Introduction

Gun Background Check Data

> The dataset from The National Instant Criminal Background Check System (NICS) is managed by the FBI according to the Brady Handgun Violence Prevention Act of 1993 (Brady Act) -- fully implemented on Novemeber 30, 1998 -- and there are differences in state law in regards to requirements. Those that have valid ATF permits and for services and repair picked u by the same person don't require a background check. Data is collected with ATF Form 4473.

Types of background checks:

- Handgun—(a) any firearm which has a short stock and is designed to be held and fired by the use of a single hand; and (b) any combination of parts from which a firearm described in paragraph (a) can be assembled.
- Long Gun—a weapon designed or redesigned, made or remade, and intended to be fired from the shoulder, and designed or redesigned and made or remade to use the energy of the explosive in (a) a fixed metallic cartridge to fire a single projectile through a rifled bore for each single pull of the trigger; or (b) a fixed shotgun shell to fire through a smooth bore either a number of ball shot or a single projectile for each single pull of the trigger.
- Other(might want to drop columns or check if they are outliers)—refers to frames, receivers, and other firearms that are neither handguns nor long guns (rifles or shotguns), such as firearms having a pistol grip that expel a shotgun shell, or National Firearms Act firearms, including silencers.

Mass Shooting Data:

Information about mass shooting in america is from Stanford Mass Shootings in America, courtesy of the Stanford Geospatial Center and Stanford Libraries.

- Data Dictionary: https://github.com/StanfordGeospatialCenter/MSA/blob/master/Methodology/Stanford_MSA_Data_Dictionary.csv
- Github main page: https://github.com/StanfordGeospatialCenter/MSA

Questions

- Which type of gun background check is increasing the most in general and with time?
- What number of states have the highest number of mass shooting evens and for which type of gun?
- What are the most common motives by gun type?

```
# import packages
import pandas as pd
pd.options.display.float_format = '{:,.2f}'.format
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
```

Data Wrangling

[ ] ↳ *38 cells hidden*

Exploratory Data Analysis

> The goal of this analysis overall is to explore the background check data in regards to states, times, and specific types of background checks. The exploration of the mass shooting data will explore the types of guns involved in shootings, including by state, and connections with the type of gun and motivations.

