Introduction to Data Science and Software Engineering Part: Data Science

Laboratory Task 1
US Gun Violence

Kasia Kopania 258342

Juliusz Szymajda 234769

Malwina Schonhofer 258348

Master CS&IT

20/10/2024

1.1. Introduction

The United State is vast and diverse, with each state having its own unique demographics, culture environment, social dynamics and financial context. This project undertakes the pressing issue that is landscape of gun violence, particularly homicide rates. This report aims to analyze processed data to assess the safety of United States, providing an insight into whether a high murder count is indicative of significant threat or simply a reflection of a larger population.
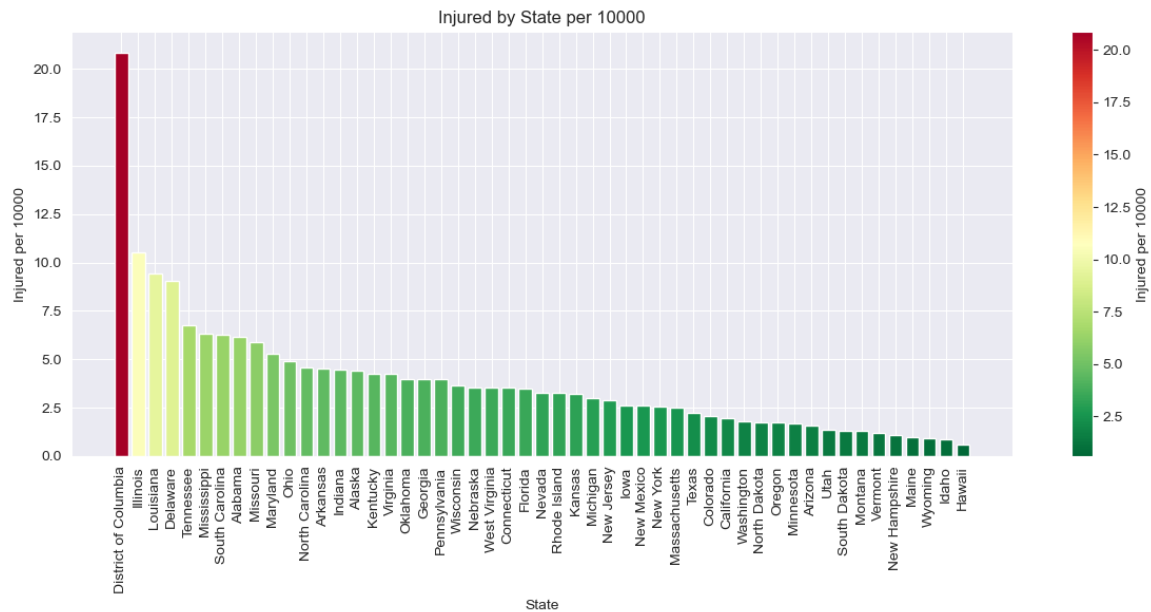
1.2. Which State has the Most Murders

