POLICE: Stop & Search Data

Information Visualization

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1 Introduction

Police are arguably one of the pillars of a peaceful and righteous modern life. They are responsible for various types of law enforcement to protect modern society's citizens.

Sometimes, in order to protect the rights of the majority, police need to violate the rights of certain individuals, such as the right to privacy and freedom of movement. These types of operations are often referred to as "stop and search" processes which should be carried out only if the violation is reasonable, appropriate, and legal. However, certain police forces are abusing their authority.

Through this assignment, we tried to approach this issue from a data-driven standpoint. The data we used was provided by the London Metropolitan Police. We tried to offer a visualization tool that could be used by police professionals in order to improve their operations. We covered three main goals related to possible biases the police officials could have; comparison based on ethnicity, gender, and age, temporal analysis, and geographical analysis.

2 Visualization Design

In this section, we describe our dashboard design with explanations of visualization techniques, interaction methods, and motivations regarding the domain of the visualization through the three main goals stated.

2.1 Visualization Techniques

Our visualization design was influenced by the three goals we already mentioned; comparison based on ethnicity, gender, and age, temporal analysis, and geographical analysis. With these in mind, we wanted to use visualizations complex enough so our users which are police officers can draw meaningful conclusions from them, but also simple enough that they would feel inclined to

actually use them. Thus we chose the following two types of graphs for our visualizations.

Bar charts. As we were dealing with many categorical variables for the group analysis, we decided to use bar charts. They present categorical data well with rectangular bars of length proportional to the values they represent. Initially, we were planning to use horizontal bar charts but in the end went with vertical ones because they were more readable. Other than for the categorical variables, we also used these for displaying temporal variables.

Maps. As each stop and search included an approximate location, we decided to show them with a map. Maps offer an opportunity to catch geographical operational biases which can then be directly mapped to certain police stations and plans to improve the operations can be easily designed.

2.2 Interaction Methods

We covered multiple interaction methods, either implemented by ourselves or already covered by the toolkit we used, *plotly*. These include:

Clicking. Users are able to choose which information is displayed. Both on the top level of choosing which of the three topics to explore and the bottom level of choosing which information is shown on each individual graph. Top level clicking is implemented as a tabbed structure and the bottom level clicking is implemented as buttons or dropdown menus.

Scrolling. Users can scroll across individual tabs in order to explore all the different graphs.

Hovering. Once a user is focusing on an individual graph, more information is displayed when hovering over certain graphical elements by mouse. This feature could be used even more extensively in the future, especially in the map visualizations to display other facts about a certain stop and search.

Selection. Users can draw a box over a graph area they want to focus on. The selected area is then displayed in a zoomed manner.

Zooming. In map graphs, zooming in and out is possible to enable the user to display more details in a specific point on the map.

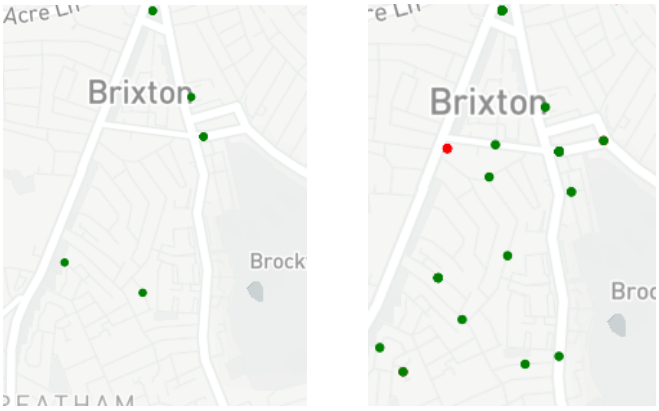
Panning. Also in map graphs, panning allows users to sweep the map in different directions by clicking and dragging, enabling the user to move around different areas on the map.

2.3 Domain Relevant Insight Examples

Although briefly explained in the previous section, we wanted to provide an example of domain-relevant insight that can be drawn from our dashboard.

One could notice patterns when inspecting specific neighborhoods. For example, in figure 1 we can see people of black ethnicity are being targeted more than

people of white ethnicity around Brixton. This of course is not a clear sign of discrimination but is an insight that could be further inspected by police officials.



