DATA 607-FINAL PROJECT

Analyzing 311 Service Requests

PROJECT SOPE

This project analyzes NYC 311 service request patterns to identify geographic disparities in complaint types and response times across boroughs, using statistical analysis, Random Forest modeling, and an interactive Shiny dashboard to support data-driven municipal decision-making.

PROBLEM & BIG PICTURE

Problem Scale

NYC received over 3.4 million 311 requests in 2024, driven by quality-of-life issues like illegal parking, noise, and housing maintenance, with these complaints unevenly distributed across boroughs.

Data Sources and API Integrations

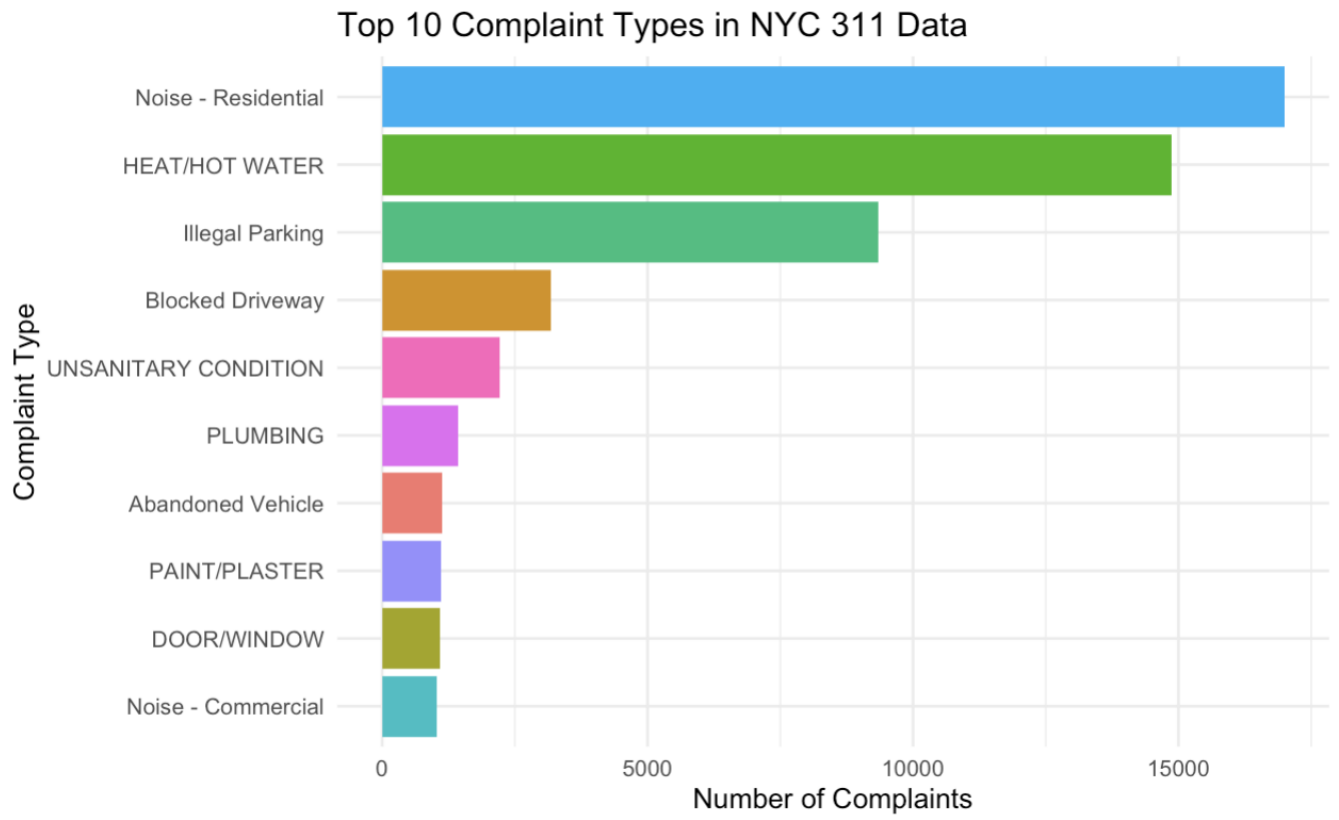
The primary dataset was obtained from **NYC Open Data** via the Socrata REST API, providing approximately 80,000 service request records with complaint type, borough, timestamps, and geographic coordinates.

