Reinforcement Learning for Traffic Light Optimization

Research Problem

Due to the increasing traffic in cities, traffic congestion is becoming a severe problem. One of the most critical considerations when designing an intelligent traffic management system is developing a smart traffic management system which is flexible and can change with the traffic flow. The main goal of this thesis is to propose an intelligent RL traffic management system which could reduce traffic congestion.

Objectives

Compare different reinforcement learning algorithms and use them to solve single-agent and multi-agent traffic simulation cases. Take the average accumulated waiting time for each intersection and plot it with the number of steps for different agents and compare the best solution.

Methods

We used Deep Q-Networks (DQN), Advantage Actor-Critic (A2C) and Proximal Policy Optimisation (PPO) algorithms and compared them in single-agent, multi-agent and real simulations. To compare different algorithms we have used the accumulated waiting time as a way to measure the success of the algorithms.

Results

We found that in the single-agent case PPO and A2C performed nearly similarly followed by fixed, random and DQN. In the multi-agent case, PPO performed better than any other algorithms followed by A2C, fixed, random and DQN.

Conclusion

This study has a lot of scope in future, but there are also big challenges we should be prepared for if we want to solve this problem.