Time Lapse Map of Snow Plow Presence

Dean W. Olin, Alex Sinfarosa

March 1, 2018

1 Introduction

The goals for this project were twofold: first, to create a data visualization which would provide insight into current road conditions during inclement weather; a dashboard of sorts. Secondly, to provide an easy way for DPW personnel to identify recurring plowing patterns, with the goal of improving efficiency, and thereby reducing costs and improving city resident satisfaction.

2 Technical Methods

The front-end display of the application was built using the React JS, and Leaflet javascript libraries. Key challenges in building the front-end was overlaying the GeoJSON data onto the map and handling the large amount of data required to display 144 different time slices of the map (48 2-hour time slices for each 4-day period).

Data carpentry and preparation was done using the Python Pandas and Numpy libraries in a Jupyter notebook environment. Key challenges in the data preparation were mapping the roughly half-million longitude/latitude data points to specific road segments, and designing a data structure that could both hold enough information for the application, and yet could be reasonably handled by an end-user's browser.

3 About the Map

The application has three buttons which let the user decide which 4-day period they would like to observe. The time-line across the top of the page allows the user to move forward or backward in 2-hour increments. As time advances, the color of a road segment represents the time elapsed since a plow was on that segment of road. Note that this does not necessarily mean that the road was plowed, only that the plow was on that road segment.

There was a large amount of data required to implement this time lapse map for 4-day periods. In a live application, updates would be much more easily kept in an updated state, since the data would be processed as it was received from the GPS provider's API.

4 Vision of Use

For live purposes, we envision the application being used as a dashboard in the DPW office, perhaps on a TV mounted on a wall. It could also be used as a tool to examine past performance and patterns, for certain days or storms.

5 Future Work and Improvements

We think the most relevant and impactful addition would be the incorporation of hourly precipitation rates and type. The application currently has predetermined time lapsed thresholds for determining the color of a road. In real-world conditions, the amount of time before a road becomes problematic for travel is a function of both time and snowfall rates. For instance, we wouldn't want to display a road as 'red' under any circumstances if it wasn't snowing at all! Likewise, if we were getting the blizzard of '93 again, we wouldn't want to wait 24 hours before a road segment was displayed as 'red'. By allowing real-time weather data to vary the color threshold values, the application would be able to give a much more accurate representation of the current state of the roads.

Additionally, we had hoped to use the activity data, but found the information too inconsistent to be of use. In an ideal situation, with accurate and complete information of the plows' activity, the map could include additional information indicating if a road had actually been plowed or salted.

Finally, given more time, we would work on capturing more of the data points in regards to getting them mapped to a road segment. Currently, our code is not able to map roughly 9 percent of the data points to a road segment. Many of these are likely due to the plow being in a location that is not on a city street (e.g. parking lots, schools, etc.....), but we still feel like we could be missing some valuable information.

6 Conclusion

With neither of us having worked with GPS data before, this competition was a learning experience for both of us. We hope that our idea is able to help the city to more efficiently keep the roads clear during winter.