I incorporated daily temperature and precipitation data from the **Open-Meteo Historical Weather API**, enabling correlation analysis between weather conditions and complaint patterns.

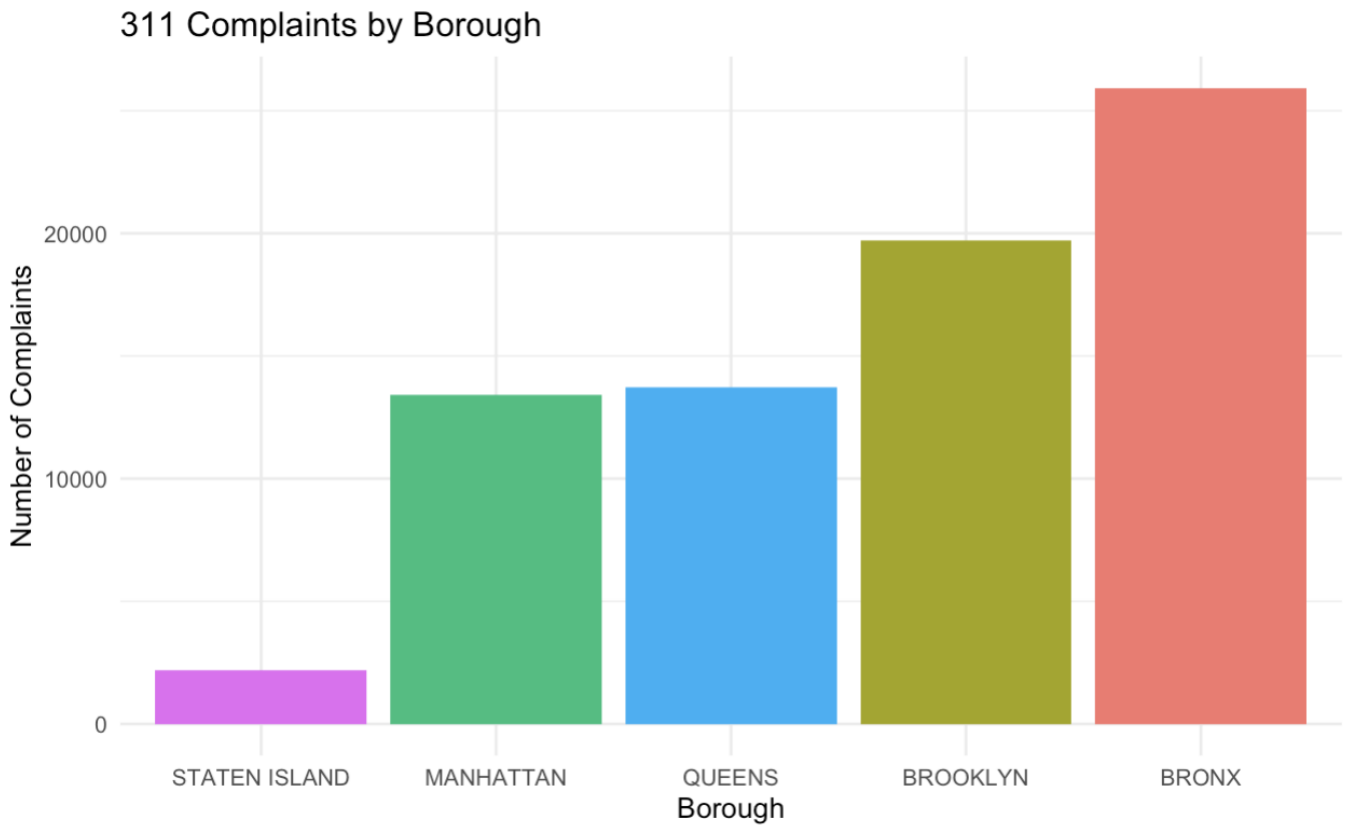
Finally, socioeconomic context was added through the **U.S. Census Bureau's American Community Survey** via the tidycensus package, providing borough-level population, median income, renter percentage, and poverty rates for equity-focused analysis and per-capita normalization.