This chart highlights the murder rate per 10,000 people across all the states of U.S., showcasing the significant disparities in incidents resulting in deceases of a victim. ***The highest murder rate at approximately 6.76 can be attributed to the District of Columbia, insinuating a severe level of gun misuse in comparison to other regions. Due to the fact that the District of Columbia functions as a federal district rather than a state, we decided to exclude this result from analysis. Therefore, following closely are Louisiana (4.67), Mississippi (3,93) and Alabama (3,86).*** On the opposite end, the record with the lowest murder rate is Hawaii (0,43), suggesting a potential correlation between the gun violence and local laws, socioeconomic conditions and community dynamics.
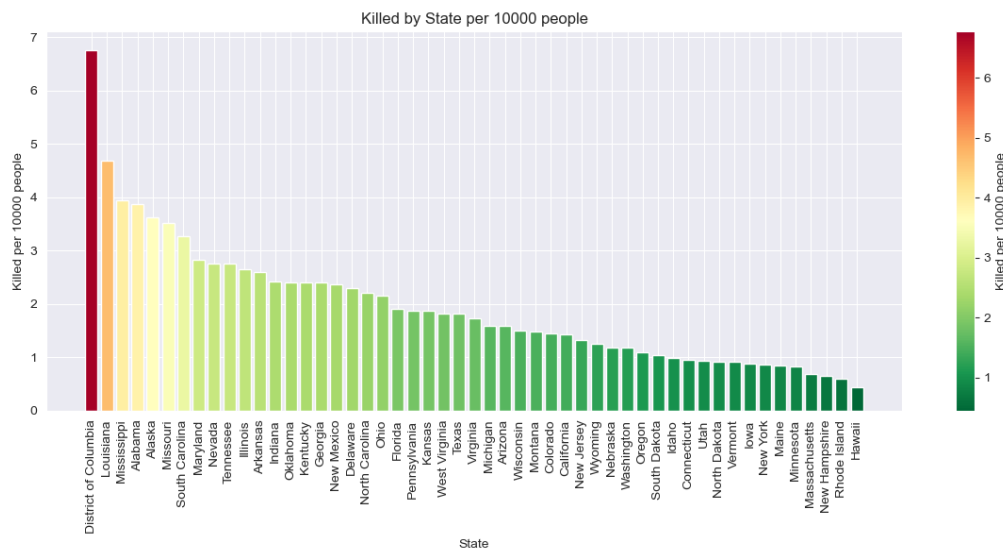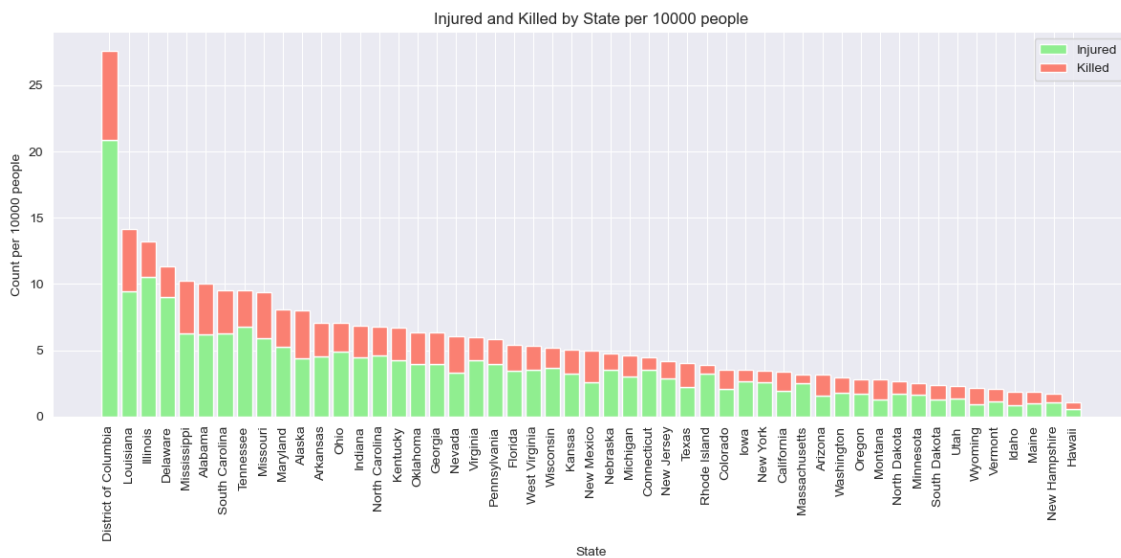
1.3. Which State has the Most Injured

The impact of gun violence extends beyond fatalities, with a significant number of individuals suffering injuries after gun incident. The state with the highest number of injuries is *Illinois (10.53), shortly following, Louisiana (9.44), Delaware (9.02)*. Once again, the state with the least number of injured is Hawaii (0.59).

