CS 3600 Project 1 Wrapper

CS 3600 - Spring 2022

Due February 13th 2022 at 11:59pm EST via Gradescope

Introduction

This Project Wrapper consists of a context paragraph, which identifies the topic of the wrapper, followed by four short-answer questions, each worth 1 point. Please limit your response to each question to **a maximum of 200 words**. Please write complete English sentences, but our focus is on the content of what you are writing and not your grammar. The goal of this assignment is to train your ability to reason through the consequences and ethical implications of computational intelligence. You should not focus on getting "the right answer," because the questions may be inherently open-ended or subject to interpretation. Instead, focus on demonstrating that you are able to consider the impacts of your AI design choices. **NOTE:** For this first wrapper, we have provided an answer for Question 1, to illustrate the length and quality of responses that we are looking for. This sample answer is around 100 words in length and will receive full credit (a free point for you!) Note that you are not required to answer this question.

Context

Consider a map of all of 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 to be the states, and the roads connecting the states to be the edges, denoting the possible actions, please answer the following questions.

Question 1

In the ice cream example in class, we used the length of roads as the edge cost between vertices (ice cream shops), and the resulting optimal route gave the shortest distance a car would have to travel by following the roads. How might we modify the search to account for speed limits? How might we account for traffic conditions if we know that traffic is flowing slower than the speed limit?

Example Answer (1 Free Point): Speed limits and traffic affect *time* instead of distance, and so we can modify the edge costs to encode time. If there is an average speed v_a in miles/hour, then for an original graph edge cost d in miles, we can replace it with a new edge cost $t = d/v_a$ in hours. We can now account for speed limits and traffic conditions by simply modifying the average speed for that edge to reflect the speed limit or a reduced average speed due to traffic conditions. As long as we have a consistent heuristic function, A* with the new costs will find the shortest duration path, which might not be the shortest distance path under the original cost model.

Question 2

Suppose there is a residential neighborhood where a lot of children live and play in the streets, which happens to be located between two very popular destinations. As more people use GPS-based route planning services, the neighborhood has started to see an increase in dangerously-fast traffic. 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 approach guarantee that cars never cut through the neighborhood? Would either approach prevent people who live in the neighborhood from generating routes to and from their homes?

Answer: If we were to adjust the speed limit on the neighborhood roads, it would raise the time cost for any routing that would previously pass through that neighborhood, making it less likely to choose that route. If we were to adjust the heuristic values at the intersections, we would be altering part of the A* calculations, causing the algorithm to calculate traversing or entering any part of the neighborhood as less advantageous. I don't think that either of these methods are ever sure-fire ways of preventing cars from cutting through the neighborhood. The adjusting of the speed limit would be useful in making sure routes don't often run along neighborhood roads for long stretches, while the intersection heuristic method would make it less likely that turn onto neighborhood roads to begin with. In the scenario that an alternate route has heavy traffic and that path cost overshadows the extra weight we put on the neighborhood paths with both methods, it may still calculate traveling along the neighborhood roads or even cutting though it for any distance to be preferable. Given the nature of the algorithm, there should not be a scenario where a neighborhood resident cannot get a route to and from their house. Even with altered weight in either method, A* will still find a solution or path.

Question 3

There is currently a big societal concern regarding artificial intelligence and automation affecting jobs. How do route planning systems (such as Google Maps or Uber navigation) impact jobs? Is their impact mainly positive or mainly negative?

Answer: Route planning is likely very crucial for many companies and their functions. For example, Amazon has to deliver a massive number of packages to many different customers. In order to deliver these packages as efficiently as possible, it is nearly certain that they need some kind of route planning system to do so. Even in getting employees to work, many use route planning systems to get to work in the shortest amount of time. The job world functions off of being as efficient as possible and route planning systems help with that. This is why I think the impact they have is mostly positive.

Question 4

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

Answer: An undesirable impact that route planning systems have had on human behavior is the over-reliance we have on such systems. If we were to take away these systems, most of us would have a very tough time getting around. Every time I get into a car and start to drive somewhere new, Google Maps is the first thing I pull up, instead of planning out my own route. It is general proof of how our behaviors have changed as a result of route planning systems.