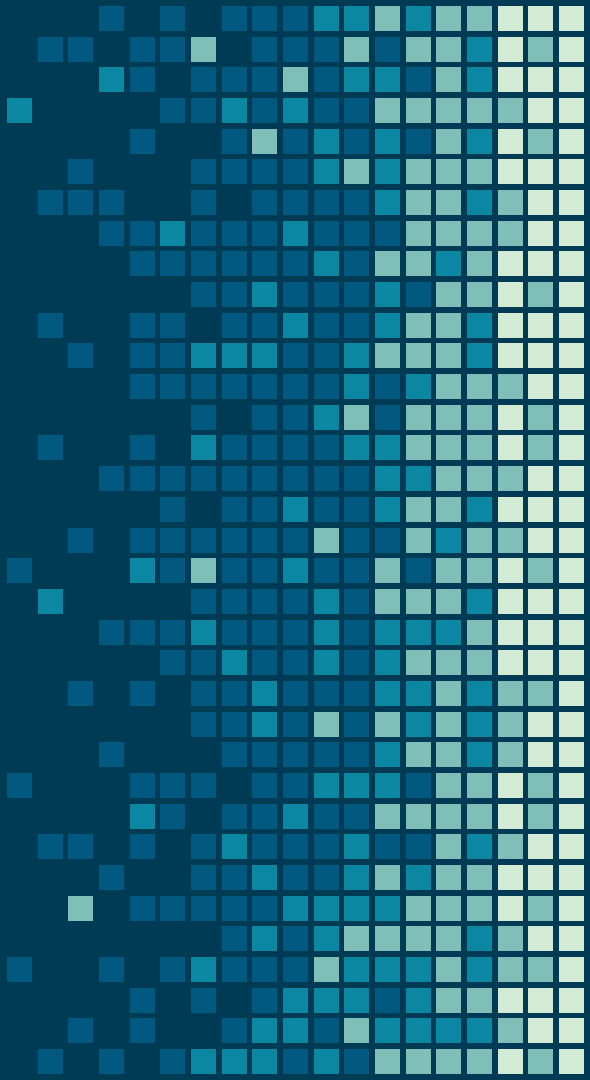
Police Data Challenge
Baltimore

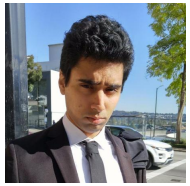
Barinder Thind, Matthew Reyers, Brad Smallwood, Ryan Sheehan

Simon Fraser University, Burnaby, Canada



Introduction

Our Group
We are a group of fourth year statistics students studying at Simon Fraser University. We're participating in the Police Data Challenge as part of our Learning from Big Data course.
We are excited to present an original model that can help Baltimore make informed decisions about police and emergency personnel allocation.


Barinder Thind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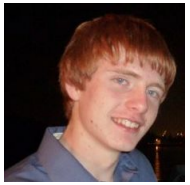

Ryan Sheehan

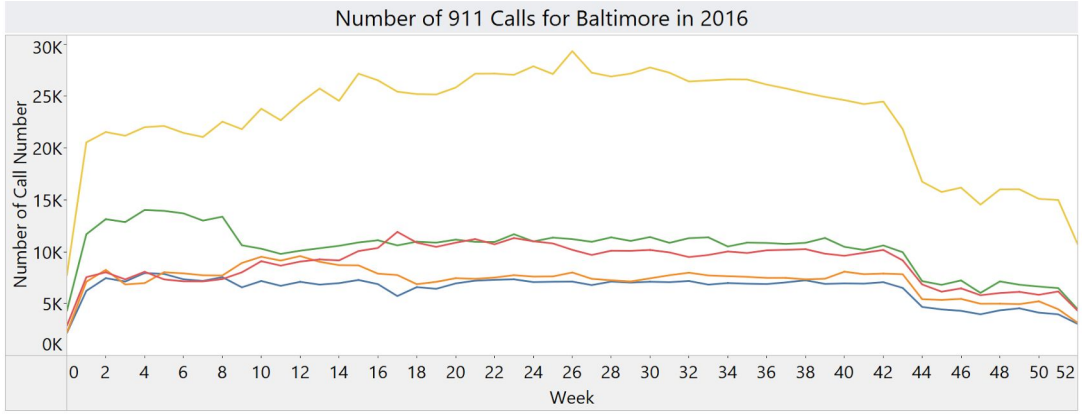
The Problem

Predicting the Proportions of the Priority Levels

Emergencies cause panic and distress for anyone involved because of their unpredictable nature. Car accidents, heart attacks, and many other events happen without warning. The best solution to these problems then, since they cannot be prevented, is quick and effective response.

If we can build a model that focuses on understanding what proportion of 9-1-1 calls will be for specific priority circumstances, we can better understand the staffing needs and deployment of resources at a district level. This should in turn improve the performance of emergency personnel and public safety.

