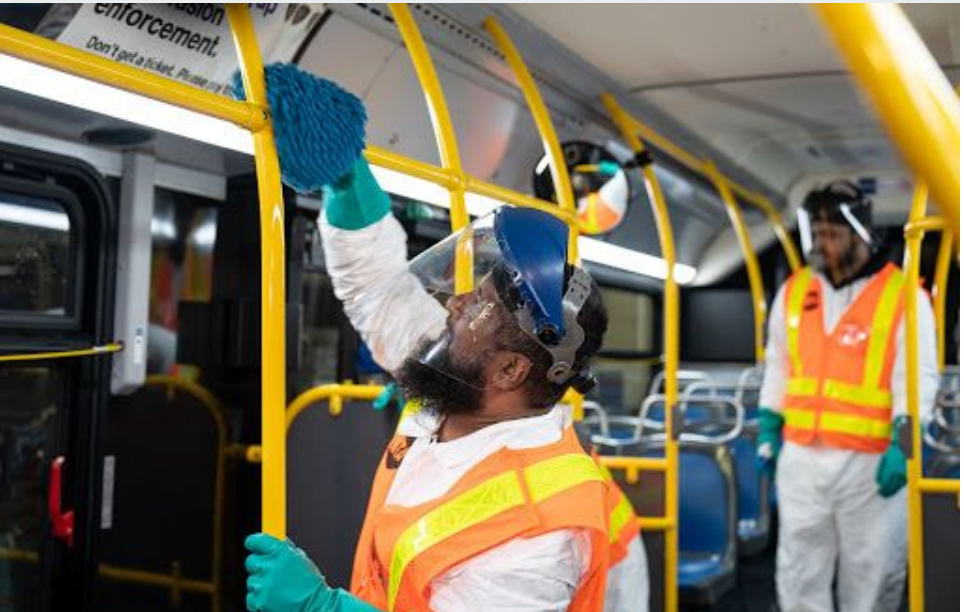
Mapping Subway Growth in Post-Pandemic New York

Elizabeth Naameh @ Urban_Footprint

The Problem



Client: The New York City Department of Transportation wishes to understand subway ridership trends as the city resumes normal life in a ‘post-pandemic’ world.

The DOT has solicited the support of UrbanFootprint, a software company that helps organizations derive actionable insights from environmental, urban, and socio-economic data.

The results from this analysis will be used to inform plans to deploy more buses in hot spots and invest in alternate transit options, such as creating more busways, bike lanes, and bike parking, to relieve overcrowding.

Design

I worked with data provided by the Metropolitan Transit Agency and the City of New York, leveraging numerical, temporal and geographic feature engineering along with linear regression to extract ridership trends for the first six months of 2021.

We measure popularity by total foot traffic daily and weekly, by station and by borough.

We also compare ridership against pre-pandemic levels using 2019 data.

Data

The analysis uses MTA's weekly turnstile CSVs, January-June of 2021 and March-June of 2019.

I also draw on MTA's Stations location data and NYC borough maps.

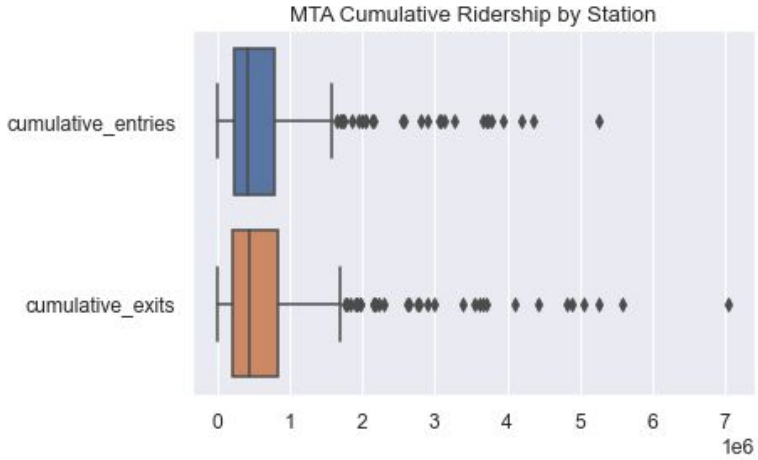
Although the datasets include information for 439 subway stations throughout New York City, I limited my analysis to the busiest 100 as determined by overall foot traffic.

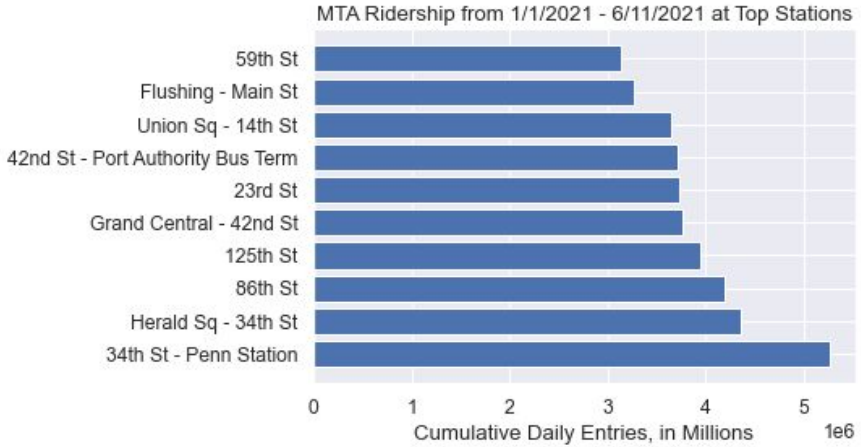
Tools

- Numpy and Pandas for data manipulation
- Scikit-learn and for modeling
- Matplotlib and Seaborn for plotting
- Plotly for interactive visualizations
- Geopandas for geospatial analysis

