Preliminary Results

The results of my project so far demonstrate the viability of my concept. I have successfully designed a workflow that can create a proposed transit diagram over city population density data.

I started by downloading the 2020 census data for Washington, D.C., at the census block level, which is the most granular division available. (The divisions are, in increasing granularity, tract, block group, and block.)

Fig 1. Census blocks of Washington, D.C.

The dataset includes census block boundaries, area, and population, which I used to calculate the population density of each block. I found that taking the log of the population density led to generally dense areas being better distinguished from generally sparse areas. I called this metric the "transit potential".

Fig 2. Transit potential of Washington, D.C. by census block.

I next calculated the "station likelihood factor" for all census blocks as follows: for a given census block, I subtracted the mean transit potential of the surrounding census blocks from the transit potential of the block. The idea here was to determine the densest parts in already dense areas.

Fig 3. Station likelihood factor of Washington, D.C. by census block.

I then used a quadtree-inspired recursive algorithm to determine station locations. At each step, I found the census tract with the highest station likelihood factor and then divided the map into 4, repeating the step on each of these subdivisions. I performed 5 layers of recursion.

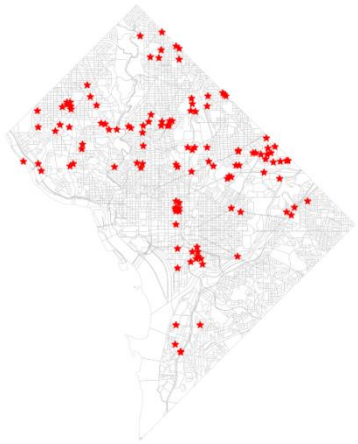

Fig 4. Identified station locations in Washington, D.C.

Finally, to connect the points, I constructed a Gabriel graph.

Fig 5. Preliminary proposed transit network.

As next steps, I am working to include census data for the suburban counties in Maryland and Virginia, to include employment, education, or tourism data, to determine more sophisticated graph algorithms that have easy implementations, to design a better algorithm for station location determination, to incorporate the right-of-way minded route selection I intended, and to work further on scoring metrics.