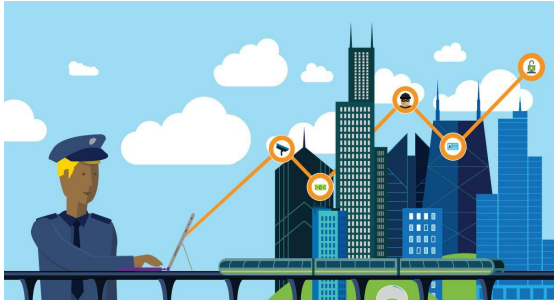
Data Exploration



https://public.tableau.com/views/BaltimoreData_Exploration/DataExploration?:embed=y&:display_count=yes

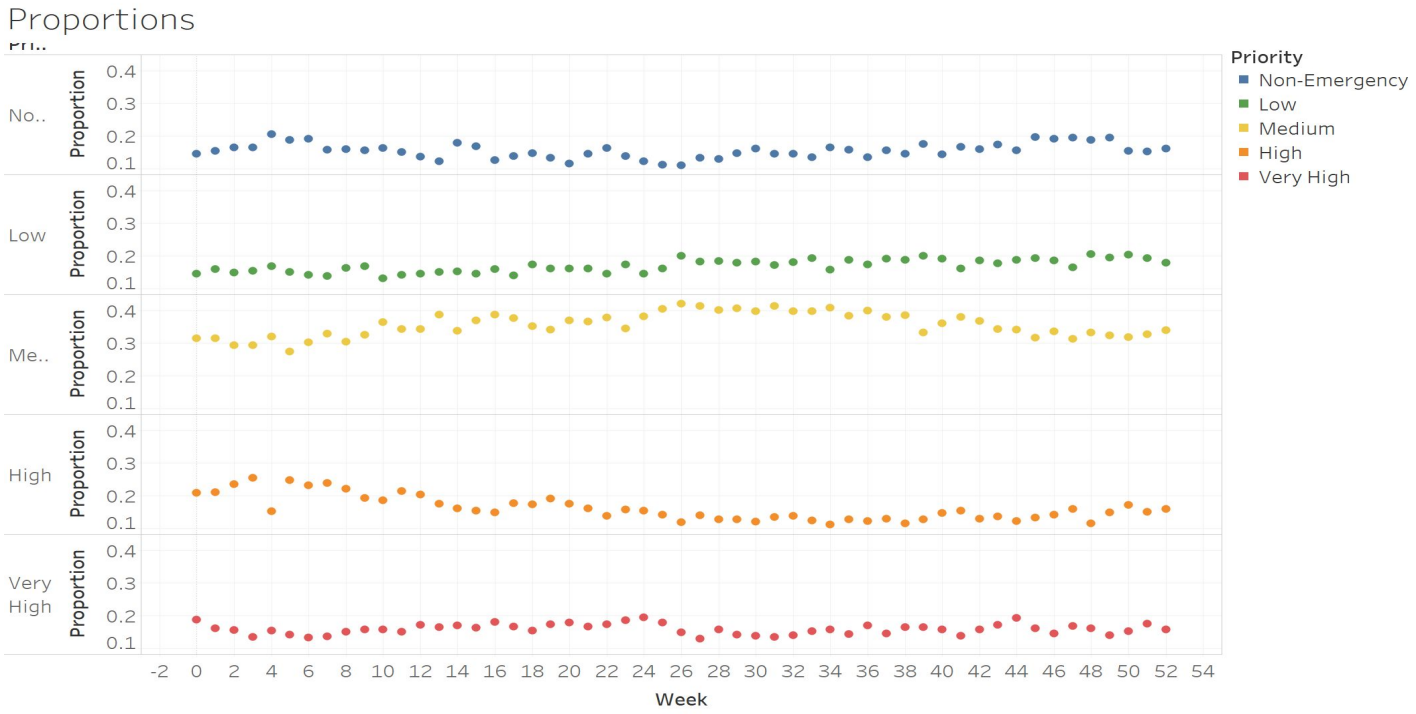
Our Solution

Our solution can be categorized as **Functional Data Analysis.** This means that we view our data, separated into weeks, as functions. Using these weekly functions, we can describe interactions over time and build a model to predict future priority distributions.



This process enables us to predict priority distribution on a weekly basis across all of the districts. By comparing the proportions of the districts, the results can be used to **determine which districts will require more personnel** in a given week.