Data Cleaning & EDA

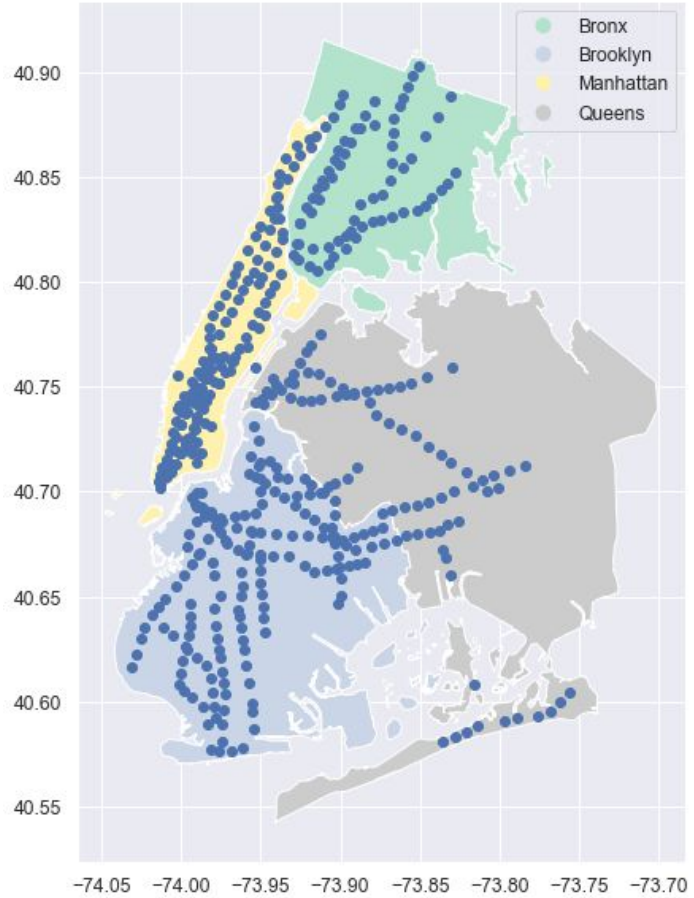
- *Remove duplicate data*
- *Manage faulty turnstile data, i..e reverse counters and resets*
- *Convert cumulative entries and exits by date to total daily foot traffic*
- *Aggregate station-level ridership counts*



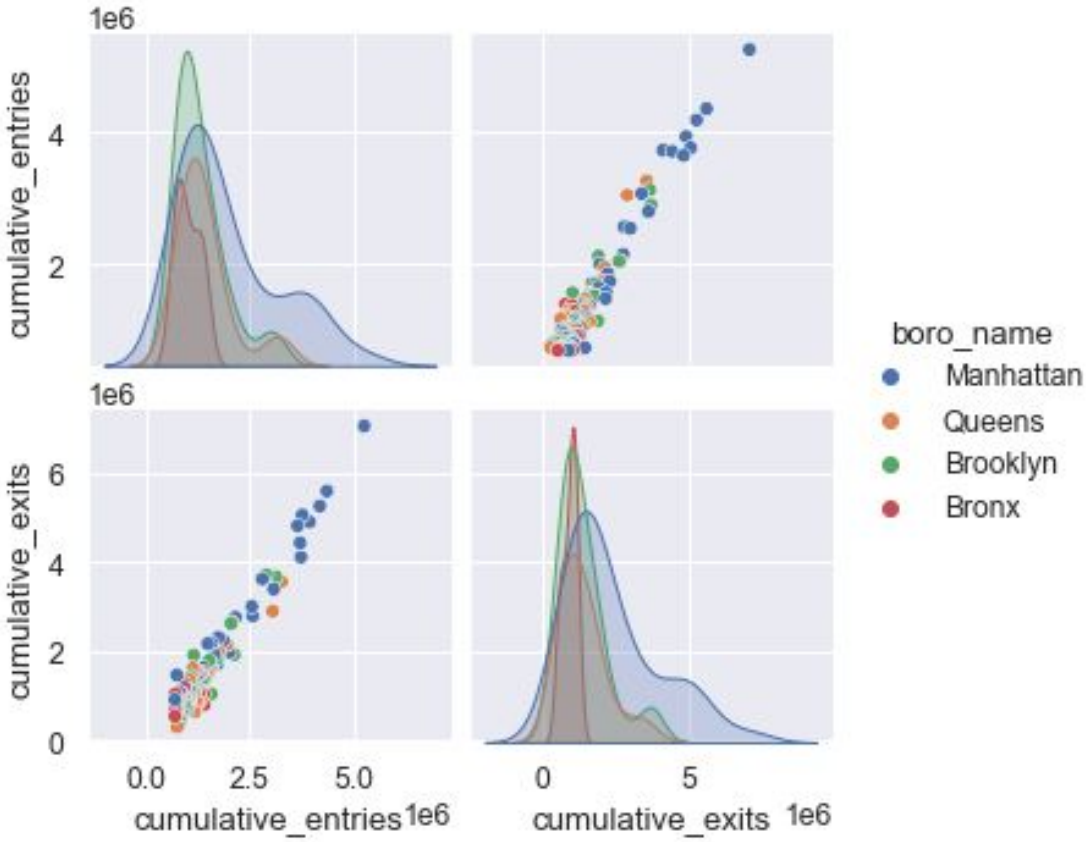


Importing Geospatial Data

- *Borough maps (1) and Station Locations (2)*
- *Clean: Drop data related to Staten Island*
- *Merge with stations dataframe*