USING VISUALIZATIONS TO UNDERSTAND 311 DATA

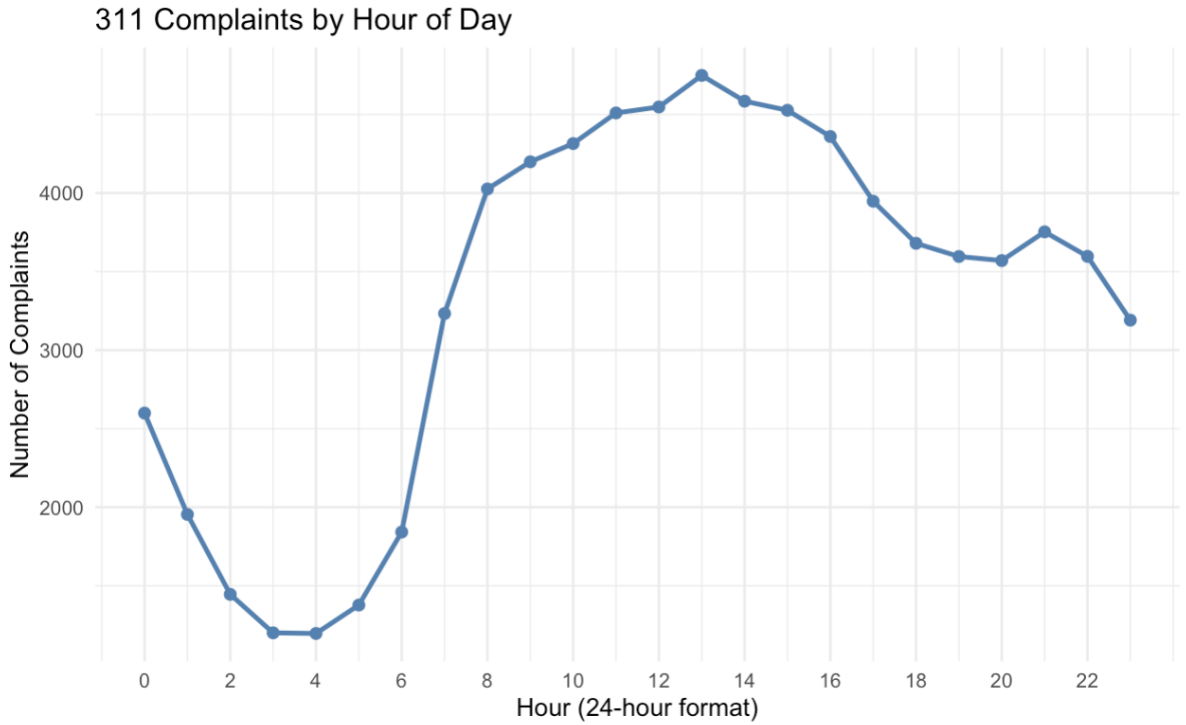
Top 10 Complaint Types



