Information Visualization Final Project Report
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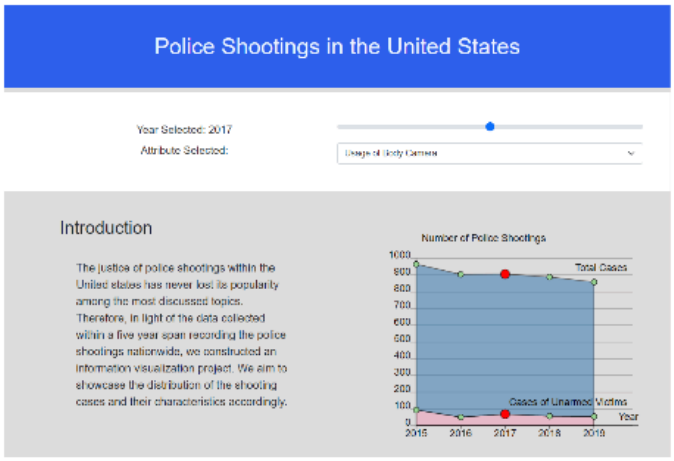
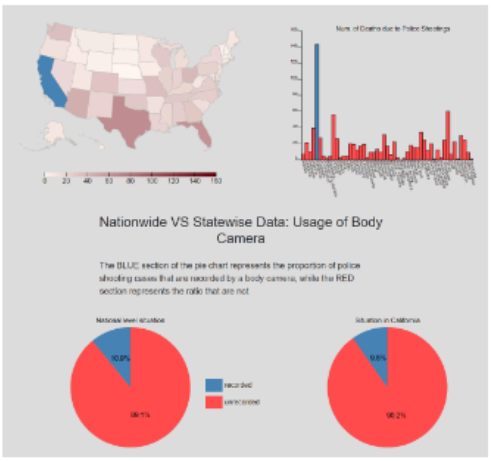
Overview

Law enforcement justice and police violence have long been popular topics in the United States, especially after the incident of George Floyd. Being one of the countries that have the most police shooting records in the world, how to contain the abuse of law enforcement while maintaining its efficacy has long been the discourse within the country. Therefore, at the very center of the debate is whether racism plays a role in police' decision of firing. At the same time, the intensity of police shootings implies more possibilities of getting involved in a local turmoil, so it is important to understand the geological trend of such cases.

To investigate the issues above, we obtained a police shootings record in the US from 2015 to mid-2020. We implemented a visualization system that helps people monitor the time trend and the geological distribution of police shootings in America. What's more, our system is able to let users choose multiple views that illustrate the certain characteristics of the criminal and the cases related, including whether the shooting process is recorded by a body camera, the ethnicity distribution of criminals, and how many unarmed victims are shot by the police in the incidents. Combining these analyses, insights into police firing decisions could be made and users could make a judgment on how these characteristics are affecting the impartiality of law enforcement. The screenshot below shows the layout of our visual solutions.





Description of the data

The dataset we obtained is from Kaggle by author Ahsen Nazir, which is called *US Police Shooting*. It is a geometry dataset that contains time series features as it contains approximately 5000 cases of police shootings in the US from 2015 to mid-2020 with several attributes describing the scenario of shootings. It has a daily time scale and a state/city-wise geometry scale. Apart from the date and the location of the incident, each record contains demographic information of the criminal (such as age, ethnicity, and gender), and several

descriptions of the firing scenario (such as whether the police turned on their body cameras, whether the criminal is armed with weapons, and whether the criminal fled). We grouped the records according to the years and the states they happened in. Number of total national cases each year was fed into the area chart. For all the states, the number of total cases and the cases where unarmed victims were shot was fed into the map visualization and the bar chart. Finally we calculate the number of cases where body cameras are used and those cases that are unrecorded, the number of victims within each ethnicity group, and the proportion of unarmed victims within each ethnicity group, with respect to different states and different years. The results were fed into the tooltips and the pie/bar chart.