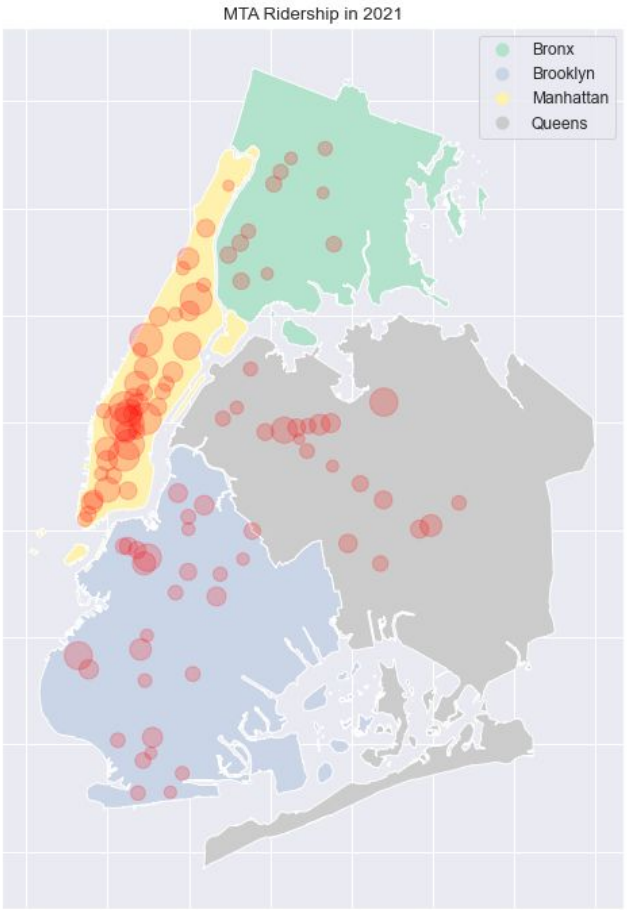
Subway Traffic by Station



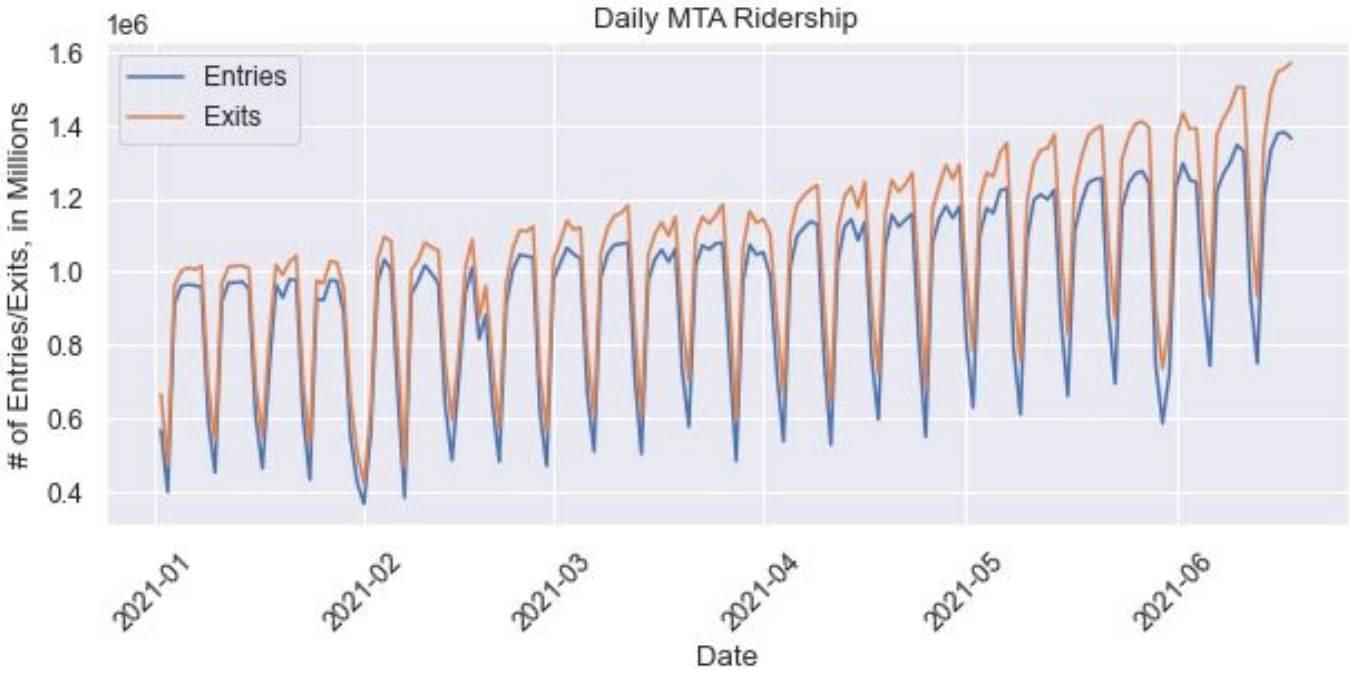
Subway Traffic by Station

	station	cumulative_entries	cumulative_exits	geometry	boro_name
0	34th St - Penn Station	5262867	7053345	POINT (-73.99106 40.75037)	Manhattan
2	Herald Sq - 34th St	4363996	5591609	POINT (-73.98794 40.74964)	Manhattan
4	86th St	4192026	5255493	POINT (-73.97622 40.78864)	Manhattan
9	125th St	3941338	4897036	POINT (-73.94550 40.80775)	Manhattan
13	Grand Central - 42nd St	3769438	5054932	POINT (-73.97671 40.75181)	Manhattan

Merged borough boundaries, station locations, and MTA stations data.



How is subway ridership changing over time?



