Transportation Network Routing

Alireza Mostafizi

Project Description

Basically, my idea is to apply reinforcement learning on transportation network routing problem. Imagine an $n * n$ simple grid network, with background traffic. The rough idea is that an agent is going to travel from top left corner to the bottom right, and the goal of this reinforcement learning is to capture the time-wise shortest route, for different background traffic patterns.

The first idea is that our set of actions are limited to a sequence of n right actions and n down actions. The reward of any set of action is the travel time through the network. To me, it is more like bandit problem since there is only one state and limited set of actions, and applying RL without modification is not possible as the problem has dead-end. But monte-carlo planning is of importance in this case.

The second idea is that in each state (intersection), agent has up to four actions (left – Right – Up – Down). The agent should wanders around and accumulate rewards based on two factors:

- The travel time on each link
- How the maneuver gets it closer to the destination

Besides, I have to come up with feasible explore/exploitation algorithm. After that, it is possible to get the optimal policy (shortest path) for the desired set of origin and destination through a model-free reinforcement learning algorithm, like Q-learning for goal based problems.

I am more leaning towards the second idea anyway since it involves RL.

Notes

- Since the reward, travel time of the link, depends on the background traffic. One of the challenges is going to be the generation of background traffic in a logical and interesting way. I still couldn't come up with a solid idea about that.
- I can code the proper simulation domain in Netlogo, and I would like to incorporate some rudimentary agent-based modeling regarding the traffic flow.
- I haven't gone through literature, but I think there is a very good chance that it has been done in the past. So please let me know if you have any suggestion or modification. Or if you think the amount of work is not enough or the idea is not good enough. All in all, please let me know what you think.
- It seems that I am going to work on this individually.