Goals and Tasks

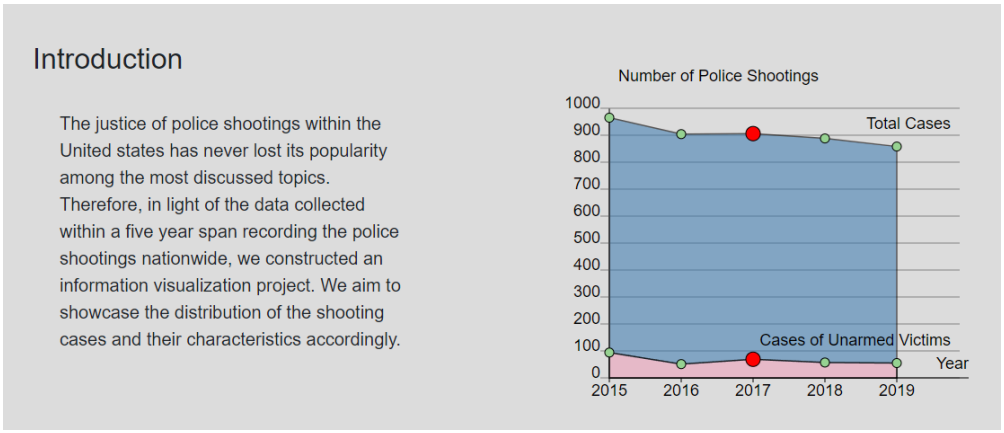
There are five visual solutions made to address the issues we are interested in as described in the first section. The descriptions are listed below:

1. Show the general trend of numbers of police shootings over the recorded years. In addition, we also hoped to illustrate the proportion and change of the number of cases where unarmed victims are involved to examine the shift of (possible) unnecessary firings. This task is completed using an area chart.
2. Show the geographic distribution of police shootings in the US. This is done by a geo map where a continuous colormap is implemented to highlight the intensity of police shooting cases in the local area. The map is linked with a bar chart. When the user hovers on a state, she will be able to see the specific number of cases and the name of the state through the bar chart.
3. Show if the local police follow the law enforcement procedures strictly. This is done by using two pie charts that highlight the proportion of cases recorded by a body camera vs. cases that are not, one at the national level of the selected year while the other at the state level according to users' selection.
4. Show the ethnicity distribution in the cases. This is done by using two pie charts that highlight the proportion of ethnicities among the cases, one at the national level of the selected year and the other at the state level according to users' selection.
5. Show the proportion of unarmed victims within each ethnic group to examine if there is a justice issue on the police's decision of firing. This is done by using two bar charts that highlight the proportion of unarmed victims within each ethnicity in the cases, one at the national level of the selected year and the other at the state level according to users' selection.

Visualizations:

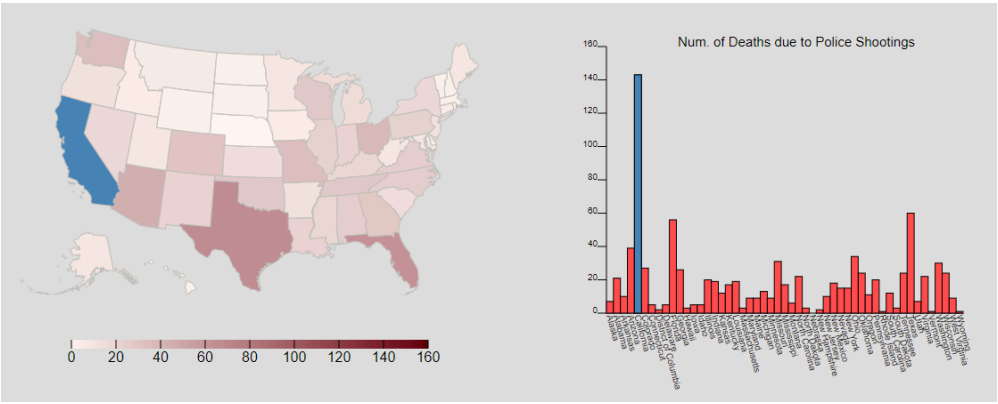
In order to implement the goals and tasks addressed in the previous section, we decided to use 4 different views, including the stacked area chart, a geo map, a bar chart, and a set of pie charts/bar charts with tooltips. Below are the detailed descriptions of each view.