1.4. Which State has the Most Rate of Affected (Injured and Killed)

The third chart in this section represents the number of injured and killed individuals per 10,000 people across various U.S. states. As can be noticed, the District of Columbia stands out with the highest numbers for both categories, reaching (27.62), thereby significantly surpassing all other states. As mentioned above, due to its outlier nature, this report excludes this result. Therefore, the highest rate is assigned to ***Louisiana (14.12),*** ***Illinois (13.19), and Delaware (11.32)*** with respectively concerning state of public safety. The lowest numbers of gun-related injuries and fatalities can be observed in New Hampshire (1.73) and Hawaii (1.04). This chart, as previous ones, assist in illustrating the stark disparities in gun violence across the United States. There can be noticed a correlation between gun violence and socioeconomic conditions. States, that are commonly known for higher rates of poverty and crime may see an increased gun violence.

Injured and Killed by State per 10000 people

1.5. Which State has the Most Rate of Affected (Injured and Killed) per 100 Square Kilometers

The next chart compares the rates of gun violence in these states, expressed as both injured and killed incidents per 100 kilometers. The highest rate is noticed in ***Delaware (21.20), New Jersey (19.46) and Maryland (19.32)***. Several factors may contribute to these trends, such as: urbanization, socioeconomic factors, legalization and law enforcement. In contrast Wyoming (0.04) and Alaska (0.04) showcase a significantly lower rates of gun violence, this disparity highlights the influence of geographical and demographic conditions. With lower population densities and different cultural attitudes towards firearms, these states are less affected by the types of gun violence seen in more urbanized states.

Injured or Killed per 100 square kilometers
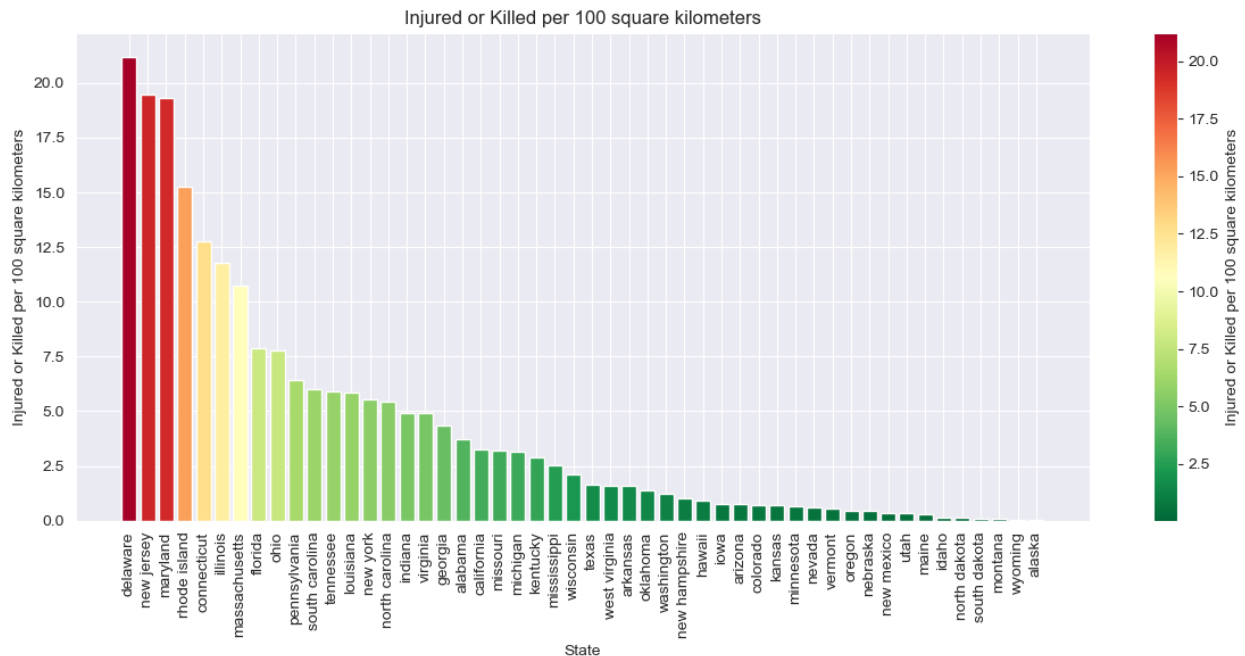
1.6. Distribution of Total Fatalities vs Population