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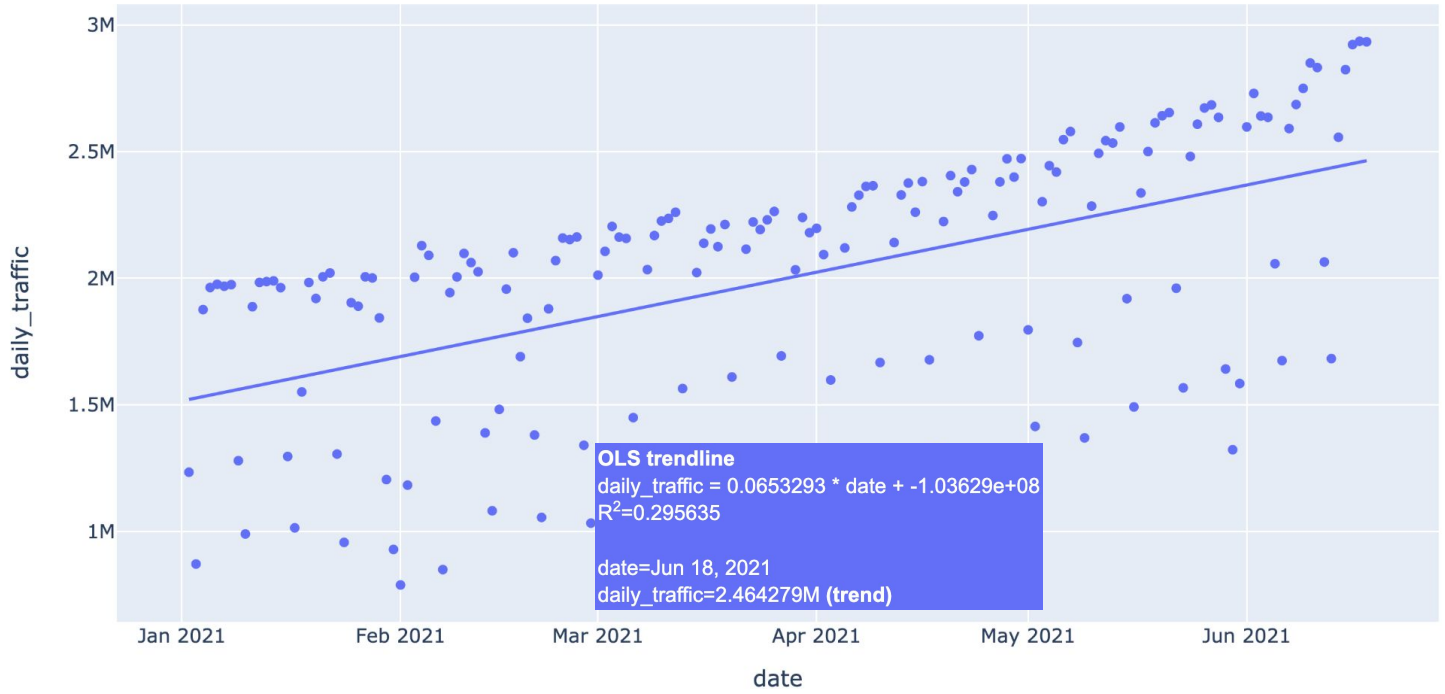

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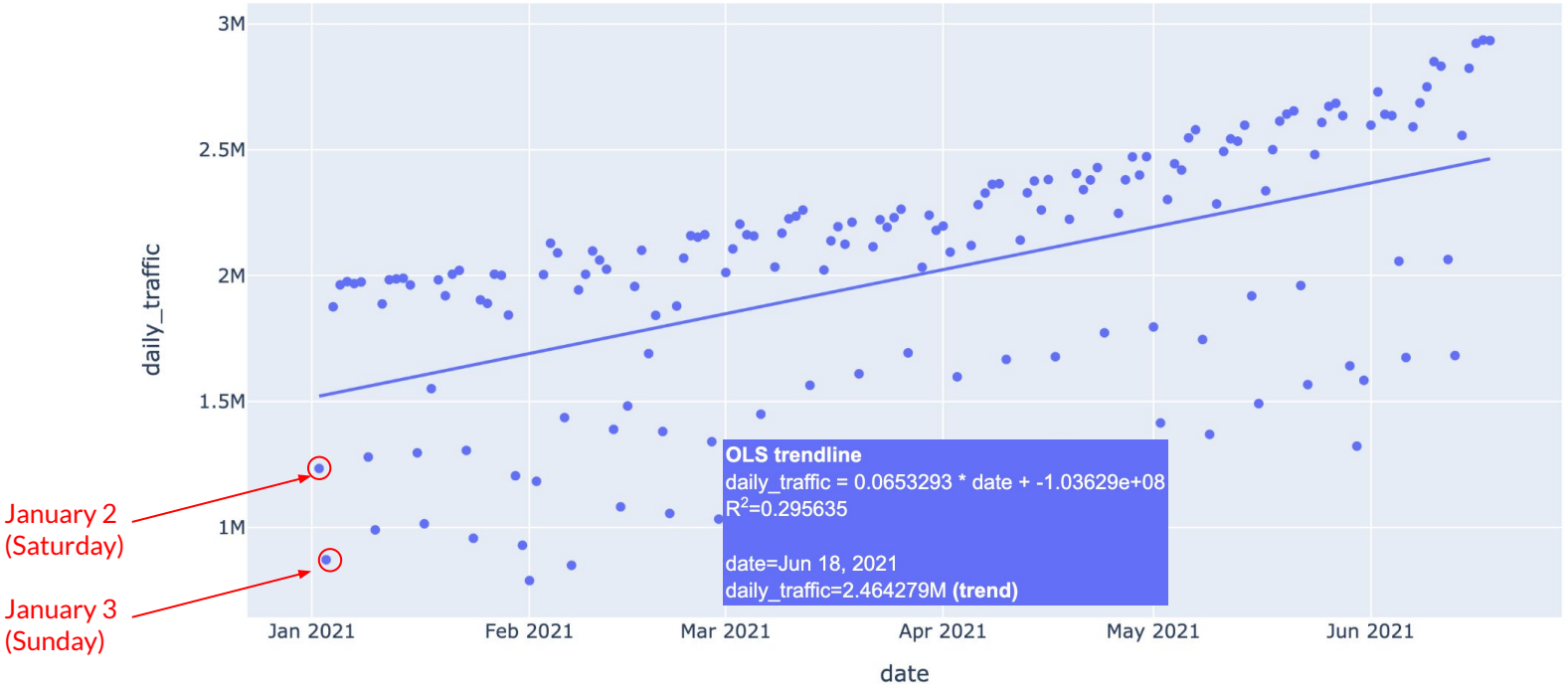

