Traffic Related Event Detection Using a Distributed Expectation-Maximization Algorithm

Shiny Abraham

Assistant Professor, Electrical Engineering, Tuskegee University, Tuskegee, AL

Abstract

Recent US-DOT statistics show that, in addition to claiming thousands of human lives, congested highways in the US cost the nation, year after year, billions of dollars in lost worker productivity and wasted fuel. Lately, various solutions for traffic monitoring and incident detection have been proposed at the nexus of Vehicular Ad-hoc Networks (VANET) and Intelligent Transportation Systems (ITS).

Current traffic monitoring techniques perform some amount of Automated Incident Detection (AID) using established ITS algorithms. Most of the algorithms, though, are threshold-based, meaning that traffic must be monitored for some amount of time to determine what "normal" is. After that, conditions that are different from "normal" are flagged as incidents. Unlike existing systems which use standard traffic models that describe normal traffic intensity variations to detect significant changes in traffic intensity, we plan to use the unique communications between Traffic Monitoring Units (TMUs) to develop AID algorithms that are self-calibrating.

In this direction, a scheme has been proposed that aggregates traffic-related data collected from passing vehicles and uses this data to detect traffic-related events and to anticipate trends including imminent slowdowns and congestion. For example, TMUs can monitor the speed of passing cars and share that information with neighboring TMUs. A TMU detecting a sudden drop in the speed of cars, but not in the volume of traffic, can infer that congestion is occurring. We propose a Distributed Expectation Maximization (DEM) algorithm that performs local computations at each TMU and passes a small set of sufficient statistics to neighboring TMUs in the iteration process.

Bio

Shiny Abraham is an Assistant Professor in Electrical Engineering at Tuskegee University. She received the B.E. degree in Telecommunication Engineering from Visveswaraiah Technological University (VTU), India in 2007 and Ph.D. from Old Dominion University, Norfolk, VA in 2012. Her research interests span the areas of wireless communication, cyber security and optimization using Game Theory. Her current research includes traffic event detection in vehicular networks, optimization in power systems, cyber security analysis in smart grids, and cognitive radio networks. Shiny is a member of the IEEE and ASEE, a technical program committee member for IEEE Globecom and VTC conferences, and a reviewer for several journals and conferences.

MONDAY, OCTOBER 21, 2013, 4:00 P.M.
235 BROUN HALL

http://www.eng.auburn.edu/~pagrawal/seminar/2013/index.html