This chart is a scatter plot that illustrates the relationship between a state's population, shown on the x-axis and the number of killed individuals, represented on the y-axis. Each purple dot on the chart corresponds to a certain state, with its position reflecting both the population size and the number of people killed. The x-axis ranges from 0 to around 40 million people, while the y-axis ranges from 0 to over 6,000 killed individuals. A red dashed line runs diagonally through the plot, representing a trend line that indicates a positive linear relationship between population and the number of killed individuals. This trend line suggests that as a state's population increases, the number of people killed tends to increase as well. As can be also noticed, most of the points cluster in the lower-left corner of the chart, indicating that the majority of states have relatively small populations and lower numbers of death occurrences. However, there are a few points located farther from the cluster, which represent more populous states that also experience a higher number of killed individuals. Additionally, a bubble plot was created to display the dimension of state size, showing that not only population but also geographic area can provide additional context when examining the relationship between population and the number of fatalities.

Scatter Plot of Killed vs Population

Bubble Plot of Killed vs Population (Bubble Size by Area)
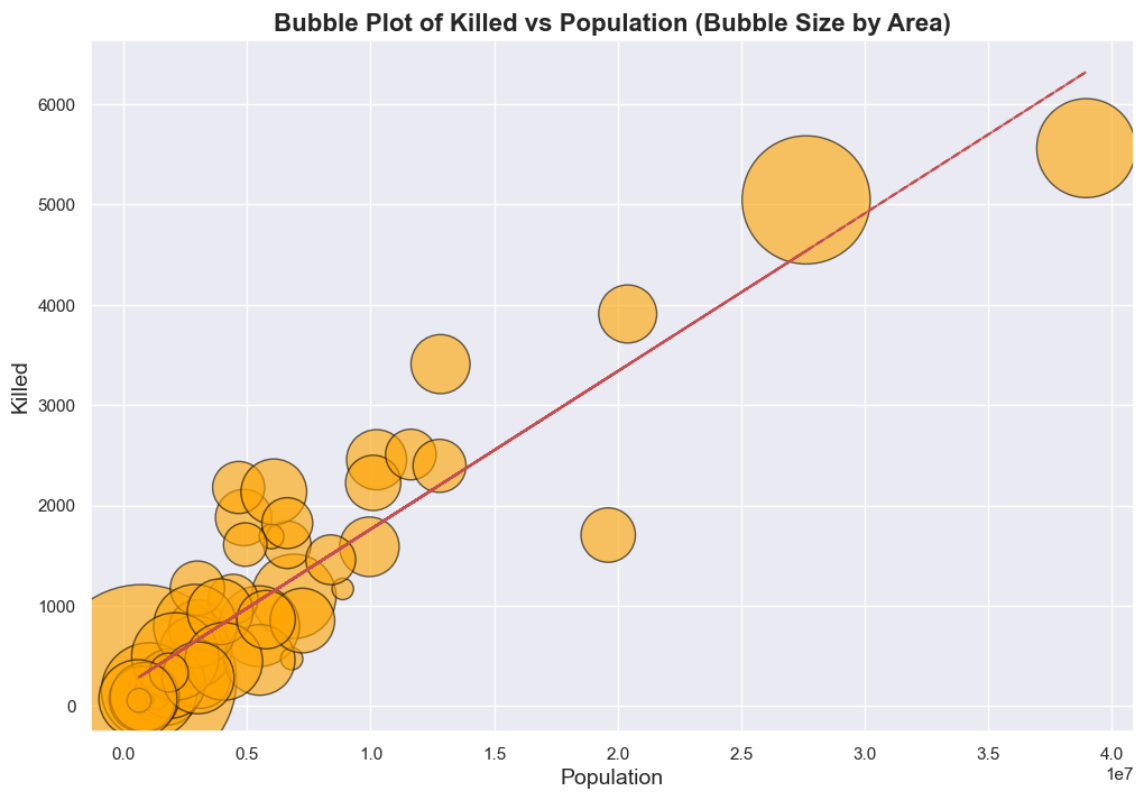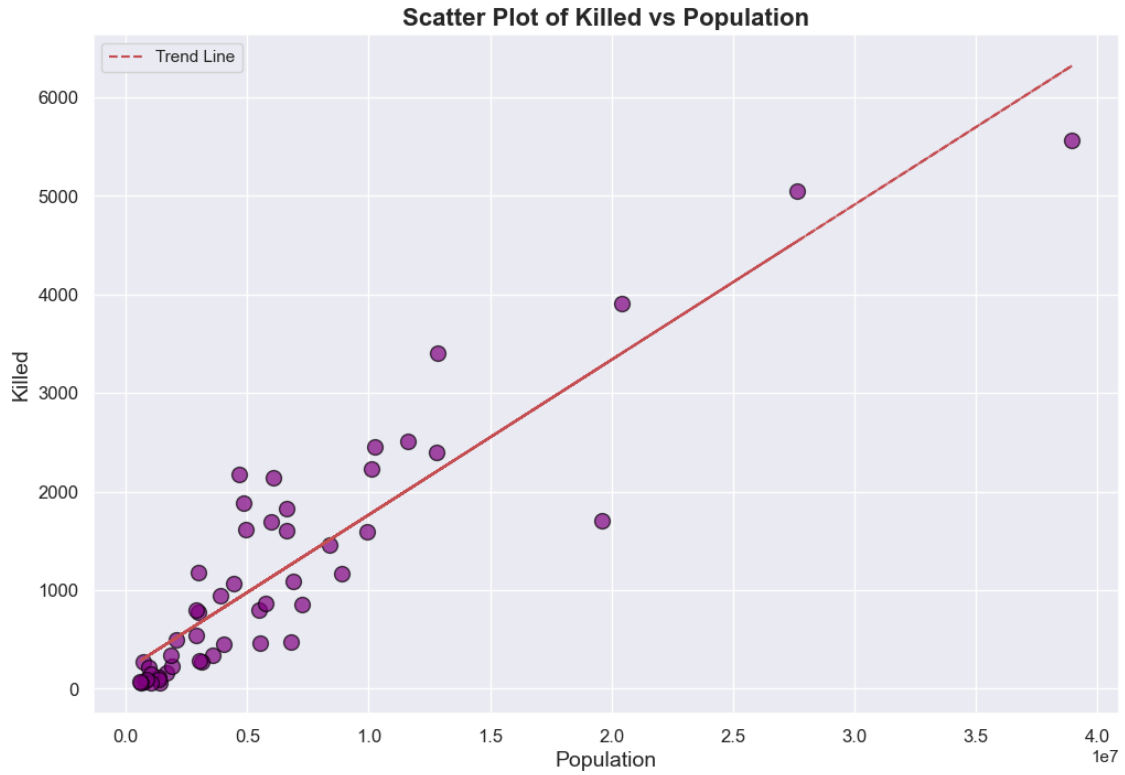
1.7. Distribution of Murder Rates on Choropleth Map

