Traffic Based Pathway Optimization

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Abstract

Traffic is a large factor in determining the amount of time it will take to travel from one place to the next. Given the appropriate data for traffic, one can use traffic data to find a path more efficient than using distance as a heuristic. The goal of this project is to make an application capable of finding a path that is optimal in terms of time. This is done through the use of traffic concentration data available online and data collected about travel times during different conditions.

Background

Many commercial GPS systems include navigators to use in a car to assist the driver in getting to a destination. Many drivers are not concerned about the distance traveled when getting to that destination, rather the time traveled is of primary concern. Often, the time it takes to travel a certain distance can vary wildly throughout the normal traffic cycle, reaching its peak during rush hour. Many human drivers often ignore the directions given by GPS systems during these times, opting for roads that they know personally are faster. If there could be a way to provide the dynamic learning aspect of a human driver with the automation of a computer, one could optimize pathways greatly.

Signifigance

Possible applications of this algorithm are in pathfinding for corporations such as shipping companies where delivery times can be of vital importance to the bottom line. In addition, in a large corporation networking all of the vehicles in a fleet would be fairly simple, allowing for companies to improve their pathfinding system as the years go on.

Factors in Travel Time

Possible optimizations include travel times based on weather, driver aggressiveness, time of day, and traffic levels. In addition the algorithm can be optimized to prevent excessive amounts of turning at intersections, and to avoid areas where there is a prevalence of vehicl accidents. With the proper data, all of these factors could be taken into account easily by factoring them into the A* heuristic.

Algorithm and Methodology

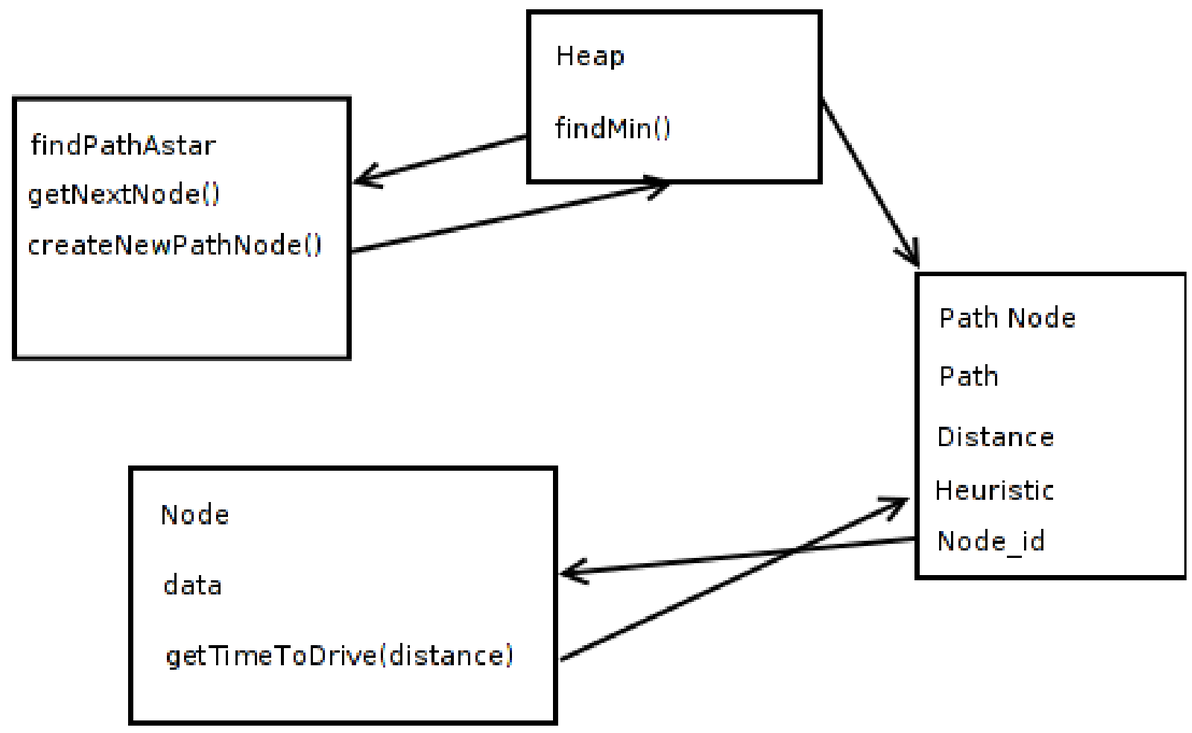

Diagram of the A* search used in the pathfinding algorithm.

The algorithm used in finding a path is a modified A* search. The basic algorithm starts by adding a node to a list. The node knows the distance it has traveled from the start and an estimate of the distance to the destination node. The algorithm then iterates over this list removing the node with the minimum value of heuristic and distance. At each node it checks to see whether the node is the destination, if it is, it will return the path associated with that node. Otherwise it will add a new node for each of the other nodes that are connected to it. The only difference between this algorithm and the algorithm used in my model is that instead of dealing with distance, the algorithm deals with time. In addition, it weighs red lights, weather, and time of day and time of week.

Traffic Data

Traffic data available through VDOT was used in this project to model the speed on the roads. This data did have some limitations however. For example, the traffic data did not include seasonal or time of day changes in traffic volume. In addition, it did not correlate directly with the TIGER data that I used for the algorithm, which meant that one could not use traffic data for the individual segments, but only for the entire road. Some of these limitations one could make up for by factoring weather and time of day into the speed estimate, but it would be a more speculative model and not based on data.