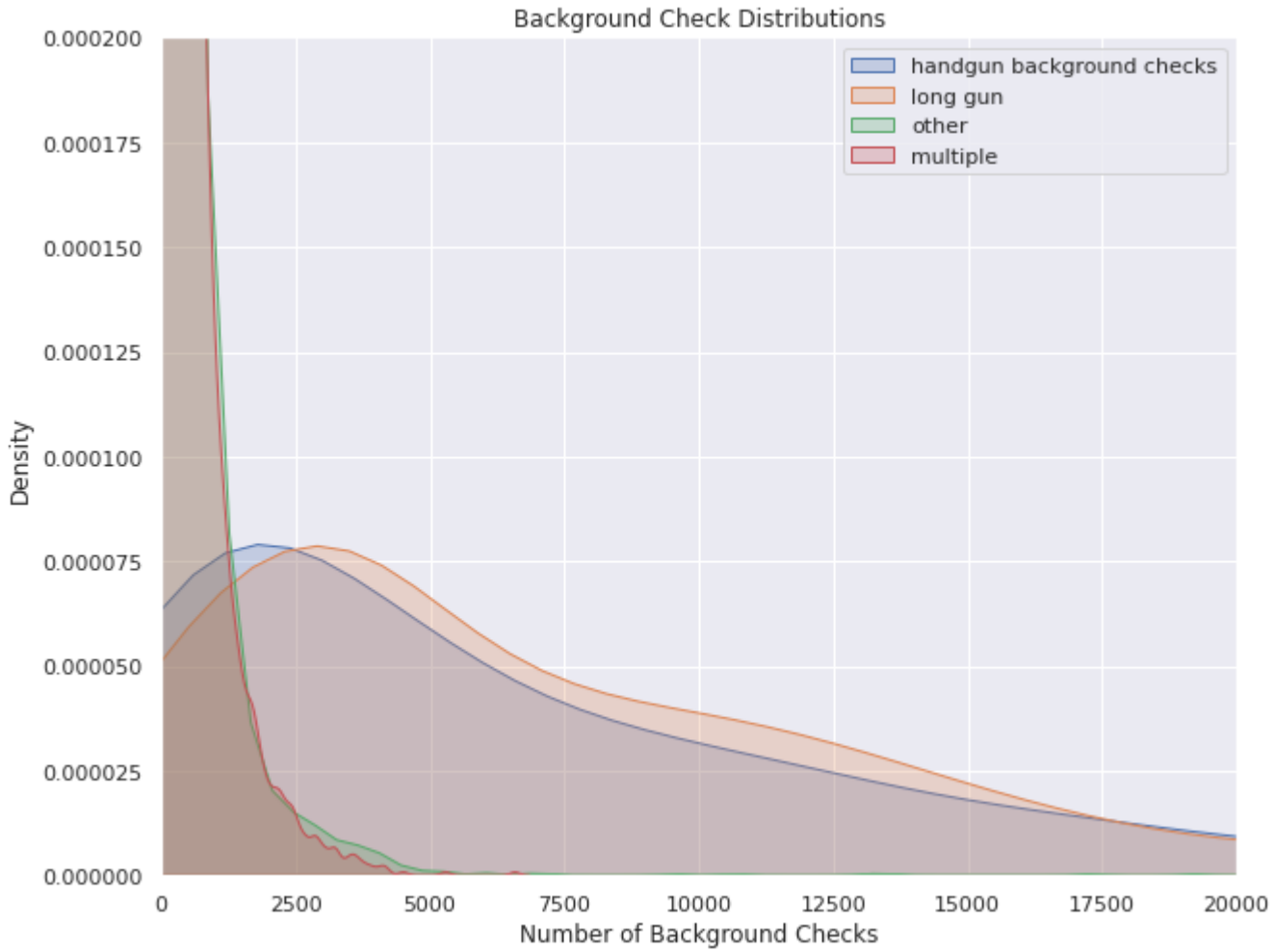
Which type of gun background check is increasing the most in general and with time?

```
# get some basic stats on gun_background checks
gun_background_check.describe()
```

	handgun	long_gun	other	multiple	totals
count	5,500.00	5,500.00	5,500.00	5,500.00	5,500.00
mean	8,874.54	8,666.89	360.47	341.19	30,603.89
std	11,180.00	10,204.22	1,349.48	512.89	43,380.59
min	0.00	0.00	0.00	0.00	0.00
25%	1,589.75	2,604.00	17.00	14.00	6,804.00
50%	4,947.50	5,697.00	121.00	172.00	17,624.00
75%	11,777.00	11,565.25	354.00	447.00	36,419.50
max	107,224.00	108,058.00	77,929.00	6,582.00	541,978.00

```
# plot distributions of the various types of background checks
sns.set(rc={'figure.figsize':(10,8)})
sns.kdeplot(gun_background_check['handgun'], label='handgun background checks', shade= True);
sns.kdeplot(gun_background_check['long_gun'], label='long gun', shade= True)
sns.kdeplot(gun_background_check['other'], label='other',shade= True)
sns.kdeplot(gun_background_check['multiple'], label='multiple',shade= True)
plt.legend()
plt.xlabel('Number of Background Checks')
plt.title("Background Check Distributions")
plt.ylim(0,.0002)
plt.xlim(0,20000)
```

```
(0.0, 20000.0)
```



From the graph, the multiple and other background check categories are close to zero while handgun and longgun are similar in distributions, but need to explore how these values vary for different times and states

```
# Use rolling average to smooth out the graph below for handguns
gun_background_check['7year_rolling_avg_handgun'] = gun_background_check.handgun.rolling(7).m
```