(a) performed on people of white ethnicity

(b) performed on people of black ethnicity

Figure 1: Stop and searches around Brixton

3 Visualization Implementation

Our final solution consists of three main parts which are visually displayed by three tabs: Group Analysis, Geographical Analysis, and Temporal Analysis.

In the Group Analysis tab we have data visualized in bar plots. There are three bar plots, each for the purpose to filter data by a different mean: Ethnicity, Gender, and Age. Bar plots display the number of people in each group which is also broken down into how many of them have been charged with a crime or not. Since the total number of people in a group varies, there is also a number indicating a percentage of crime or no crime charges. There is also an option to view just the cases that were or weren't charged with a crime by choosing an option from a dropdown menu.

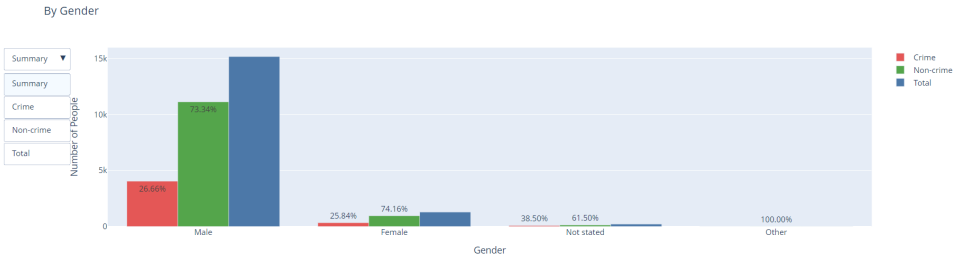


Figure 2: Bar plot in Group Analysis

Geographical Analysis is split similarly. Here we can choose what group we want to see on the map and each case is colored depending on whether they were charged with a crime or not. In addition to previously stated group filters, there is also a filter for Legislation.

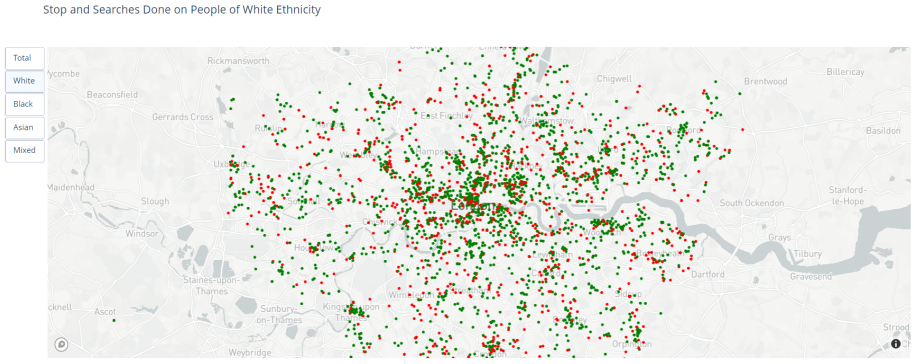


Figure 3: Map in Geographical Analysis

In the third tab dedicated to Temporal Analysis we have visually displayed data in bar plots. The first graph shows us how crime charges varied throughout the whole timespan. Since the dataset is from a one-month span we can see how the crime charges changed depending on the time of the month. The second graph grouped dates by the day of the week, this way we can see how crime rates changed for example depending on whether it was a working day or weekend. Lastly, the third graph grouped the dates by the hour of the day. Just like in the Group Analysis, there is an option to view just the cases that were or weren't charged with a crime by choosing an option from a dropdown menu.

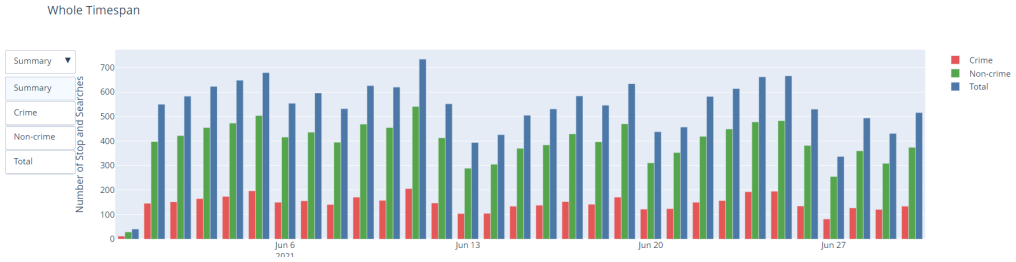


Figure 4: Barplot in Temporal Analysis