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Technology Offer

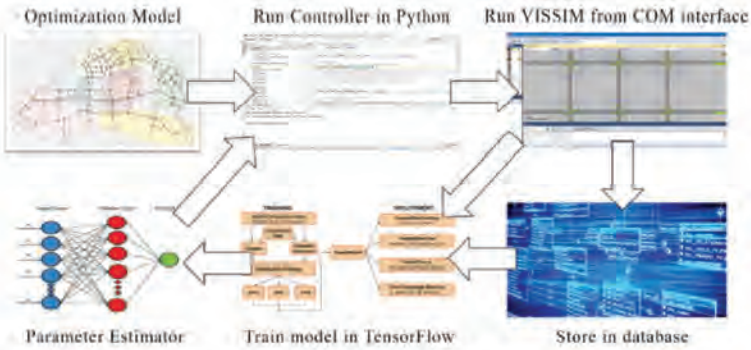
A Hybrid Traffic Light Control Strategy with Congestion Identification

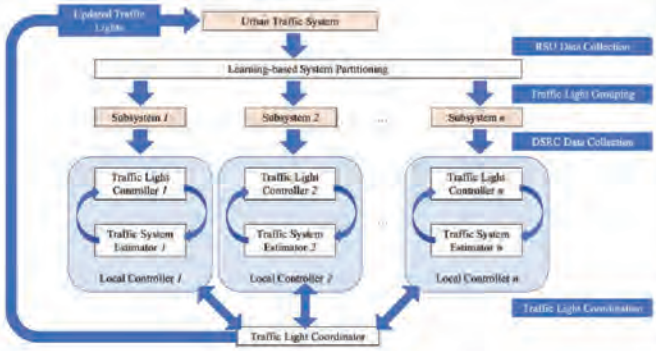
Technology Overview

Traffic congestion is a key challenge in most cosmopolitan cities around the world, which leads to billions of dollars lost every year. With the economic growth, the congestion problem becomes much crucial in recent years for both developing and developed countries. Besides upgrading the costly infrastructure, a renovated traffic signal scheduling scheme is vital and more affordable to smooth the traffic movement in urban areas to alleviate the traffic congestion. In this solution, a macroscopic traffic network model is proposed to depict the traffic dynamics and a closed-loop traffic control strategy is designed based on the estimation of branching ratios at intersections. To reduce the computational complexity, a hybrid approach is proposed based on the congestion level identification and system partitioning method, which is based on machine learning algorithms.

Technology Features / Specifications

In this invention, a macroscopic model is proposed to depict the traffic dynamics involved in urban traffic systems. The link dynamics are described based on a novel cycle-based model and the link capacity, while the flow dynamics are proposed based on the discharge headways and saturation flow at intersections.





The large-scale traffic system is partitioned into several small subsystems, to reduce the computational complexity. The partitioning is based on the congestion levels identified by a learning-based strategy. After obtaining the system partition, various traffic light control schemes could be implemented in different subsystems with consideration of their individual traffic patterns. For example, for subsystems with low traffic demands, an optimized fixed-time strategy would be adopted with a low implementation cost. For subsystems with high traffic demands, optimization-based traffic responsive traffic light control schemes would be adopted, and the traffic light settings would be optimized in a real-time manner. Finally, the traffic light assignments will be coordinated to fulfil specific system-level performance requirements. The proposed closed loop, including networkwide congestion level prediction, traffic light scheduling and control, and traffic parameter estimation and prediction, can run autonomously to ensure high adaptivity and real-time responsiveness.

Potential Applications: A city-scale real-time traffic responsive traffic light control system

This proposed strategy has the following potential applications. (1) To upgrade an existing traffic light control system or enhance a new traffic light control system for better network performance, e.g., fewer traffic congestions, low travel delay time, higher network throughput. It relies on types of data that are commonly available nowadays via, e.g., cameras and/or V2X. (2) To help the traffic authorities handle emergencies efficiently, e.g., to quickly smooth traffic congestions due to traffic accidents via smart traffic light control, and to facilitate better public transportation system performance during peak hours. (3) The developed technologies on congestion region identification and turning ratio estimation may provide new means for traffic authorities to monitor real-time traffic conditions, analyse and predict network performance, and enhance route planning effectiveness for individual users, e.g., to make ETA more accurate than the current existing commercial solutions.

Benefits

The proposed technology will bring the following benefits: (1) to improve the traffic network performance and enhance real-time traffic responsiveness, e.g., reducing congestion and increasing throughput; (2) to quickly recover traffic flows from one-time events such as traffic accidents; (3) to ensure better performance of public transportation vehicles during peak hours via proper traffic light control, without significantly affecting other vehicles; (4) to facilitate real-time prediction of network performance. Our technology can be not only adopted in new traffic light control systems, but also used in existing control systems for functional upgrade with low retrofitting costs.

Please contact A/Prof. Su Rong (NTU) for further discussions on this technology.

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