311 Complaints by Borough



311 Complaints by Hour

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### Shiny app and dashboard
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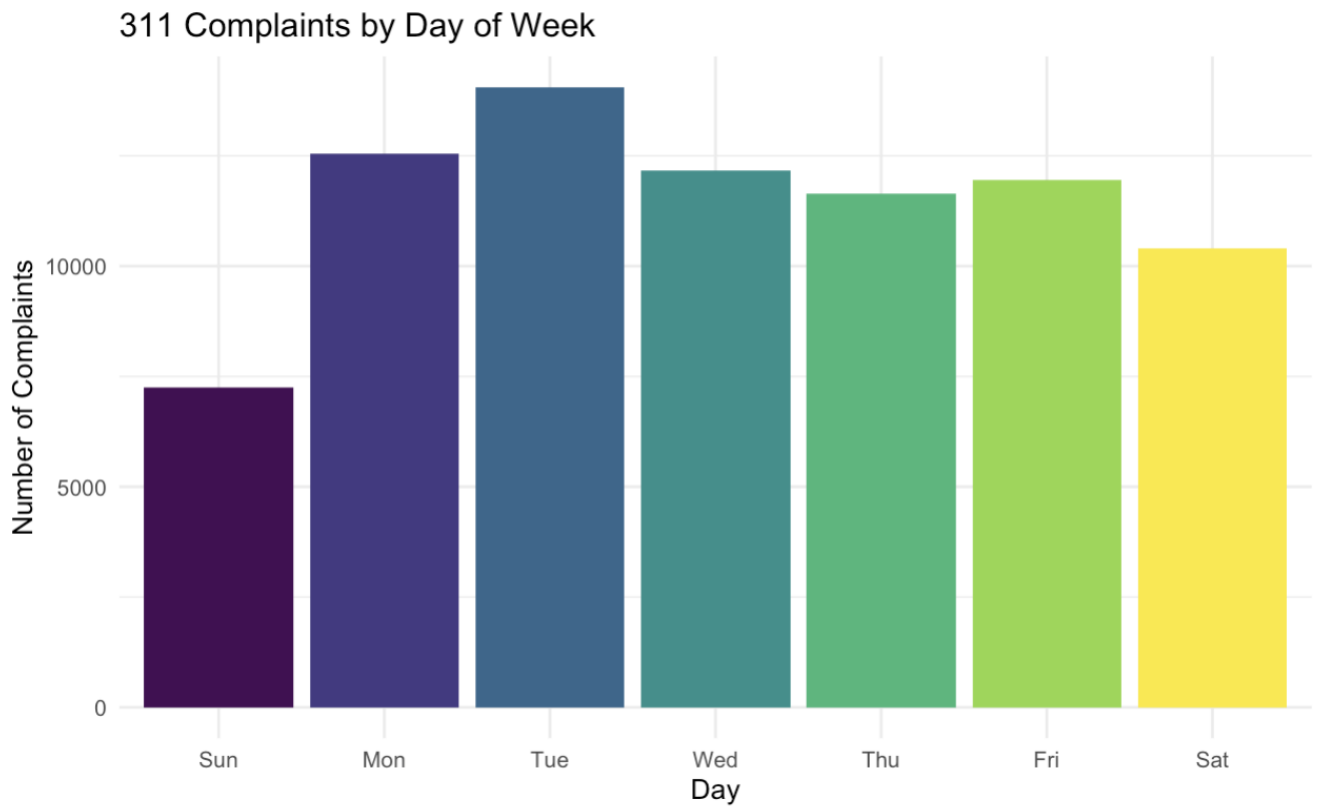
