PATTERN RECOGNITION BASED MICROSIMULATION CALIBRATION AND INNOVATIVE TRAFFIC REPRESENTATIONS

Sandeep Menneni

Dr. Carlos Sun, Dissertation Supervisor

ABSTRACT

Even though calibration techniques for traffic simulation abound, this dissertation presents the first mathematical formalization using representations and invariants. The calibration is defined succinctly over three levels of representation: traffic, dissimilarity, and search. The methodology encompasses the currently used calibration procedures while improving the calibration process. The theoretical formulation of calibration lays the foundation for several improvements in calibration such as improvement in traffic relationships employed in calibration, new pattern recognition methods for accurate measurement of the differences in complex relationships, and seamless integration into direct search methods. These new methods are demonstrated in the microsimulation of a freeway network in California. In the first case study, speed-flow graphs were shown to replicate field data better than methods based on either capacity or sustained flow. The study also demonstrates the usefulness of pattern recognition in automatically measuring the degree-of-closeness of traffic relationships based on graphs. In the second case study, the calibration process is improved by integrating a microscopic traffic representation (action points) and a macroscopic representation (speed-flow graphs). The microscopic traffic representations are developed by analyzing several leader-follower vehicle pairs from real-world vehicle trajectories.