Mason McBride
Professor Marta Gonzalez
19 April 2022
CE88

(25pts) Choose a descriptive title

Introduction - Abstract. The network I have chosen to analyze is LA county bikeways. This dataset was provided by the county of Los Angeles and it includes existing and proposed bikeways all over the county. Nodes of this network represent streets that the bikeways are attached to and can also represent a recreational area (eg. a park) that also contains bikeways within. The edges of this graph represent the existence of a bikeway *between* two streets, in other words the edges of this network are the paths one can take on these bikeways. This network is undirected, because bike paths are bidirectional by nature. The paths are also unweighted. I live in an outer part of LA county where there is a lot of bikeway infrastructure (existing or planned), but there is not a population large enough to incorporate the flow of the bikeways into the weighting of the network. (2) Previous similar work to this network analysis has been [cite papers that I will be citing for my paper. (3) The rest of my abstract will introduce the following things I will be talking about in my article. I am telling a story.

Sources and similar work:

Data-driven strategies for optimal bicycle network growth

A Micro-Scale Analysis of Cycling Demand, Safety, and Network Quality

Data and Methods

I will analyze my data with the following 3 methods:

(1) Betweenness centrality

For betweenness centrality I decided to use this metric to analyze all 152 connected clusters of biking lanes because there are large enough subnetworks where betweenness centrality plays a relevant role in their dynamics. I will iterate through all of the graphs and plot their betweenness centrality by their number of nodes and then label each node on the graph by the street.

(2) Clustering

Clustering the data bike path data with many of the other columns of data could reveal some interesting patterns in bikeway construction, particularly how likely they are to succeed and which ones are structurally doomed to fail.

(3) Small world

A small world network is characterized by a small average shortest path length and clustering coefficient much larger than than the clustering coefficient of a random graph. After testing for these conditions on the set of connected components of the network, it was discovered that none of the bikeways are small world networks, even with the unfunded path incorporated. This reveals something very interesting about the way bikeway infrastructure is created in the

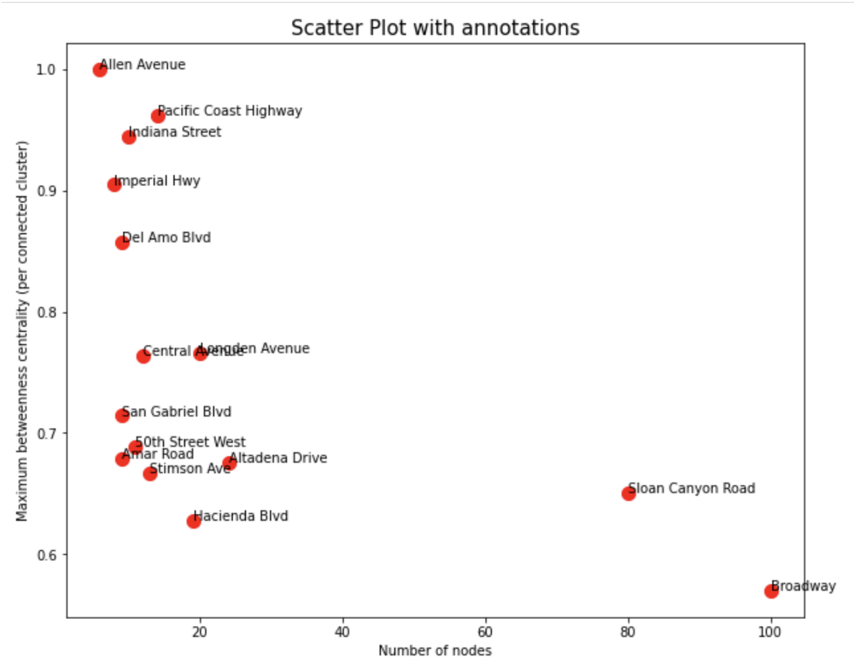
United States: we are either in a stage where bike paths are trying to expand and cover as much distance possible, therefore trading off the ability to create small world networks, or by trying to connect different areas of Los Angeles with bikeways it reveals how the current ways cities are set up is not conducive to a small world way of living.