To better visualize the murder rates across the United States, a choropleth map was created that shows the number of people killed per 10,000 residents by state. The map uses a color gradient, where states with the lowest murder rates are shaded in green, while states with moderate murder rates are shaded in yellow to orange and those with the highest rates are filled in with red. Looking at the map, it can be observed that most states in the ***Northeast and Midwest, such as Vermont, Maine and Minnesota, are shaded dark green, indicating low murder rates, often below 2 per 10,000 people. In contrast, Southern states like, for instance Louisiana, which is shaded in orange, stand out with significantly higher murder rates, oscillating around 5 per 10,000. Other states located nearby, like Mississippi and Alabama also display relatively high murder rates, shown by their lighter green and yellow shades.*** An intriguing case worth mentioning is Alaska, which stands out as an anomaly on the map. Despite being a vast state with a low population density, it is shaded in yellow, indicating a moderate murder rate. Several factors may contribute to this unexpected level of violence. One significant factor is the prevalence of substances, particularly alcohol and drug abuse, which are known risk factors for violent crime. Other reasons could be high levels of poverty and unemployment as well as isolation and remote communities. In general, the South tends to have higher murder rates, possibly due to a combination of factors like higher poverty levels, less access to education and healthcare and historical crime trends. Meanwhile, regions like the Northeast experience lower rates of violent crime, which can be likely due to stronger gun control laws, more developed infrastructure and lower poverty rates. Hawaii (shaded dark green) reflects a very low murder rate, like many other states with higher levels of socioeconomic stability.

