DRISI
Caltrans Division of Research, Innovation and System Information

Research Results

Traffic Predictive Control: Case Study and Evaluation

This project developed a quantile regression method for predicting future traffic flow at a signalized intersection by combining both historical and real-time data.

Transportation Safety and Mobility

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Project Title:
Traffic Predictive Control: Case Study and Evaluation

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WHAT IS THE NEED?

Despite the emergence of high-resolution sensing technologies in transportation systems, many traffic control approaches used in practice still fail to adequately leverage real-time and historical measurements. In California, a large number of intersections, including in LA County, possess sensors that provide the required data to a central server. Although typical signalized intersections are often able to accommodate moderate deviations from average traffic conditions, they lack the ability to adapt to more significant and uncommon variations in vehicle flows. Harvested real-time data, analyzed in tandem with historical information, provide a practical solution to this problem, as they enable us to predict the future state of traffic and to modify the intersection's behavior accordingly.

WHAT WAS OUR GOAL?

A vehicle traffic predictive strategy was developed for control and monitoring of intersections and arterial corridors. Algorithms were produced for traffic predictive control, as well as a self-contained open source software package implementation.

WHAT DID WE DO?

This project developed a powerful method for estimating quantiles of future traffic flow at an intersection using diverse real-time measurements. Furthermore, the efficiency of the regression algorithm was demonstrated through a case study conducted using data on a test site in South Carolina.

WHAT WAS THE OUTCOME?

The predictions accurately described the observed traffic flows for several volume scenarios, using only computationally non-intensive operations. The case studies results demonstrated an average delay reduction of 4.6 hours per day at the intersection switching from a historical quantile-based control policy to a prediction-based policy. Through this algorithm, it is also possible to accomplish better green split management and reduce traffic delays while making no additional adjustments to the existing infrastructure encountered on the roads.

WHAT IS THE BENEFIT?

The relative ease of implementation of the apparatus exposed in this paper makes quantile regression a versatile tool, handily applicable to a wide array of forecast-dependent fields.

Since quantile predictions reflect historical, day-to-day variation in traffic flow, it may be possible detect anomalous deviations from usual traffic conditions due to car accidents or lane closures. Contributions could also be made to the theory of stochastic control in the framework of model-based traffic control design.

IMAGES