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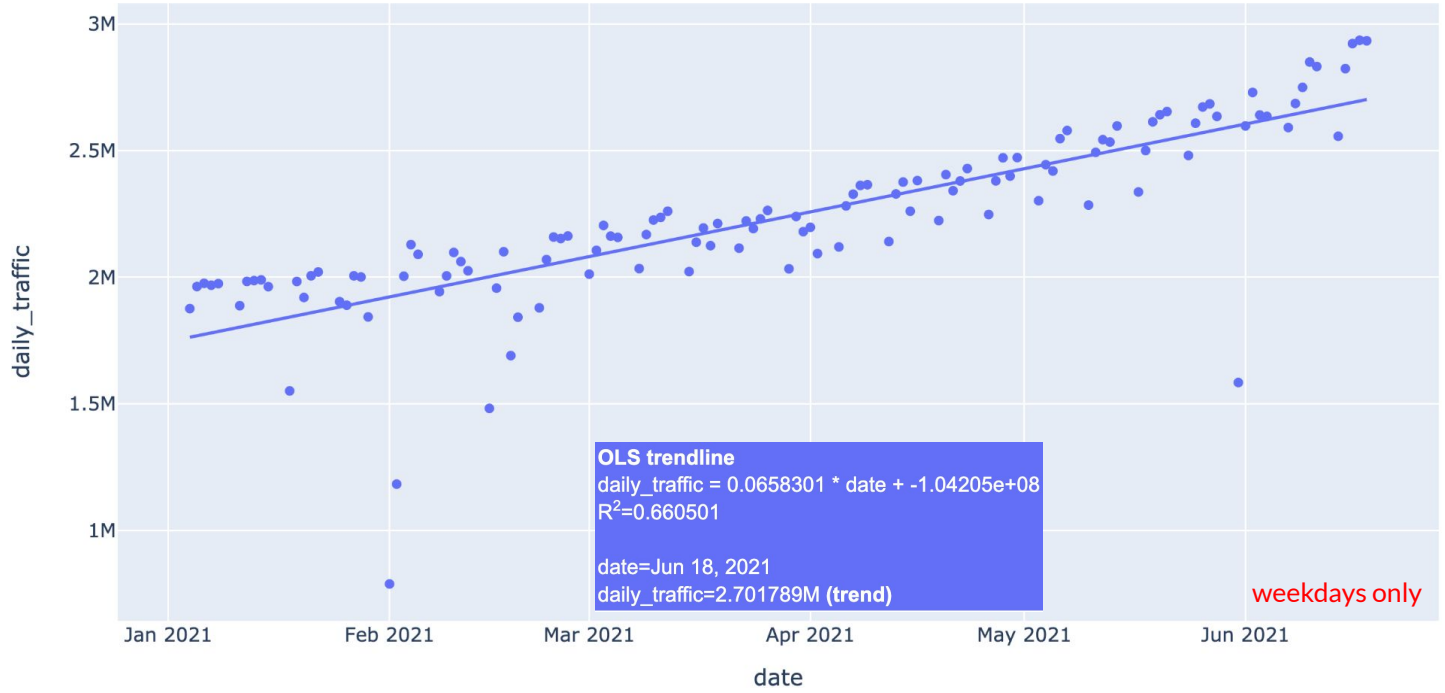

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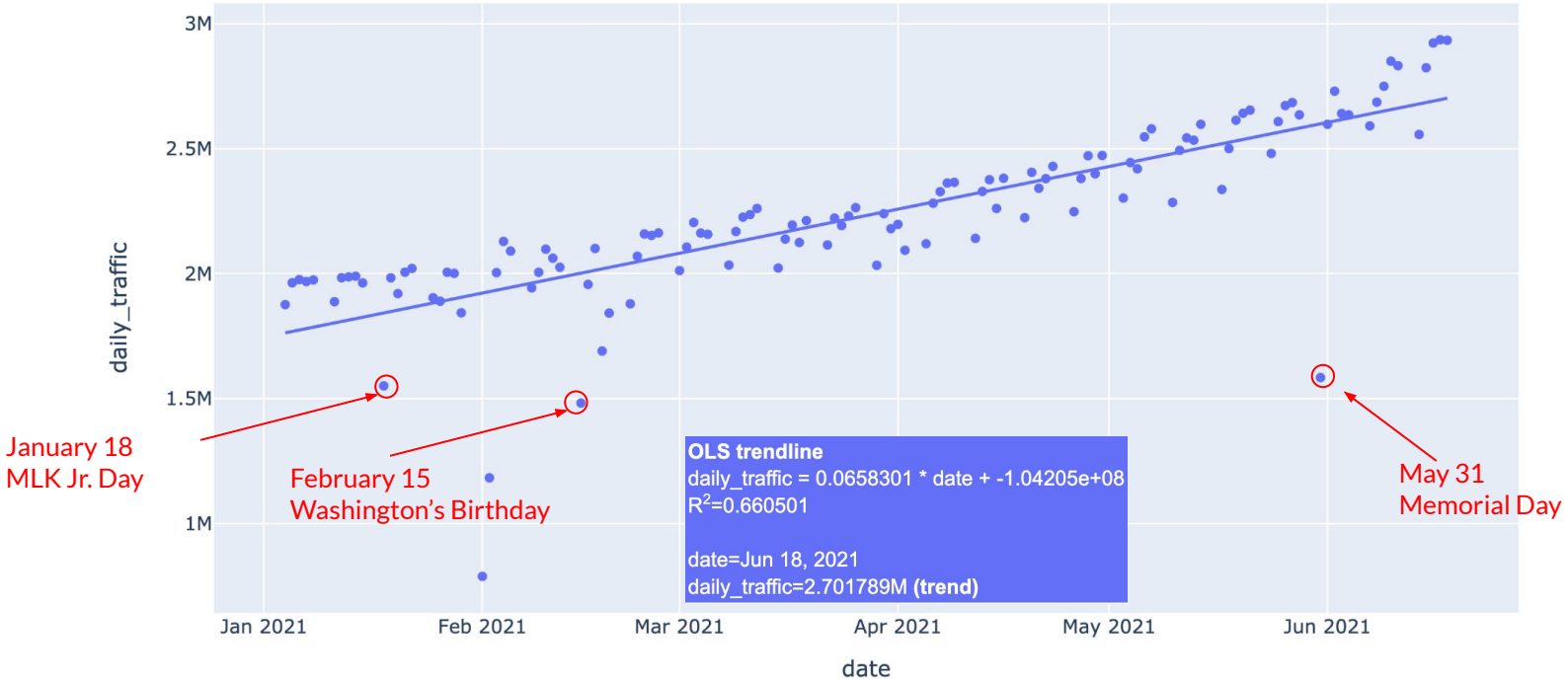