Killed Or Injured per 10000 Residents
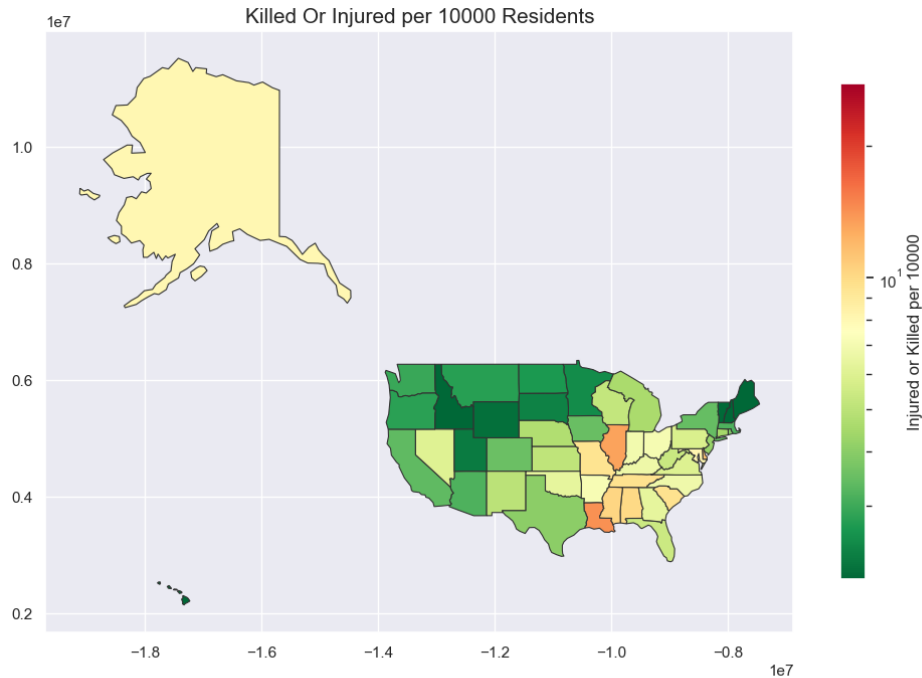
## 1.8. Which State is the Most Dangerous

To fully understand the danger level of gun violence in United States, we must first clarify the definition of gun violence. As for our case, what truly matters is the safety of our friend, therefore we wouldn't want him to get either injured or killed. Specifically, to include the variable of population size, the danger level is calculated using the following formula:

$$\text{Danger Level} = \frac{killed + injured}{population} \cdot 10000$$

By combining the total number of both individuals killed and injured, and then normalizing this figure relative to the population, we express the danger level per 10,000 people. This method provides us with the most standardized comparison across different states and regions, facilitating clear understanding of impact of gun violence.

To obtain the most reliable data for comparison, we gathered population statistics and gun violence figures from 2013 to 2018 for each state. After compiling this data, we calculated the average incidents over these years to ensure a more accurate representation of trends and patterns in gun violence across states.

To further enhance our analysis, we separated the states into four categories: Midwest, Northeast, South and West. This regional classification allows us to better identify geographic disparities in gun violence rates, providing insights into which areas experience higher or lower levels of incidents. Notably, our findings indicate that the South has the highest rates of fatalities resulting from gun violence, underscoring the urgent need for targeted interventions in this region.