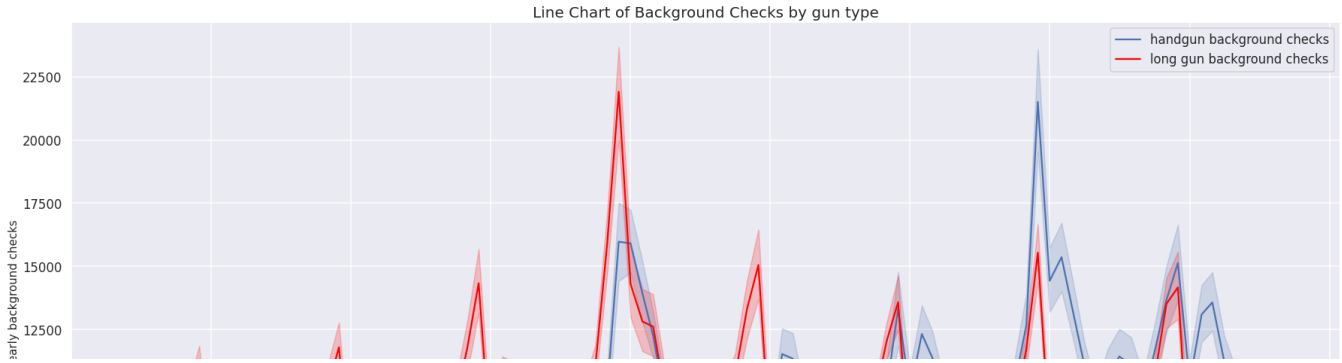
```
# Use rolling average to smooth out the graph below for longguns
gun_background_check['7year_rolling_avg_longgun'] = gun_background_check.long_gun.rolling(7).


# check to see if rolling_avg columns were added to the Dataframe
gun_background_check.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 5500 entries, 0 to 5499
Data columns (total 9 columns):
 #   Column                     Non-Null Count  Dtype         
---  ------                     --------------  -----         
 0   month                      5500 non-null   datetime64[ns]
 1   state                      5500 non-null   category      
 2   handgun                    5500 non-null   float64       
 3   long_gun                   5500 non-null   float64       
 4   other                      5500 non-null   float64       
 5   multiple                   5500 non-null   int64         
 6   totals                     5500 non-null   int64         
 7   7year_rolling_avg_handgun  5494 non-null   float64       
 8   7year_rolling_avg_longgun  5494 non-null   float64       
dtypes: category(1), datetime64[ns](1), float64(5), int64(2)
memory usage: 395.0 KB
```

```
# Plotting handgun and longgun background checks with time
sns.set(rc={'figure.figsize':(30.27,13.27)}) # set figure size
sns.set_theme(context='talk') # set graph theme
sns.lineplot(x="month", y='7year_rolling_avg_handgun', data=gun_background_check, label='hand
sns.lineplot(x="month", y='7year_rolling_avg_longgun', data=gun_background_check, label="long
plt.xlabel("year", size=15)
plt.ylabel("yearly background checks", size=15)
plt.title("Line Chart of Background Checks by gun type", size=20)
```

```
Text(0.5, 1.0, 'Line Chart of Background Checks by gun type')
```

