Florida Department of Transportation Research

Data Management and Analytics for UF Smart Testbed

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Current Situation

The UF Smart Testbed, or I-Street, is a project implemented on public roads in the City of Gainesville (COG) and on the University of Florida (UF) campus. The project is a collaboration of COG, UF, and the Florida Department of Transportation to provide opportunities to both industry and researchers to test and deploy advanced transportation technologies in a setting that provides a "significant presence of various transportation modes and a diverse population." I-Street includes substantial instrumentation, providing voluminous data that must be collected, managed, analyzed, and accessibly archived.

This busy intersection at the northeast corner of the UF campus is a fully instrumented part of the I-Street Trapezium.

Research Objectives

University of Florida researchers developed methods for data collection, management, and analysis, including requirements for applications that use these data.

Project Activities

The researchers reported on the data management and analytics for a portion of I-Street called the Trapezium, which comprises four major urban roads that border the main UF campus and include 27 instrumented intersections. These roads are heavily traveled, and the northeast segments separate the university from student housing and other amenities such as restaurants, and shopping, and therefore experience significant pedestrian traffic. Significant bicycle and scooter traffic occurs on allTrapezium roads.

The researchers describe the data collection architecture they developed that includes edge components, local servers, and cloud servers, on which they have implemented data pipelines for automated traffic signal performance measures (ATSPM), video analysis, roadside unit data analysis, and wireless data collection. The researchers provided a detailed summary of all Trapesium sensors and data sources and derivation of into performance measures.

High-resolution logs and essential data cleaning techniques are also included. They describe a model to derive or infer crucial metadata, when they are not present, such as detector-to-phase mappings, a prerequisite for calculating most performance measures. Through intersection ranking, clustering, and change detection techniques developed by the researchers, they show how to use these techniques to build a decision support system.

The researchers also developed a two-stream spatial and temporal convolutional network architecture to analyze large volumes of video data. The architecture enables real-time detection, tracking, and near-accident detection for vehicles in using traffic video data. The spatial network detects individual vehicles and likely near-accident regions at the single-frame level by capturing appearance features with a state-of-the-art object detection method. The temporal network leverages motion features of detected candidates to perform multiple object tracking and generates individual trajectories of each tracked target. Other information relevant to the effort, including software details and cloud service providers is also provided.

Project Benefits

The state-of-the-art systems operating on the I-Street testbed will provide models and data for innovations to improve the efficiency and safety of urban traffic.

For more information, please see www.fdot.gov/research/.