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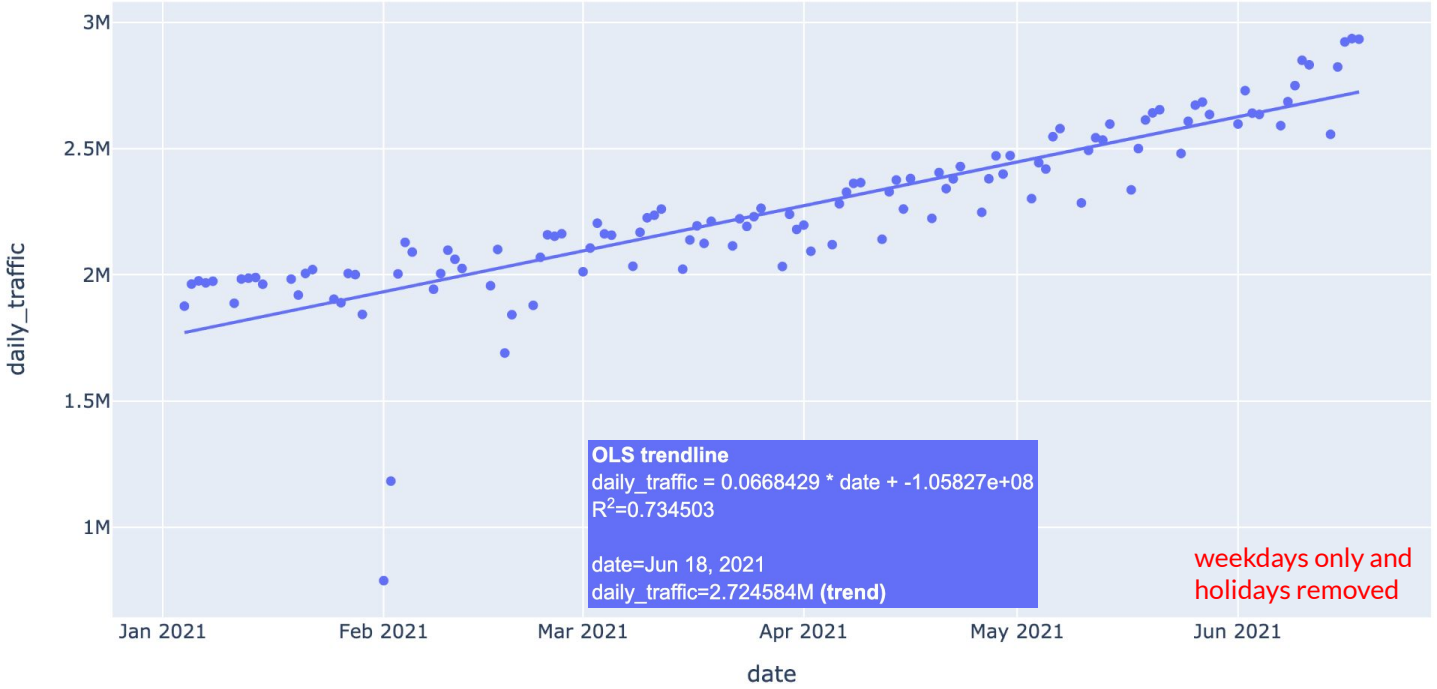
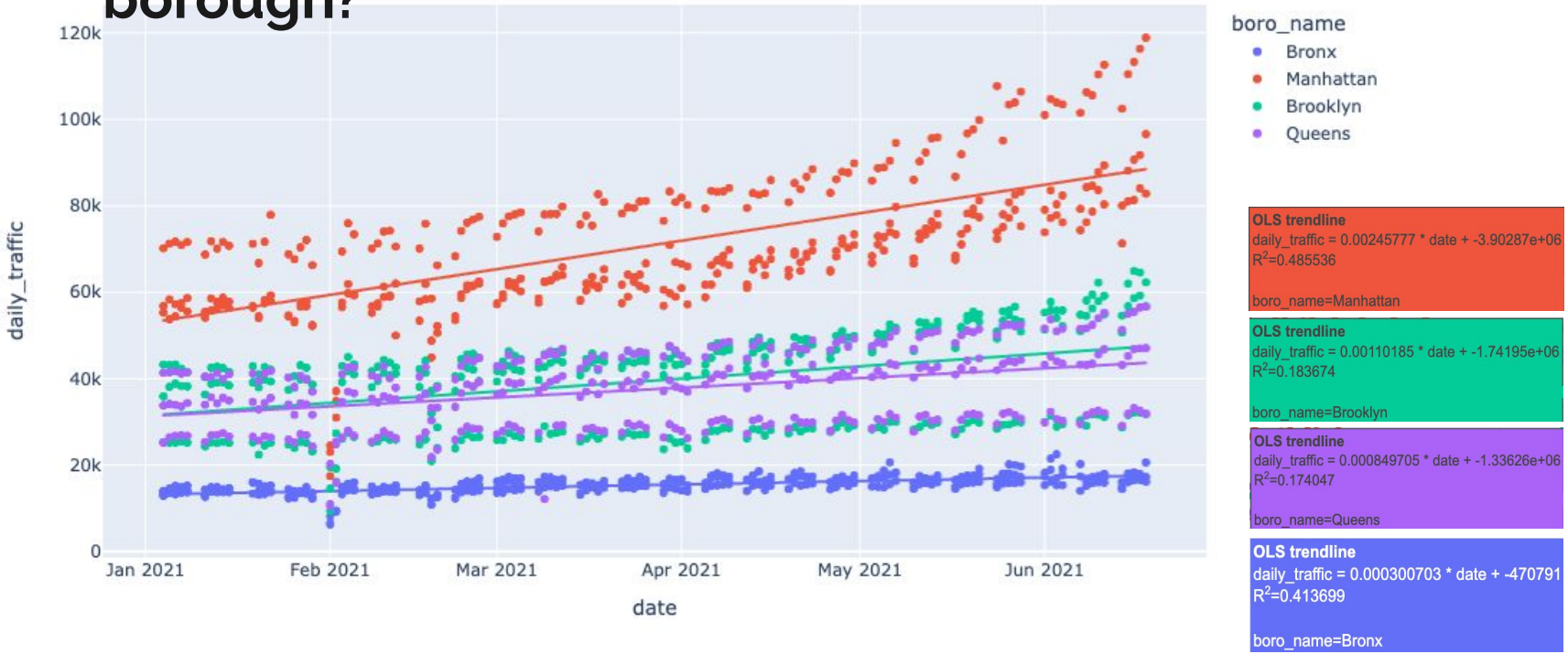
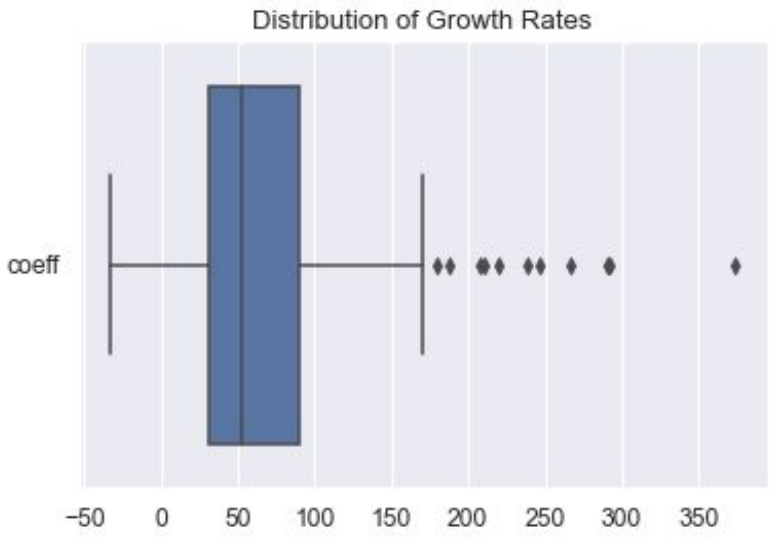


