

Project 1 Wrapper

CS 3600 - Spring 2021

Due February 17th 2021 at 11:59pm via Gradescope

This Project Wrapper is composed of 4 questions, each worth 1 point. Please limit your responses to a maximum of 200 words.

The focus of this assignment is to train your ability to reason through the consequences and ethical implications of computational intelligence, therefore do not focus on getting "the right answer", but rather on demonstrating that you are able to consider the impacts of your designs.

Context

Consider a map of all the roads in a city. A driver in this city is using a GPS app which locates the user's position on the map, and uses a A* implementation to identify an optimum route to the driver's destination using an admissible and consistent heuristic. Considering the intersections between roads as states and the roads connecting states as edges / possible actions, answer the following questions.

Question 1

In the Romania example in class we considered the length of roads to be the edge cost between vertices (cities), and the optimality of the route was respective to the shortest distance a car would actually have to travel by following roads. How might we account for speed limits? How might we account for traffic conditions if we know that traffic is flowing slower than the speed limit?

ANSWER: We can have a new cost variable called travel time, which is calculated by (the shortest distance a car travel) / (min (traffic conditions, speed limits)). This new method takes into account the traffic conditions and speed limits. The total travel time will be shorter if traffic conditions are good or have high speed limit. In this case, the algorithm will choose the path that will take the least amount of time to travel.

Question 2

Cities are designed with a few major roads and a lot of smaller roads. Sometimes the shortest route between two places is through a neighborhood. Suppose there is a neighborhood in between two very popular destinations where a lot of children live and could be playing in the streets, and A* has been routing cars through the neighborhood. As more people use GPS-based routing services, the neighborhood has started seeing an increase in cars cutting through dangerously fast. Suppose we wanted to discourage A* from routing cars through the neighborhood. What would happen if we artificially adjusted the speed limit on roads in the neighborhood versus if we artificially increased the heuristic values of intersections in the neighborhood? Would either guarantee cars never cut through the neighborhood? Would either keep people who live in the neighborhood from generating routes to and from their homes?

ANSWER:

First case (adjust the speed limit): If we decrease the speed limit on roads, it would increase the total travel time, and discourage the A algorithm from selecting this path. However, it would not guarantee cars never cut through the neighborhood because if other paths experience a traffic condition and thus increase the total travel time, the A* would still choose the shortest time path, which could be through the neighborhood. I don't think it would keep people who live in the neighborhood from generating routes to and from home because there is only one path to their home and it is through the neighborhood, there is no other choice for the A* algorithm.*

Second case (increase the heuristic values): If we increase the heuristic value of intersections in the neighborhood, it would increase the total distance and thus increase total travel time. The A algorithm will be discouraged from selecting this path. However, it is not guaranteed that cars will not cut through the neighborhood because if there are traffic conditions in other paths, A* will find the path that minimize total travel time, which can be the path through the neighborhood. I don't think it would keep people who live in the neighborhood from generating routes to and from home because there is only one path to their home and it is through the neighborhood, there is no other choice for the A* algorithm.*

Question 3

There is currently a big societal concern regarding artificial intelligence and automation affecting jobs. How do routing systems impact jobs? Is their impact mainly positive or mainly negative?

ANSWER: A routing system can affect the business of small stores/restaurants. All the restaurants/stores like McDonalds located near a road which has high heuristics and large total travel time will not be selected by the A algorithm, thus have no business. In comparison, stores/restaurants located near a road with low heuristics and small total travel time will have a lot of customers. As a result, businesses near only a few most traveled roads flourishing, while businesses in other higher heuristics roads closed, and people losses their jobs. The impact for the overall economy is not good since a lot of people will lose their job. For business owners near most traveled areas, their business will be positively impacted since the routing system help them attract customers.*

Question 4

Reliance on artificial intelligence systems can change human behavior in unanticipated ways. Describe one way in which a routing system can have an undesirable impact on human behavior.

ANSWER:

After people start relying the routing system, they will stop memorizing roads. If someday the battery of their phone died, people will panic and does not know where to go. When we are using the routing system, we tend to focus on either the navigation or other things, we can negatively impact our awareness of surrounding environment, and thus degrades our spatial knowledge acquisition.