Injured or killed per 10,000 Residents by USA Region
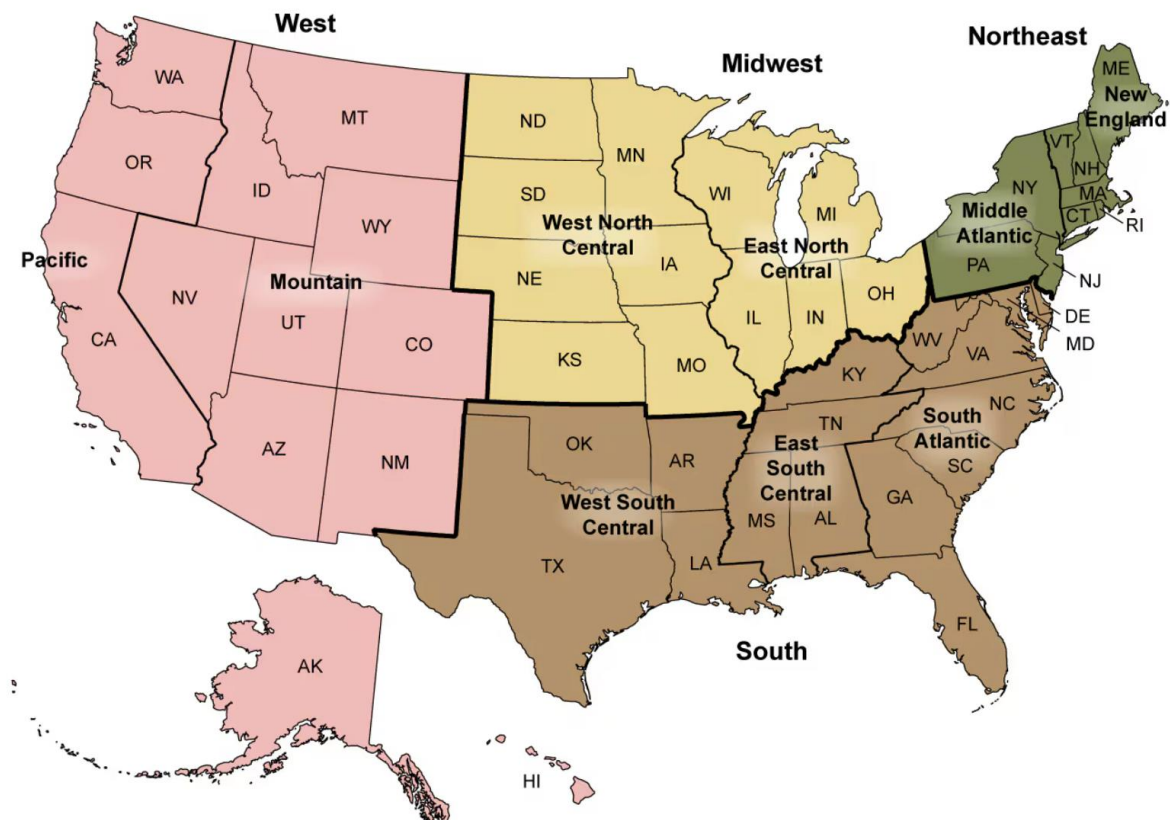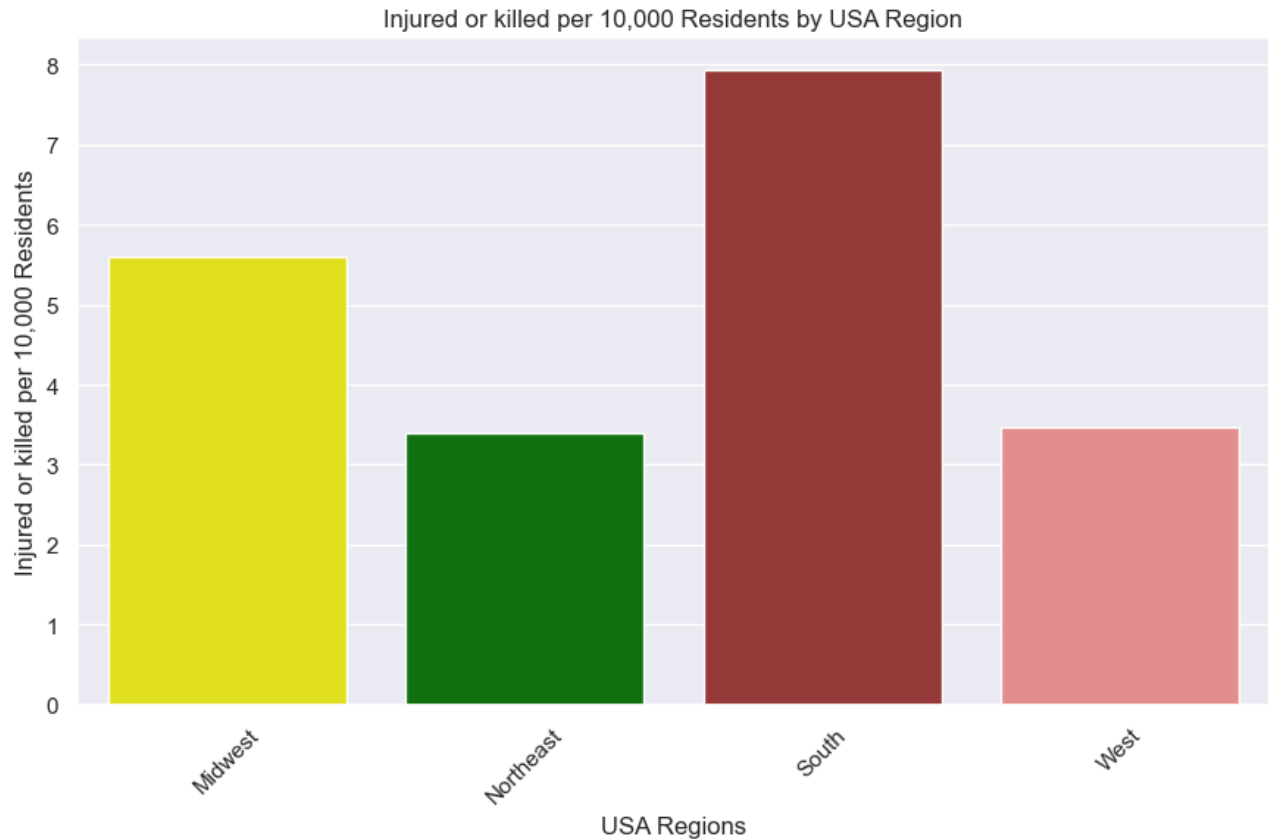
1.9. Conclusions

