## Hierarchical multi-agent system in traffic network signalization with improved genetic algorithm

## ABSTRACT

Instead of using classical offline data-driven optimization technique in traffic network signal control, this work aims to explore the potential of implementing an online data-driven optimization technique. A dynamic modeling technique is proposed using Q-learning (QL) algorithm to online observe and learn the inflow-outflow traffic behaviors and extract the model parameters to update the evaluation model used in the fitness function of genetic algorithm (GA). The proposed GA with dynamic modeling is known as dyna- GA. Dyna-GA is then integrated into a hierarchical-based multi-agent traffic signal control system which consists of two layers. The lower-layer consists of several local agents that have autonomy in controlling their local intersection, whereas the upper-layer consists of one supervisory agent that has jurisdiction on all the local agents. The supervisory agent has the superiority in overwriting the local control decision if conflict occurred. The robustness of the proposed dyna-GA under several traffic scenarios is tested using a simulated arterial traffic network. The simulation results show the proposed dyna-GA has better performances in minimizing travel delay as compared to the classical GA which does not have the dynamic model.