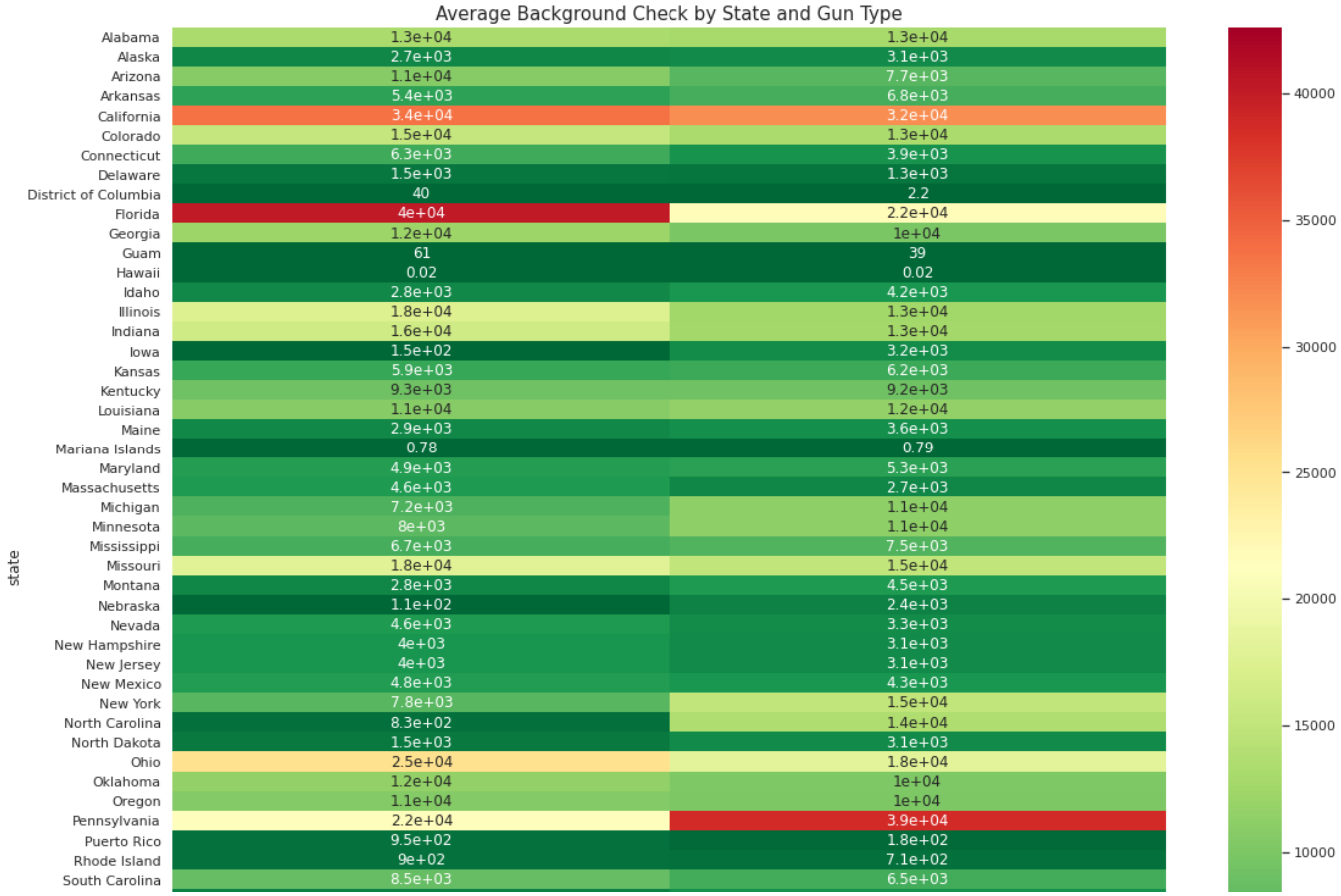


Largest peak background check numbers are around 2013 for longguns and 2015 for handguns. it might be interesting to know which states have these peaks and what polices/events where going on around that time, but thats not in the scope this analysis. So, need to look at how state's background check numbers vary by gun type

```
sns.set(rc={'figure.figsize':(18.27,16.27)})

sns.heatmap(gun_background_check.groupby('state') \
['handgun','long_gun'].agg('mean'),cmap='RdYlGn_r',annot=True);
plt.title("Average Background Check by State and Gun Type", size=15)
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:3: FutureWarning: Indexing
  This is separate from the ipykernel package so we can avoid doing imports until
Text(0.5, 1.0, 'Average Background Check by State and Gun Type')
```



The mean values in regards to handguns and longguns are:

1. Texas
2. Pensivania
3. Florida
4. California

It's nice to know the top states that have the highest number of background checks, this could be an indication of states that have a higher gun population or sales