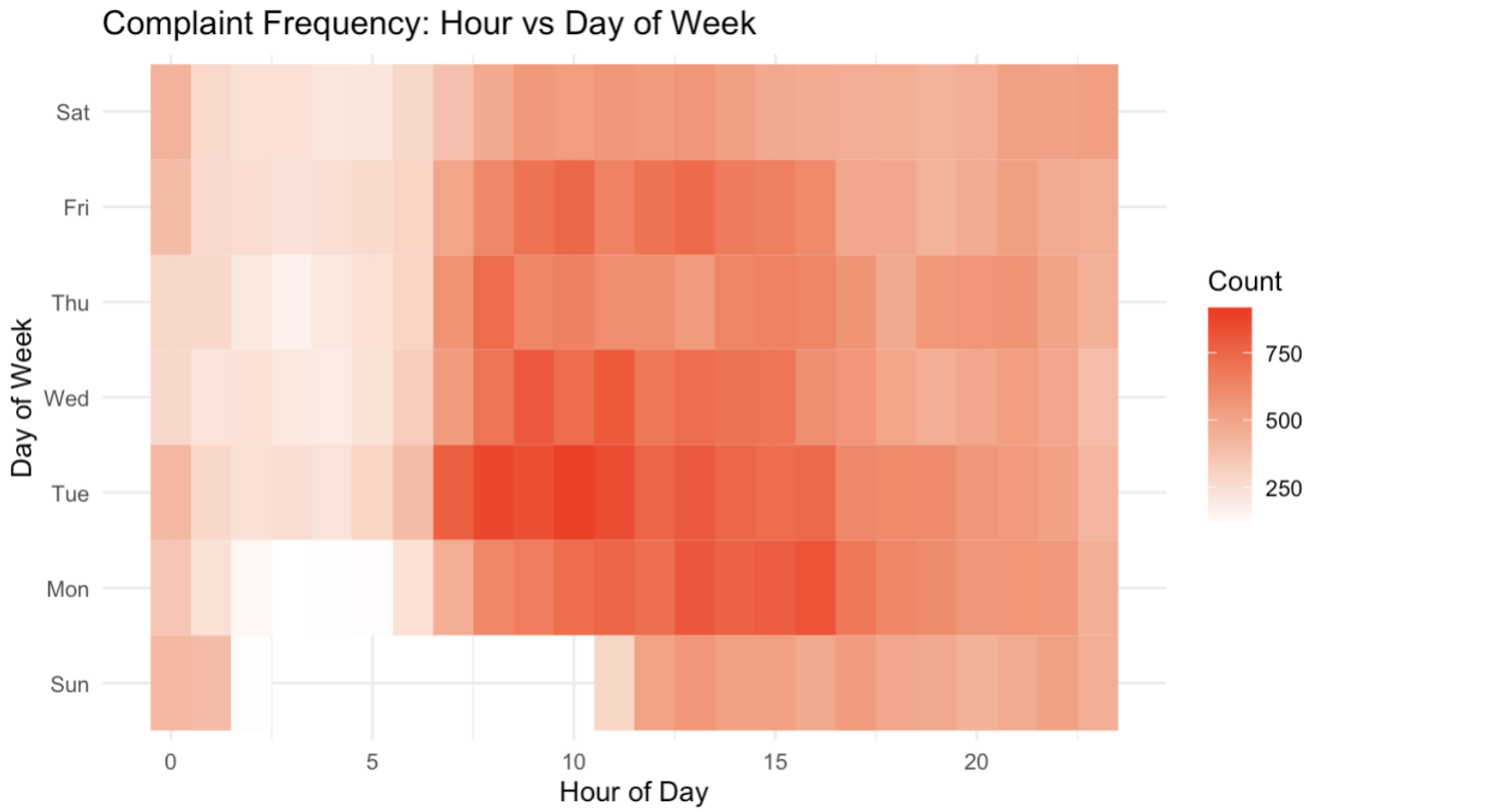
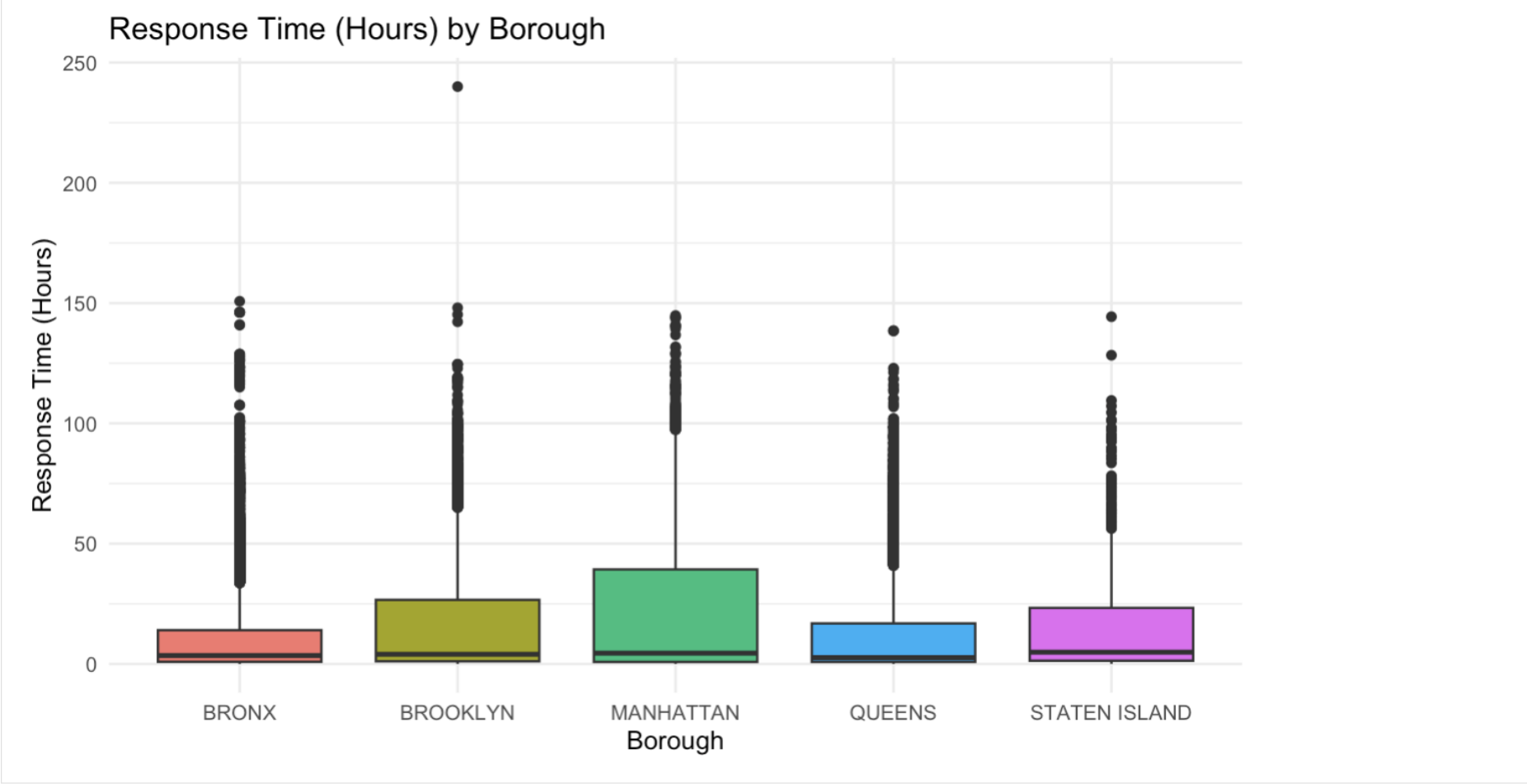
311 Complaints by Day of Week



