATED COMPLETION DATE: AUGUST 2020
SPONSORS: THE PACIFIC NORTHWEST TRANSPORTATION CONSORTIUM, UI



Background

The most promising solutions to the current challenges of real-time traffic network monitoring and analysis involve multi-sensor data fusion, leveraging a suite of complementary sensors and platforms. One example of a type of sensor that can be deployed for traffic monitoring is airborne LiDAR. Work conducted to date by the project team has shown that LiDAR mounted on unmanned aircraft systems (UAS) can reliably detect vehicles, signs, and other traffic features. However, UAS-based LiDAR alone is far from a complete solution to current traffic network monitoring needs, and its use can be hindered by regulations (e.g., FAA regulations related to flights over nonparticipants), short endurance, and other logistical challenges. The synergistic fusion of complementary technologies, including ground-based or pole-mounted LiDAR, HD video, and multispectral imagery, using emerging algorithms from the field of machine learning, can overcome these limitations and enable robust, reliable, and near-real-time sensing data for traffic networks.



Research Project

This research project will build upon the project team's current work on real-time object recognition and event extraction from LiDAR scans using UAS on-board processing, while also incorporating a suite of complementary sensors and recent advances in transfer learning and geometry matching techniques. Advanced algorithms will be employed to fuse the objects recognized from multiple sources, increasing the accuracy and robustness of traffic network monitoring and detection of features/events of interest. A key benefit of the terrestrial sensors will be to enable the construction of recognition maps, even when UAS data acquisition is infeasible due to regulatory and/or logistical considerations. The proposed solution relies on the collection of recognized objects from the same site by different sensing sources, which are then transmitted to a fusion center. This fusion center will apply transfer learning and geometry matching techniques to both create correspondences between these detected objects (i.e., determine which object corresponds to which other object across the different data sets) and add undetected objects/zones by some of the sources into their proper positions. The final integrated recognition map will provide much richer and more robust information to traffic network controllers, thus enabling data-driven optimization and efficiency for transportation networks.