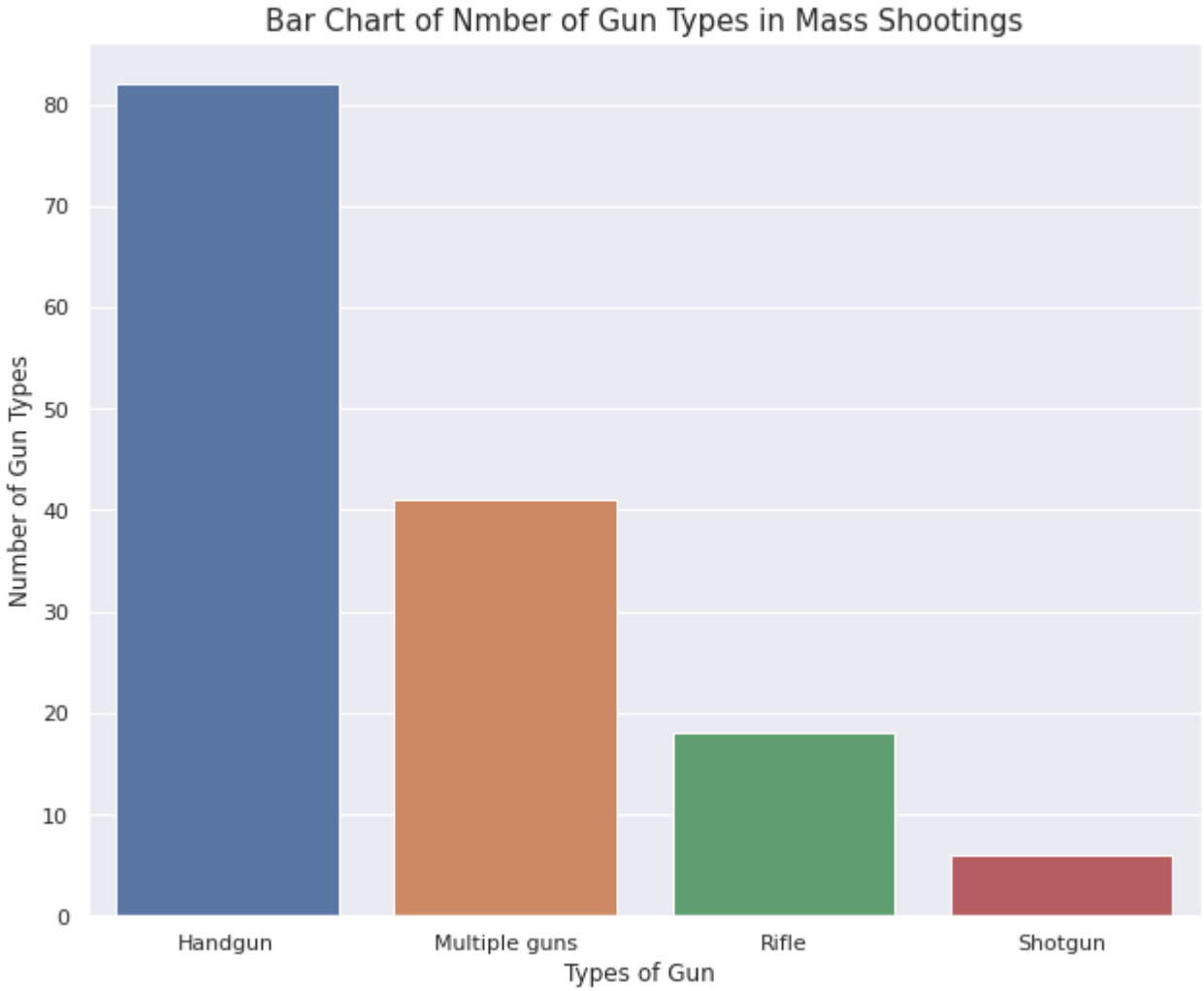
Yet, more detail can be taken from actual guns used in mass shooting incidents complied by Standford.

What number of states have the highest number of mass shooting evens and for which type of gun?

```
# Plot the type of gun
sns.set(rc={'figure.figsize':(10.27,8.27)})
sns.barplot(x=mass_shootings['Type of Gun - General'].value_counts().index, y=mass_shootings[
plt.xlabel("Types of Gun ", size=12)
```

```
plt.xlabel("Types of Gun", size=12)
plt.ylabel("Number of Gun Types", size=12)
plt.title("Bar Chart of Nmber of Gun Types in Mass Shootings", size=15)
```

```
Text(0.5, 1.0, 'Bar Chart of Nmber of Gun Types in Mass Shootings')
```



Above it is shown that single handguns are involved in the most amount of mass shooting incidents -- around 80, multiple guns, rifles, then shotguns.

