PhD thesis subject

Title: Adaptive and Coordinated Traffic Network Control: Dynamic System Modeling and Algorithm Research

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This subject is related to the adaptive traffic signal control at urban traffic network. It is the continuation of the previous work of Biao YIN. He proposed DP (Dynamic Programming), FSDP (Forward Search Dynamic Programming) and ADP (Approximate Dynamic Programming) algorithms to find the optimal or near-optimal solution of the traffic signal control problems. The traffic system is designed in a distributed way so that the subsystems can work by self-organization. All algorithms are based on the dynamic model formulation of MDP (Markov Decision Process) and implemented in a simulation environment, which is structured by the basic vehicle-based micro-simulation model. He proved that the exact algorithms, such as DP and FSDP, take much memory and time to compute the multiple intersections and suggested to use the near-optimal algorithm, such as the ADP. Being similar to reinforcement learning, in ADP the learning techniques, such as gradient descent, temporal difference learning and least-squares method, for linear function approximation are used in his work. This algorithm computes efficiently and performs quite well on traffic delay reduction. Moreover, by using ADP, the signal phases can be split to more possibilities than conventional four-phase mechanism. This way is proved to be more adaptive. In the other hand, despite of the independently control at intersections, the coordination between adjacent intersections is just in preliminary study and should be improved in future work.

The candidate for this subject will continue the work which has already begun by Biao YIN. The objective is to further research especially in the coordination of multiple intersections, even in large network, to ensure better traffic control and reduce traffic delay. In further research, based on the technologies of intelligent transportation system (ITS), the autonomous intersection management (AIM) could be studied on basis of the previous work. For example, with the wireless communication of V2I and V2V, the embedded vehicle guide system is considered in the traffic network system for this coordination. As for the intersection management, vehicles can approach the intersection with speed advisory and pass through intersection in an adaptive way as the sequence plan generated by ADP algorithm.

Some related references