1. Stacked Area Chart



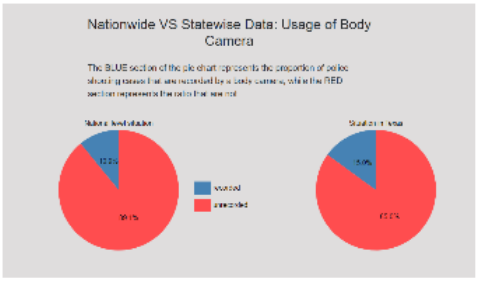
The stack area chart demonstrates the overall trend of police shooting cases during the recent 5 years. Users are able to hover over the dots to change the year they are viewing and this is linked with the year slider and other visualizations.

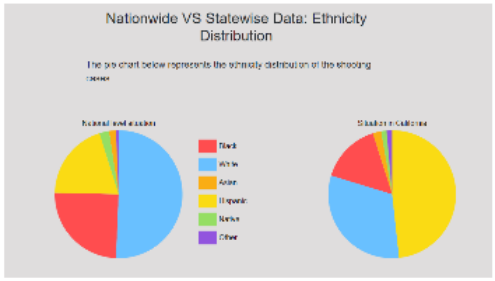
2. Geo Map & Bar Chart

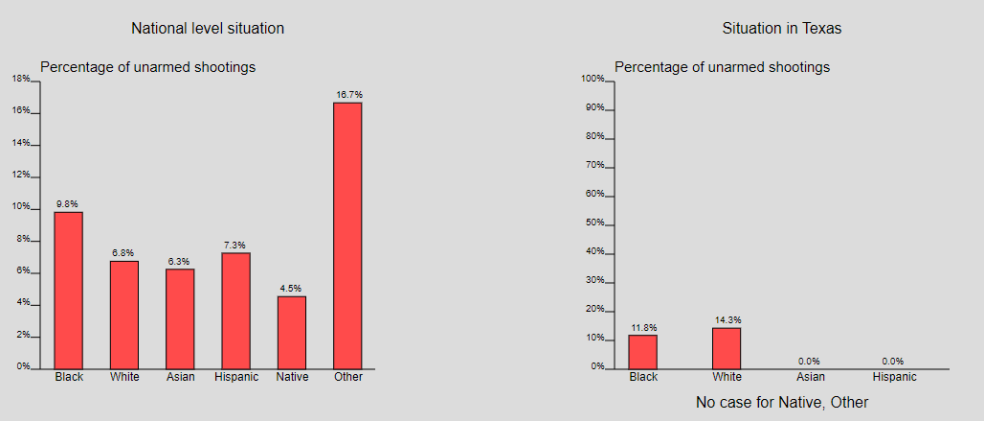


In order to show the spatial distribution of the shooting cases, we applied a geo map as well as a bar chart to both describe and quantify the data. Users are able to hover over different states, which are linked with the corresponding bar chart. Besides, they are able to drag the slider positioned at the top of the page to change the year that they are viewing.

3. Pie Chart/Bar Chart with Tooltip







Linked with the geo map and bar chart, the pie charts/bar charts are applied to demonstrate the comparison between national-level and state-level situations of 3 attributes, including the usage of body cameras, the ethnicity distribution, and the proportion of unarmed victims within each ethnicity group. Users are able to select the attributes in the dropdown menu at the top of our platform. In default, only the national chart is shown, with a note 'Hover over a state' to encourage users to select a state for comparison. When a state has no shooting case for an ethnic group, a message will be shown at the bottom to inform users of the group's absence from the chart.

Reflections:

In retrospect of our development process, we did encounter some issues that hinder our progress. This includes how to put map onto our platform stood in our way when we tried to visualize the national distribution of shooting cases; the drawing of the stacked area chart took us a long time to figure out the structure of the data passed into the path tag in svg; the connection between pie charts and the geo map seemed more complicated than we had previously expected… to name just a few.

Fortunately, the rich resources online and offline, the frequent communication between team members, and the timely assistance we received from Professor Gu, all contributed to our successful overcoming of the issues we met during the development process. Overall speaking, the final project deliverables have almost aligned with our initial visualization design, which can be seen in the proposal that includes our initial sketch. The only difference is several position choices of texts and/or the charts.

In conclusion, our careful structuring as well as the practical design of the project are the main reasons that we avoided a large-scale change in the midst of the development process. We therefore were able to focus on solving the technical issues that we encountered, and a well-planned kick-off is the major lesson that we acquired reflecting on our whole project. Finally, we would like to extend our sincere gratitude to Professor Gu and all the resource providers online who offered us enormous support in the completion of this project.