The heatmap below is a graph of the mean of the number of handguns in the handgun category and multiple handgun categories

```
plt.figure(figsize=[14,12])

sns.heatmap(mass_shootings.groupby(['State','Type of Gun - General']) \
['Number of Handguns'].agg('sum').unstack('Type of Gun - General'),cmap='RdYlGn_r',annot=True
plt.title("Heat Map of Sum of Gun Types Verusu States", size=15)
```

```
Text(0.5, 1.0, 'Heat Map of Sum of Gun Types Verusu States')
```

The heatmap above is a graph of the mean number of gun types.

Looks like California has the highest number of handgun mass shooting with a handgun, but this is also seen in the multiple guns category as well followed by Texas, Arizona, Georgia and washington.

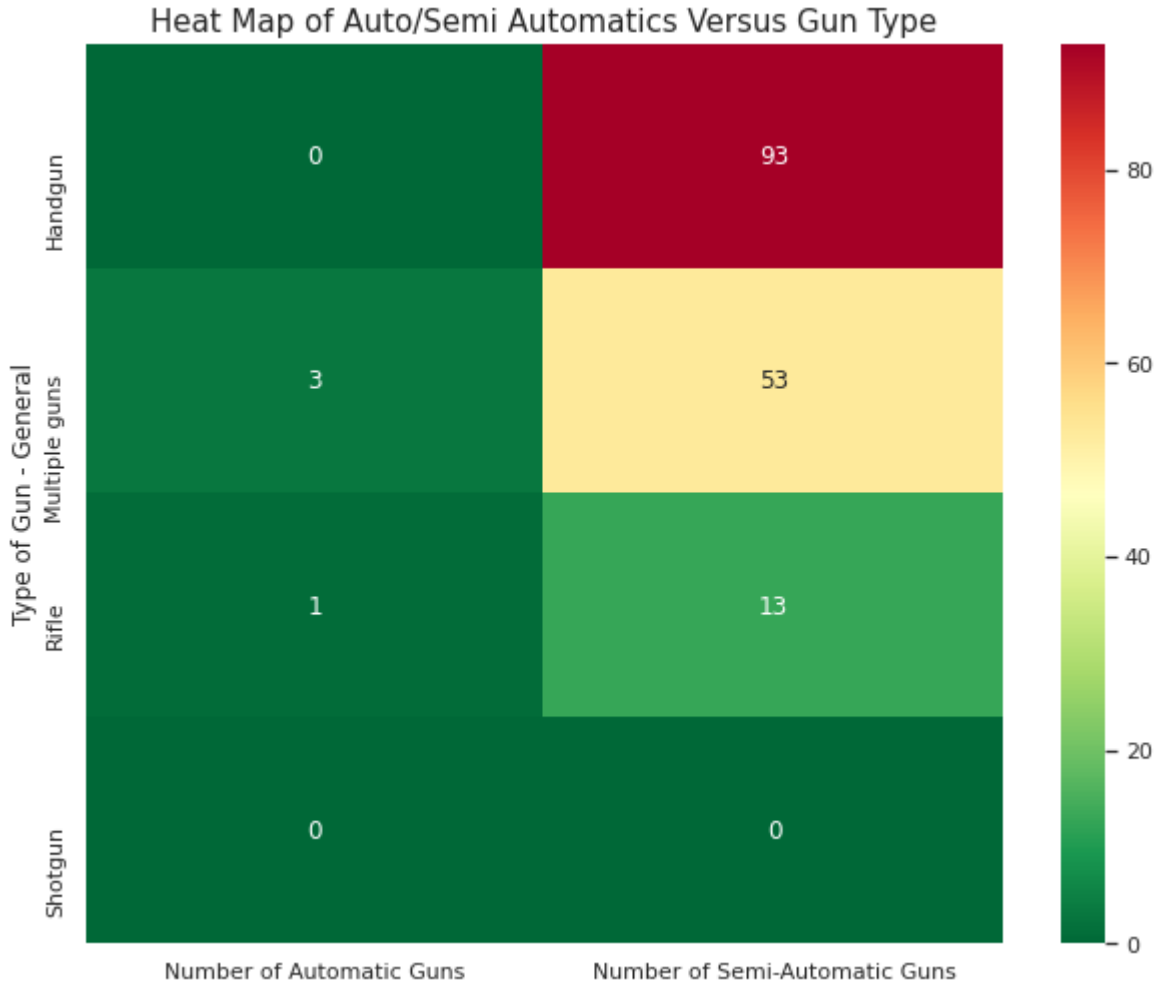
It's known that handguns are in the most mass shootings(which can include the multiple gun category) based on the standford database.