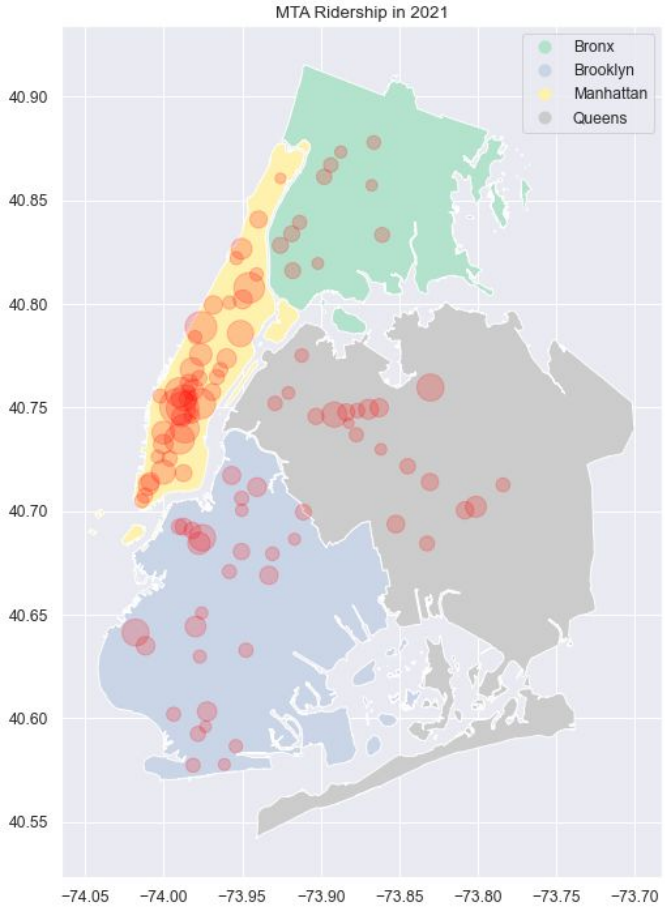
How do changes in subway ridership vary by borough?

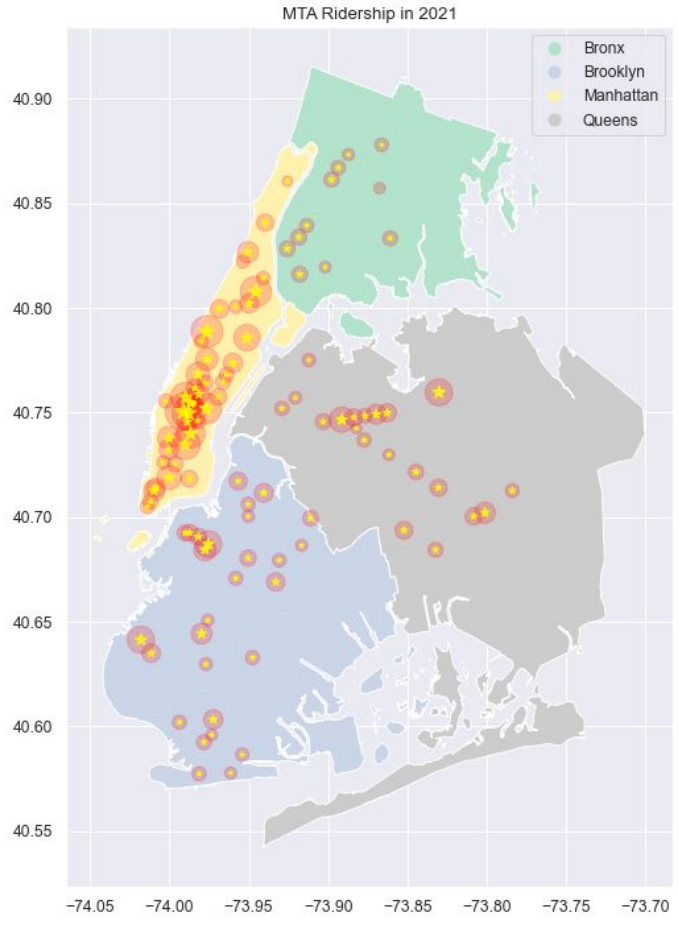


How does ridership growth vary by station?

	coeff
34th St - Penn Station	374.089
Herald Sq - 34th St	292.085
Grand Central - 42nd St	291.135
Union Sq - 14th St	265.915
86th St	245.894
23rd St	238.103
Times Sq - 42nd St	219.830
42nd St - Port Authority Bus Term	210.837
Fulton St	207.091
Canal St	187.411