My dataset is courtesy of the County of Los Angeles' open data repository located at data.lacounty.gov. It is titled on the website as "LA County Bikeways," and I downloaded the csv. The dataset also contains geospatial data, which I may use in my analysis of these bikeways, but for my purposes the exact location of bikeway clusters is secondary to the analysis I am making about these networks. As for the specifications of the network, there are a total of 868 elements. I had to prune one extraneous item from my dataset because all of its values were null. The nodes of this network represent streets in the la country area, including some streets that I grew up on! The network may be modeling the bikeways of LA county, but due to the way city planners develop bikeways, they are defined in my dataset as running along streets for cars. Edges in this network are bike paths between LA streets, ie., you would be able to follow the edges of this network to end up at different streets. The graph is undirected because bikeways go two ways, and is unweighted because having or not having a bikeway between streets is a binary operation.

I chose to analyze these features because the papers cited above defined desirable properties for bikeways as small-work networks with low average traffic. I calculated the betweenness centrality of each of the 152 weakly connected networks and then took the max to understand worst-case congestion on each of these bikeways.

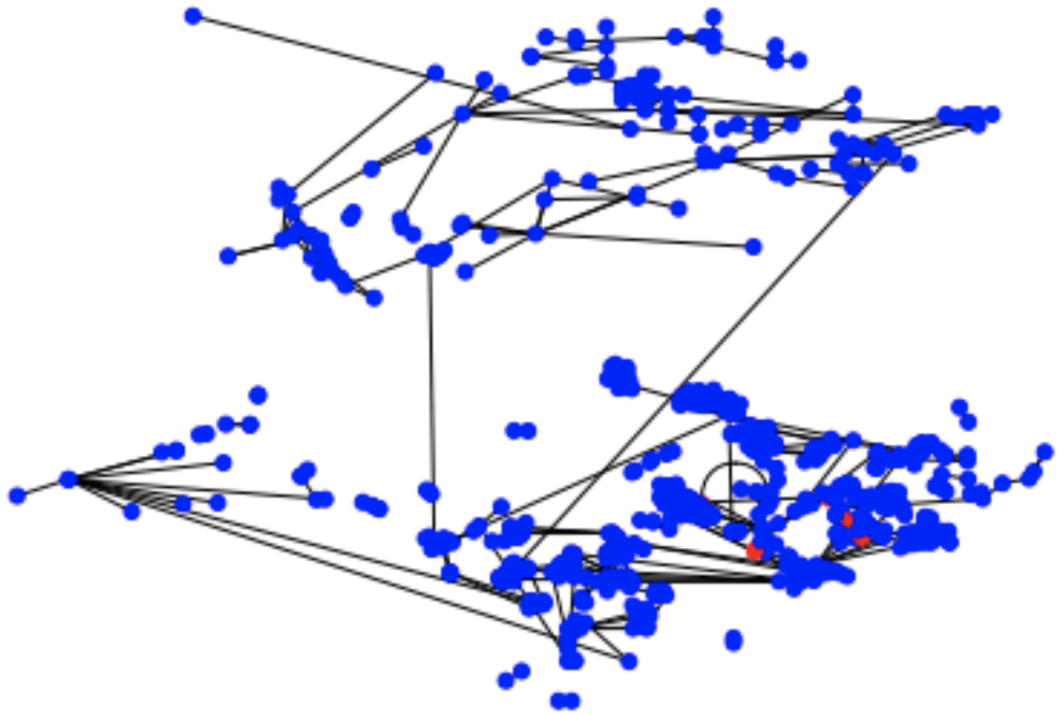
Results

(1) Betweenness figure (labeled w/ caption)



This scatter plot only plots the top 15 roads, but with further plotting a visible cluster emerges of neglected and underfunded bikeways that are doomed to have bad benefits to the rider statistically.

(2) Clustering analysis figure (labeled w/ caption)



(Caption: Cluster 1 colored blue; cluster 2 colored red.)

Future Work and Conclusions

Future work on this project could involve incorporating the distances of the bikeways into the calculation of the network in the form of weights. This could be a valuable future extension, but my current work was focused on the fundamental structures the county of Los Angeles is developing for their future bikeways, and not on the exact spatial impact (beneficial and/or detrimental) specific bikeways are having in transportation and recreation. It would also be interesting to investigate what an optimal network would look like using this information gathered here. Maybe creating a network from the ground up that had very high minimum betweenness centrality while also keeping a small world property.