Complaint Frequency Analysis by Day & Hour



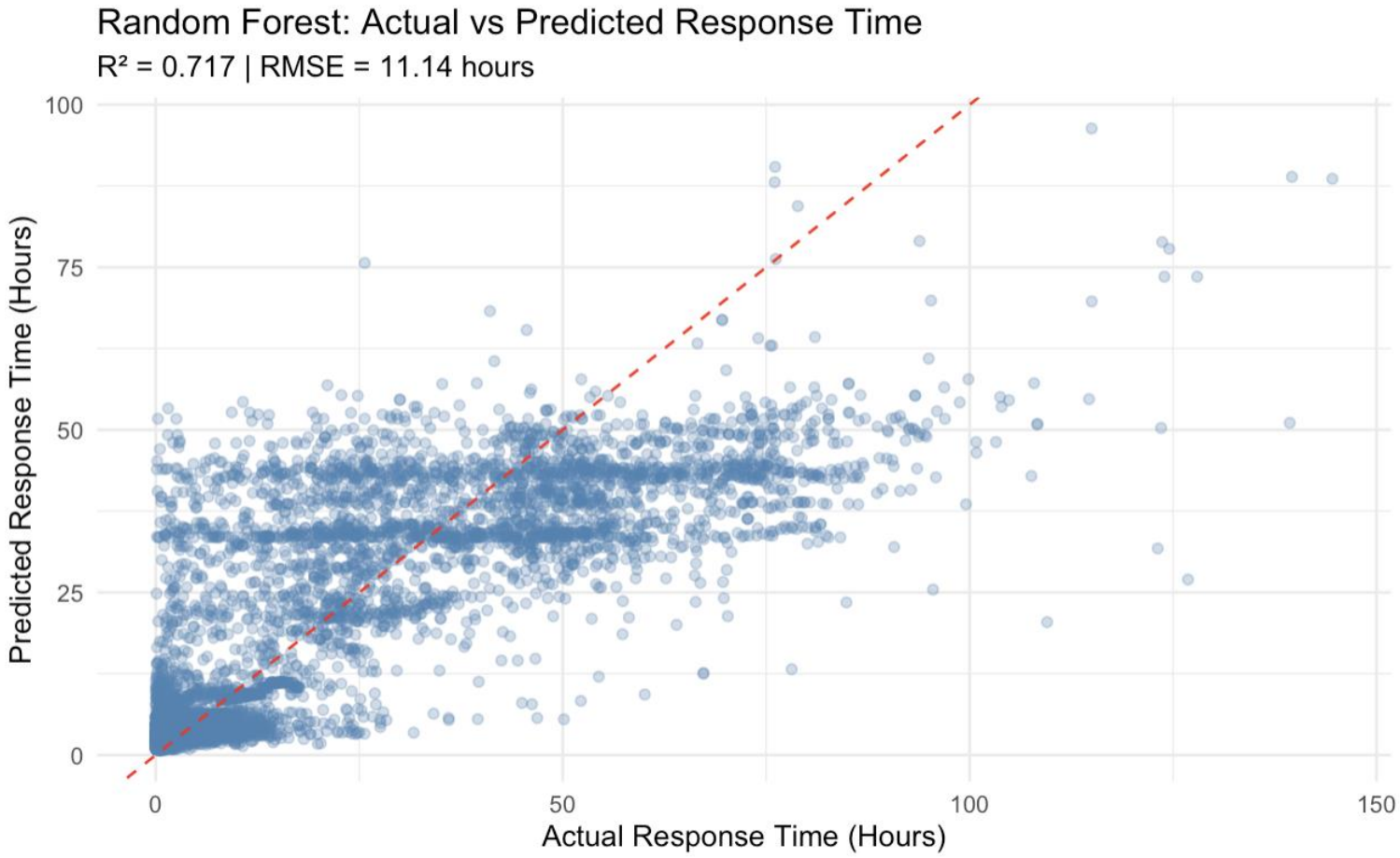
Response Time by Borough



Response Time by Borough

- Response times vary considerably across NYC boroughs.
- Queens and the Bronx demonstrate the most consistent service, with tight interquartile ranges and median response times under 10 hours.
- In contrast, Manhattan and Brooklyn show substantially higher variability—Manhattan has the widest spread in typical response times, while Brooklyn recorded the longest individual delays (exceeding 240 hours).
- Staten Island falls in the middle, with moderate variability. All boroughs exhibit outliers extending beyond 100 hours, indicating that while most 311 requests are resolved efficiently, a subset of cases across the city experience significant delays warranting further investigation.

Analyzing Random Forest Data



Predicting Response Time with Machine Learning

R^2 = 0.71

71% of the variation in response time can be explained by my model's predictors (complaint type, borough, hour, day of week, month).

