Application of reinforcement learning in adaptive traffic signal control

Master‘s Thesis of Riti E

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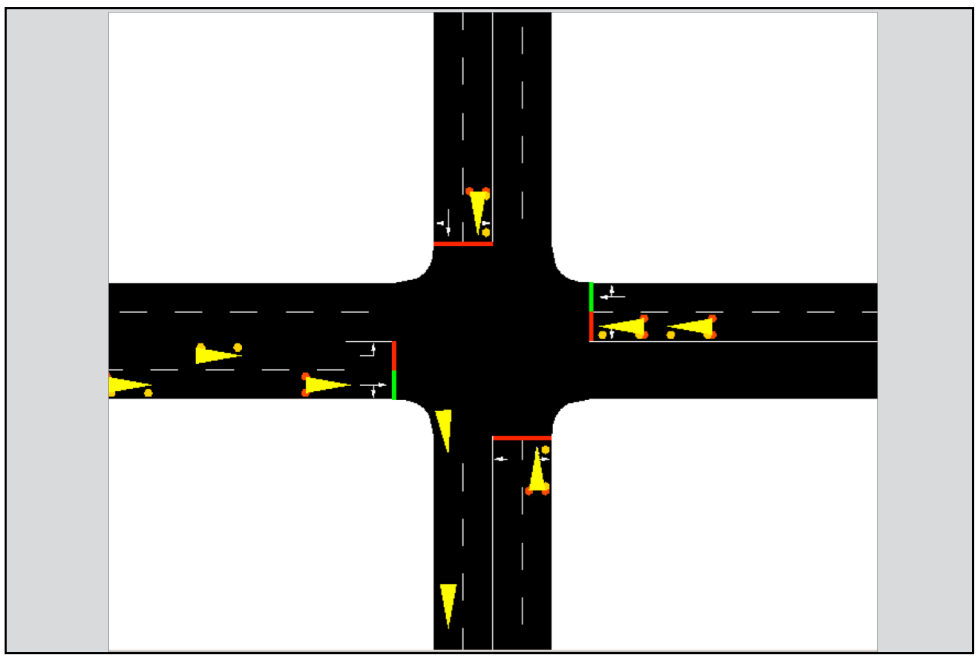


Experiment based on microscopic traffic simulation SUMO

Deploy machine learning algorithm in traffic control

Reinforcement learning: Trial and Error, Q-learning method

Based on real-time traffic features

Experimental objectives:

Adaptively terminate or prolong the green phase

Reduce accumulated waiting time per vehicle

Training results

Agent design

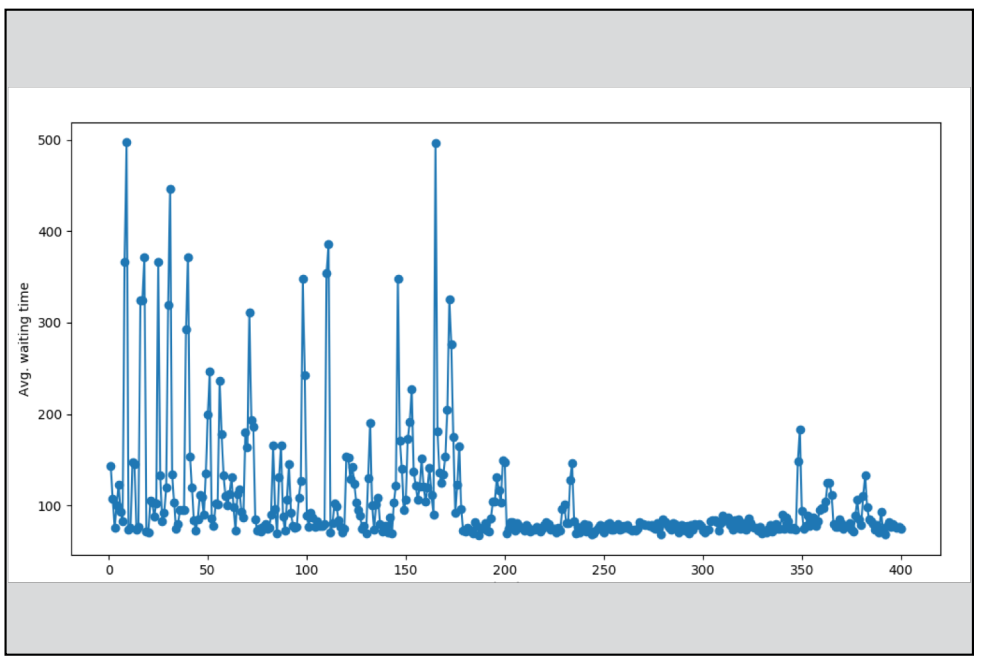
State: Status of signal program, Occupancy rate, Average speed

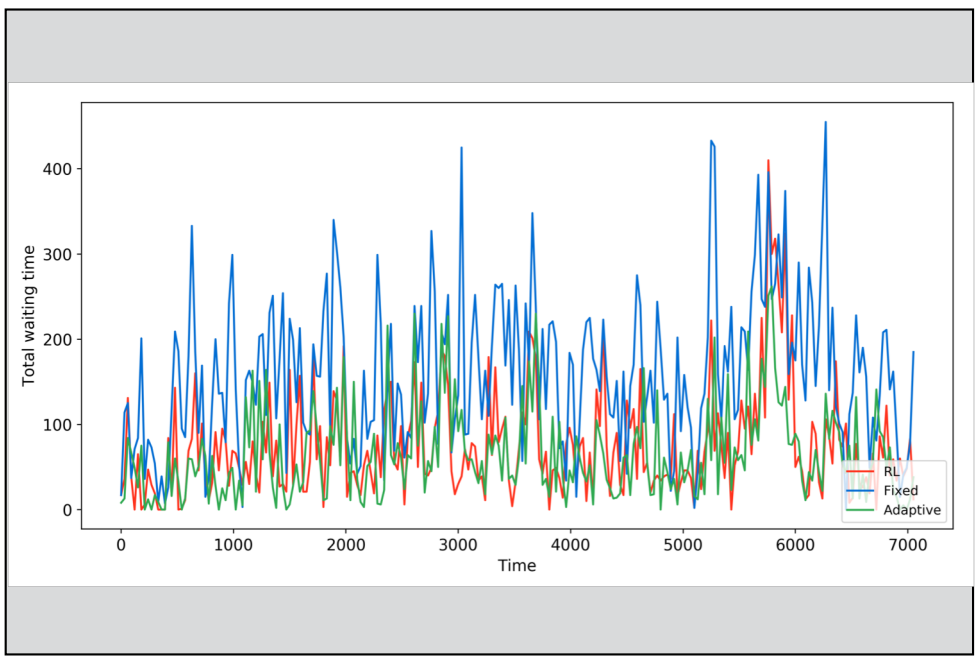
Policy: Q-learning update, Epsilon-greedy,

Action: Terminate or extend the current green phase every 5 sec.

Reward: Comparison between unutilized green time and increased waiting time

Iterative training: the average waiting time stays at a lower level after training





Testing results

The trained agent (red) outperforms the fixed-time plan control (blue), reduced the average waiting time by 50-80 %

The trained agent performs equivalently to the conventional traffic control system (green)

The RL agent is potential and promising in future application of traffic control systems.