Florida Department of Transportation Research

Bigdata Analytics and Artificial Intelligence for Smart Intersections

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Current Situation

Bigdata is being used to take on every little movement on Florida roadways to improve safety for all road users. Traditionally, vehicle loop detectors are used to detect the passage of motor vehicles. The data collected from the detectors can be used for traffic management planning, such as improving traffic signal timing, conducting a traffic safety analysis, and determining traffic volumes at locations. However, deploying and maintaining vehicle loop detectors can be expensive and, when considering the goal of overall safety, they are not always useful for detecting the passage of non-motor vehicles. The use of other tools, such as video and LIDAR, alongside vehicle loop detectors, may present a cost-effective alternative and has great potential to improve accuracy and timeliness of detecting all road users, including vehicles, pedestrians, and bicyclists.

Fisheye camera image of an intersection with bounding boxes on detected objects.

Research Objectives

The primary objective of this study was to develop a multi-sensor system for vehicle and pedestrian traffic analysis at intersections.

Project Activities

After a literature review, the University of Florida research team developed multiple algorithms, software, and techniques using different sensor types to detect vehicles, pedestrians, and bicyclists in intersections.

The techniques developed as part of this project were used to process data streams from video-camera and LIDAR systems installed at traffic intersections along with the loop detector data captured by advanced traffic controllers.

The team worked on many applications using fisheye cameras. These included a novel approach that performs real-time object recognition, multiple object tracking, and near-miss detection; and nighttime camera video processing-based traffic analysis, which worked well for tracking multiple objects (vehicles) in real-time if moderately lit.

Next, the team developed LIDAR-based techniques to count the number of pedestrians and bicyclists and the patterns of movement they follow while crossing the intersection.

The UF team also explored ways to merge information from video, LIDAR, and Automated Traffic Signal Performance Measures data streams to give more robust analysis.

The team then developed a visual analytics system to look at intersection video using machine learning, as well as algorithms and software for intersection incident detection, which uses video to predict traffic incidents without traffic signal or GPS data. These items, when combined, provide a more comprehensive analysis of intersection safety.

Project Conclusions and Benefits

With the techniques developed in this project, FDOT can be better equipped to detect traffic conflicts, perform safety analysis, and improve signal timing plans. They can also more accurately count pedestrians and bicyclists and track their movement patterns while crossing intersections, especially when lighting conditions are poor.

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