MTA Ridership in 2021
Bronx
Brooklyn
Manhattan
Queens
40.90
40.85
40.80
40.75
40.70
40.65
40.60
40.55
−74.05
−74.00
−73.95
−73.90
−73.85
−73.80
−73.75
−73.70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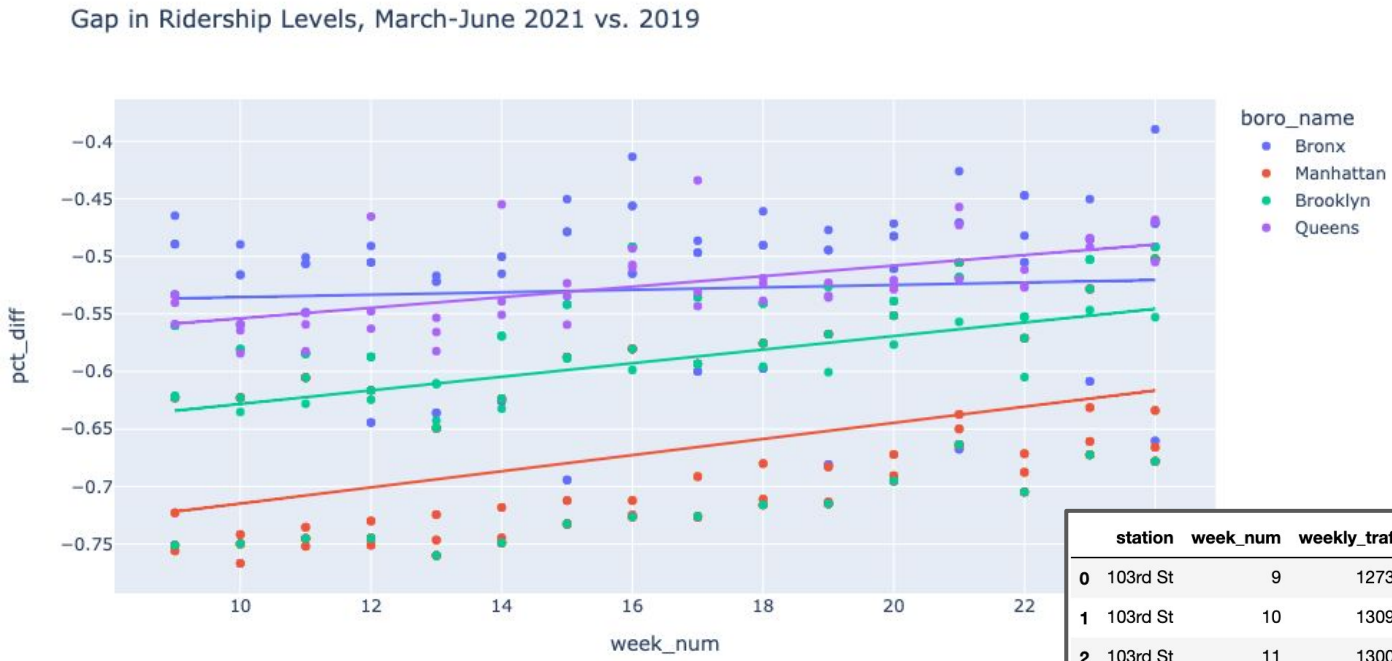
Visualizing the Return to Normalcy by Borough



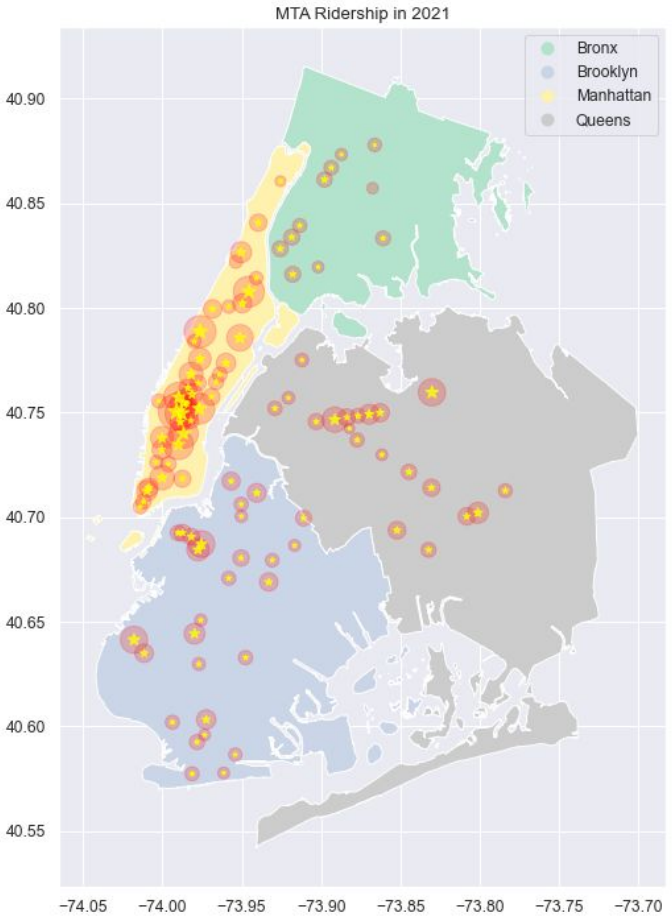
	station	week_num	weekly_traffic	weekly_traffic_19	pct_diff
0	103rd St	9	127328	309427	-0.588504
1	103rd St	10	130942	327508	-0.600187
2	103rd St	11	130033	319849	-0.593455

Conclusion

The most populous stations are also growing the fastest.

NYC DOT should focus resources on alleviating congestion in:

- Manhattan
- Brooklyn (esp. near Brooklyn Bridge)
- Queens (throughout)



Future Work

Explore alternate public transit options in high-traffic, high-growth areas as measured by subway foot traffic data, and expanding capacity.

Why New York Buses Are on the Rise in a Subway City

During the coronavirus pandemic, daily ridership on buses has surpassed the subway for the first time in over half a century.

N.Y.C.'s Bike Parking Problem: 1.6 Million Riders and Just 56,000 Spots

During the pandemic, bicycling boomed, leaving many cyclists to lock and park their bikes wherever they can.

Car Lanes to Become Bike Lanes on 2 Major New York City Bridges

Mayor Bill de Blasio wants to add bike lanes on the Brooklyn and the Queensboro Bridges to encourage cycling as the city recovers from the pandemic.