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Polling Location Optimization with Mass Transit

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Introduction

According to statistics collected by the U.S. Elections Project, about 40 percent of U.S. citizens did not participate in 2016 presidential elections.[1] Although many states provide various solutions to fix America's voter turnout problem, voter turnout rates have not increased in last two decades. With researching the relationship between voter turnout rates and the other factors, we found the journal, "Increasing Voter Turnout: Can Mass Transit Help?"[2]. Since Boston is one of the top 10 cities for public transportation, we decided to apply this journal to Boston to reconfigure 255 optimal polling locations across Boston.[3]

Data Sets

Wards: Geospatial data for wards in Boston.
Polling Locations: Set of polling location coordinates in city of Boston.
Bus Stops: Set of bus stop coordinates in city of Boston.
MBTA: Set of MBTA T station coordinates in city of Boston.

Methodology

To determine optimal polling locations and compare accessible score for the result by each data set, we ran a k-means algorithm on MBTA T station only, bus stops only, and both MBTA T station and bus stops. After reconfiguring 255 polling locations each, we ran a scoring method to calculate the average and standard deviation of Euclidean distance between randomly generated voter addresses and polling locations. We visualize each polling location coordinate on the map with Leaflet.js and Python/Flask. Also, we created the scoring board to compare scores of each result.

Conclusion

As the table (Table 1) shows, each result has an improvement over original polling locations. Polling locations optimized with bus stops only and with public transportations (bus stops and public transit combined) are more accessible than polling locations optimized with MBTA T station because the number of bus stops is more than MBTA T station. However, in this research, we found some original polling locations are in the same building but each location is for different people. By running a k-means algorithm we have more markers on the map (Figure 1, 2), which improves the accessible score of each result of optimization. Therefore, we found that the county commission already chose enough accessible polling locations for Boston voters. Still, the work presented here will be developed more for future studies of America's voter turnout problem with considering more factors to increase voter turnout rates.

Figure 1: Original Polling Locations

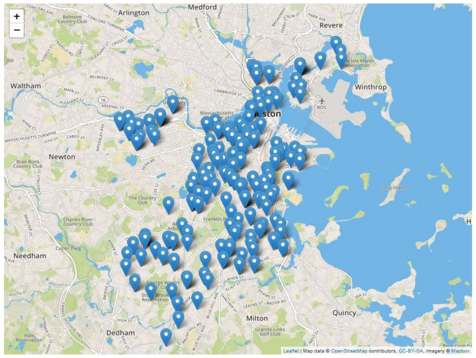

Figure 2: Optimized by Public Transportation

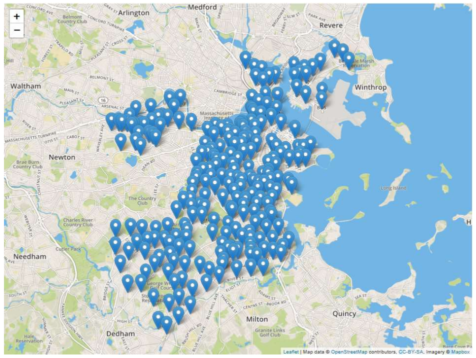

Table 1: Comparison between Original Polling Locations and Optimal Polling Locations

Polling Locations	Average (Miles)	STD (Miles)	95% Lower Tail Confidence Interval (Miles)	95% Upper Tail Confidence Interval (Miles)
Original Polling Locations	1.035	0.828	0.069	2.967
Optimization with Bus Stops	0.828	0.69	0.069	2.553
Optimization with MBTA T station	0.966	0.828	0.069	2.829
Optimization with Public Transportations	0.828	0.69	0.069	2.484

Future Work

Our next step to improve this research is routing between the nearest polling locations and randomly generated voters' addresses. In this research, we did not care how people would get the designated polling location. Therefore, with considering the route to polling locations, we will be able to determine which polling locations are more accessible to Boston voters. Furthermore, since we ran a k-means algorithm to optimize on public transportations, we did not consider building usage, openness to public, and so on. Therefore, our optimal polling locations might not be ideal polling locations in reality. For example, some polling locations might be too small or private properties. Therefore, we will develop the scoring methods to evaluate suitability as a polling location.

References

[1] U.S Elections Project. "2016 November General Election Turnout Rates.", www.electproject.org/2016g
[2] Romano, Rosie. "Increasing Voter Turnout: Can Mass Transit Help?" Clocks and Clouds 1.1 (2012). www.inquiriesjournal.com/a?id=1618
[3] Wallace, Nick. "The Best Cities for Public Transportation." SmartAsset, SmartAsset, 6 July 2017, smartasset.com/mortgage/best-cities-for-public-transportation

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