After preparing and analyzing various charts depicting murder and injury rates across the United States, clear patterns emerge regarding the safety of different regions and states. The data revealed significant geographical disparities in violence, influenced by a combination of social, economic and legislative factors. Firstly, the South stands out as the most dangerous region, with several states showing alarmingly high murder rates. **Louisiana (14.12), Illinois (13.19) and Delaware (11.32)** rank among the worst in terms of both murder and injury rates. This is likely influenced by more relaxed gun laws and higher poverty rates, contributing to the prevalence of violence. ***On the other hand, the Northeast and Midwest prove to be the safest regions in the U.S. States like Vermont (2.08), Maine***

(1.83) and Massachusetts (3.19) in the Northeast, as well as Hawaii (1.04) and California (3.38) in the West, consistently rank among the lowest in terms of murder and injury rates. These states benefit from stricter gun control laws, stronger social services and better economic conditions, which contribute to lower levels of violence. In summary, while the South faces significant challenges in controlling violence, having more relaxed regulations and economic difficulties, the West and Northeast show that a combination of effective legislation and economic stability leads to safer communities.

2.0. Data References

- Population Data - U.S. Census Bureau. (n.d.). *Annual estimates of the resident population for the United States, regions, and states: April 1, 2010 to July 1, 2019*. Retrieved October 20, 2024, from https://www.census.gov/data/tables/time-series/demo/popest/2010s-state-total.html