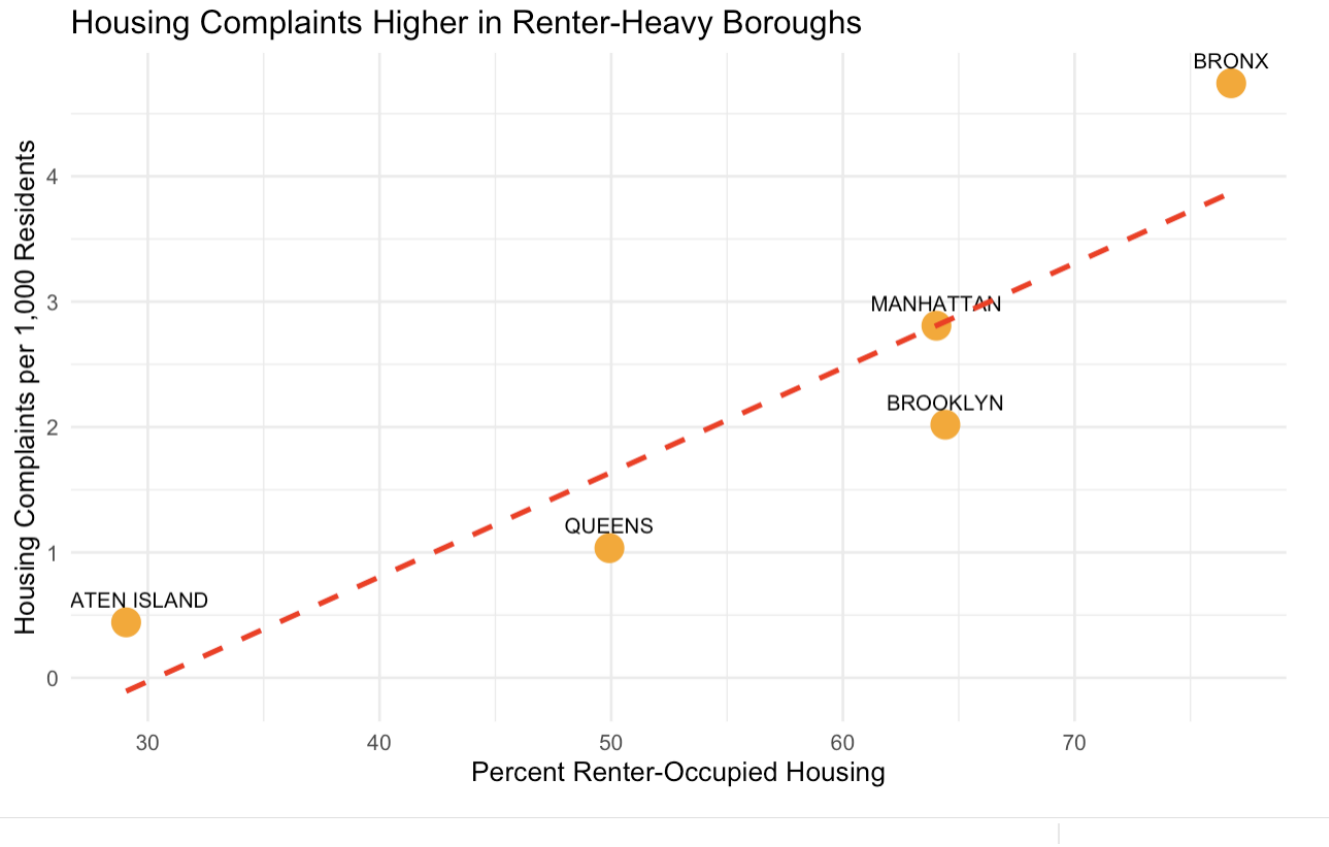
An R^2 of 0.71 is strong for real-world municipal data. The remaining 29% of unexplained variance comes from factors not in your dataset

RMSE = 11.14 hours

Predictions are accurate within approximately 0.46 days(about half a day) sufficient for operational triage and resource planning.

Do Lower Income Boroughs File More Complaints

Housing Complaints vs. Renter Occupied Housing



Biggest Challenge

- The biggest challenge I had in completing. This code was learning how to build, update and modify a Shiny app. The process felt similar to developing a User Experience(UX) application which is quite a challenging feature.

- My second challenge was developing meaningful insight from the data. I used three API's in this project and only one from NYC open data allowed me to get a max of 80000 data points. Since 311 gather thousands of service calls in a day, 80,0000 data pints approximates to a few data of data. With the variety of visualizations, I was able to with trial and error develop meaningful plots.

Presenting a solution

Shift Needed from reactive complaint processing to targeted, data-informed resource allocation

Predictive Resource Allocation

- Data scientists can build models to forecast complaint volumes before they occur, enabling proactive staffing.

Targeted Intervention Strategies by Borough

- The response time disparities between boroughs suggest operational inefficiencies that can be addressed.

311 SHINY APP

An interactive look at important 311 with a borough focused analysis

References

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