

CS 575 Project Proposal

Team Members:

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Problems:

I plan on working with single-source shortest path algorithms. Specifically, I am looking to implement Dijkstra's Algorithm and the A* Search Algorithm. If either of these algorithms are deemed too trivial, I can also look at all-pair shortest path algorithms such as the Floyd-Warshall Algorithm.

Why these problems are important/interesting:

I will be applying these algorithms to a real-world situation. The graph these algorithms will be working with will consist of all urban areas/clusters [1] in the United States with a population over 10,000. The user will be able to input a source and destination city (e.g. New York City and Houston) and identify the shortest path between the two. The user will also be able to choose which algorithm they want to run and can compare computation times between the two. By running the shortest path algorithms between many sets of large city pairs, we can develop a network around the country that can be used, for example, to determine if the Interstate Highway or railroad system is optimized.

Why these problems are significant/non-trivial:

I plan on implementing the base algorithms with an additional weighting system that adds distance and population considerations to all possible edges. Furthermore, the creation of the graph will be non-trivial. I will need to geocode [2] all urban areas (~1,500) to obtain latitude/longitude data and match it with characteristic data. Once I have all latitude/longitude coordinates, I will need to generate edge data via distance calculations. Lastly, I will visualize the results by creating a website that uses the ArcGIS JavaScript API [3]. This will add an additional layer of interactivity that will allow the user to fully grasp what the shortest path between two cities would look like.

Why it is doable:

I plan on starting early and having the algorithm implementation done by the end of March. After that, I will work on the visualization task and creating any necessary presentations. I plan on writing most of the code in Go, with some code written in JavaScript for visualization purposes. I don't have much experience with the APIs I'm planning to use, but I am confident that I will be able to figure them out.

References:

[1] - https://en.wikipedia.org/wiki/List_of_United_States_urban_areas

[2] - <https://developers.arcgis.com/rest/geocode/api-reference/geocoding-find-address-candidates.htm>

[3] - <https://developers.arcgis.com/javascript/latest/>