Proportions of Priorities



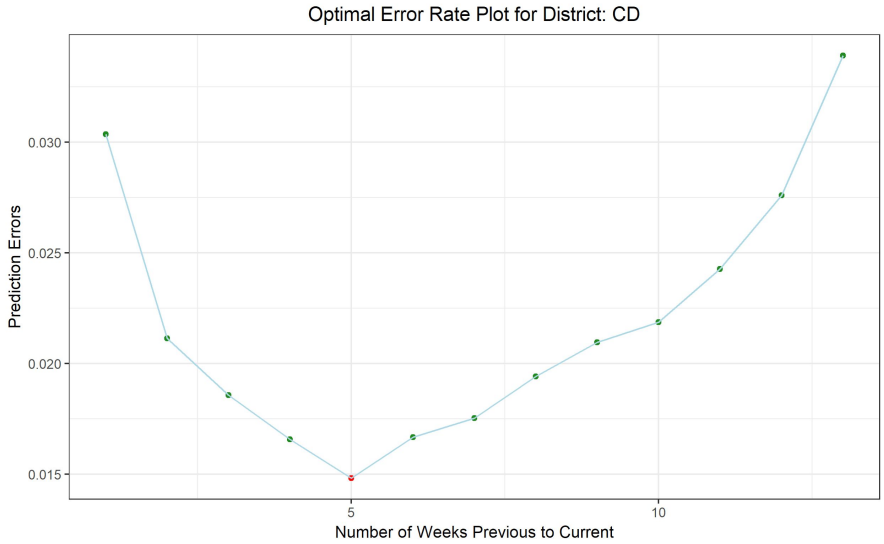
Week vs. Proportion broken down by Priority. Color shows details about Priority. The data is filtered on Year and District. The Year filter ranges from 2016 to 2016. The District filter keeps SE. The view is filtered on Priority and Week. The Priority filter excludes Emergency and Out of Service. The Week filter ranges from 0 to 52.

https://public.tableau.com/views/Proportions/Proportions?:embed=y&:display_count=yes

The Optimal Number of Weeks

Our analysis explored the temporal relationships that exist between the weeks.

We found that each district can be best explained by using the information from the previous 4-6 weeks, dependent on the district.



We demonstrate this in the graph above with data from the CD district of Baltimore. This graph shows that the prediction error (a measure that we want to be small) attains its minimum on week 5. This means that the data for the 5 weeks immediately prior to the current week provide the optimal prediction accuracy.

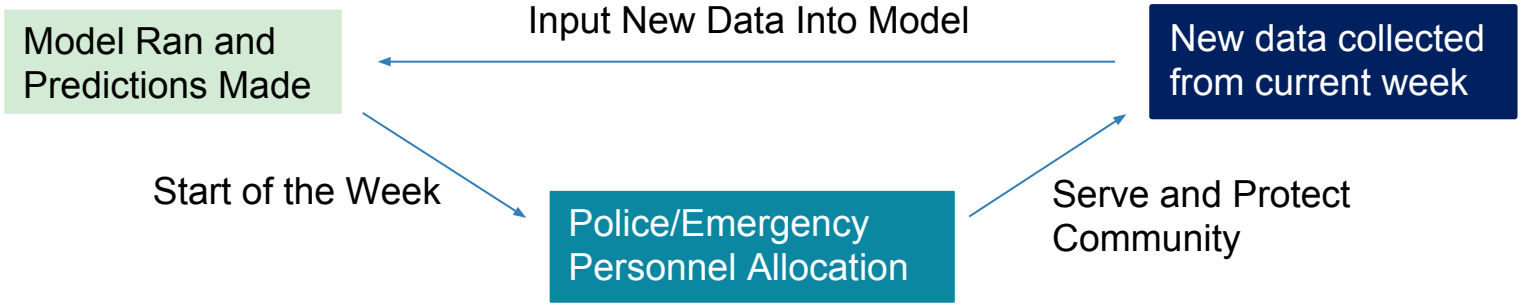
Predicting the Next Week

The table below indicates what a weekly prediction could look like. Predicting for week 26 of 2016 (using weeks 21-25 as the lagged weeks), the chart below contains our predicted proportions for each priority as well as the prediction error across each district.

Priority/District	Non Emergency	Low	Medium	High	Very High	Prediction Error
CD	0.1447	0.2036	0.2321	0.2216	0.1940	0.0005834
ED	0.1608	0.2031	0.2276	0.2160	0.1913	0.0007541
ND	0.1673	0.2029	0.2151	0.2128	0.2034	0.0001621
NE	0.1656	0.2002	0.2197	0.2148	0.2027	0.0001444
NW	0.1843	0.1960	0.2063	0.2090	0.2126	0.0002849
SD	0.1766	0.1933	0.2039	0.2097	0.2087	0.0005932
SE	0.1738	0.1978	0.2086	0.2119	0.2123	0.0007406
SW	0.1789	0.1999	0.2101	0.2076	0.1979	0.0001039
WD	0.1605	0.1965	0.2151	0.2159	0.2121	0.0006286

Applications

Our model allows for emergency personnel and police officers to be better allocated and maximize their impact on Baltimore communities.



This model can be written to automatically update and make predictions on the following week. These predicted proportions, as demonstrated, will have a high accuracy and will therefore provide Baltimore with useful information pertaining to their allocation of police officers and emergency personnel. For example, if some district is predicted to have a higher number of “high” priority calls in an upcoming week, more police officers can be distributed there so that district is better prepared.

SAFER COMMUNITIES

Informed Decision Making

Our solution is low cost and low maintenance, extracting its value from the data already being collected. The results would foster a better relationship between the public and the emergency personnel of the city using the model. Baltimore, or any other city, can improve the safety and well-being of their communities through the implementation of this algorithm!