So from the graph it can be seen that handguns are first, followed by multiple guns, rifles and shotguns yet from a gun regulation standpoint, it would be helpful to have more detail in regards to

type of guns used.

```
sns.heatmap(mass_shootings.groupby('Type of Gun - General') \
['Number of Automatic Guns', 'Number of Semi-Automatic Guns'].agg('sum'),cmap='RdYlGn_r', ann
plt.title("Heat Map of Auto/Semi Automatics Versus Gun Type", size=15)
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:1: FutureWarning: Indexing
  """Entry point for launching an IPython kernel.
Text(0.5, 1.0, 'Heat Map of Auto/Semi Automatics Versus Gun Type')
```



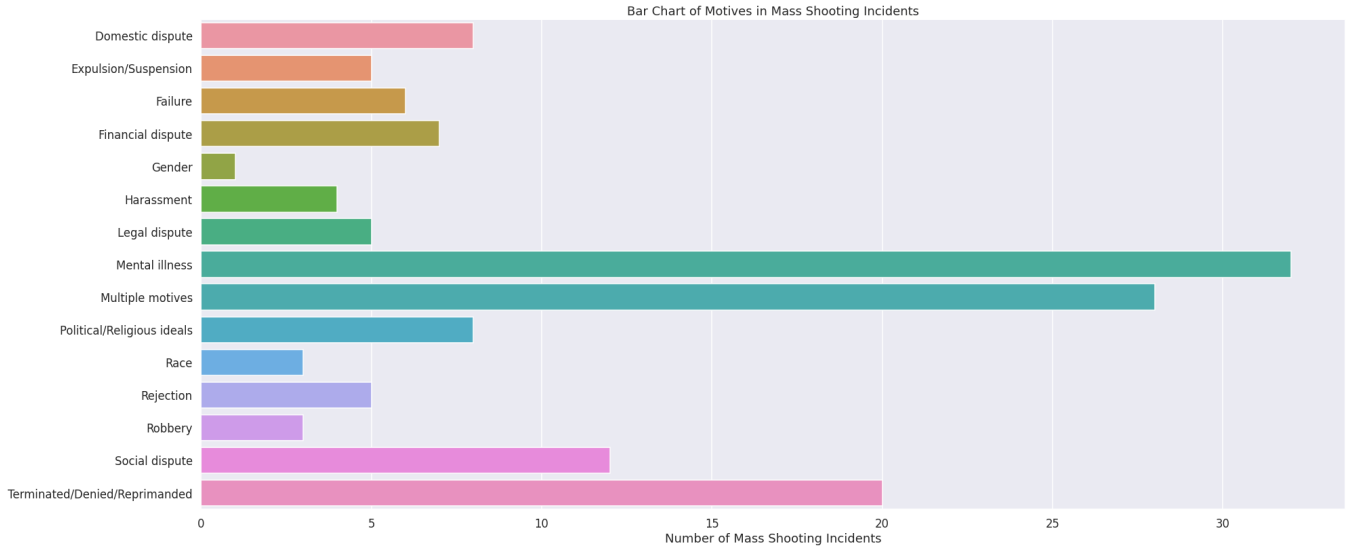
As you can see from the heatmap above, most semi-automatic guns involved in mass shootings -- according to data collected by Standford -- are handguns as well as some multiple guns(which can include handguns) and very few incidents of automatic weapons.

What are the Most Common Motives by Gun type?

```
# PLot the type of gun
sns.barplot(y=mass_shootings['Possible Motive - General'].value_counts().index, x=mass_shooti
plt.xticks(horizontalalignment="center")
plt.title("Bar Chart of Motives in Mass Shooting Incidents")
```

```
plt.xlabel('Number of Mass Shooting Incidents')
```

```
Text(0.5, 0, 'Number of Mass Shooting Incidents')
```

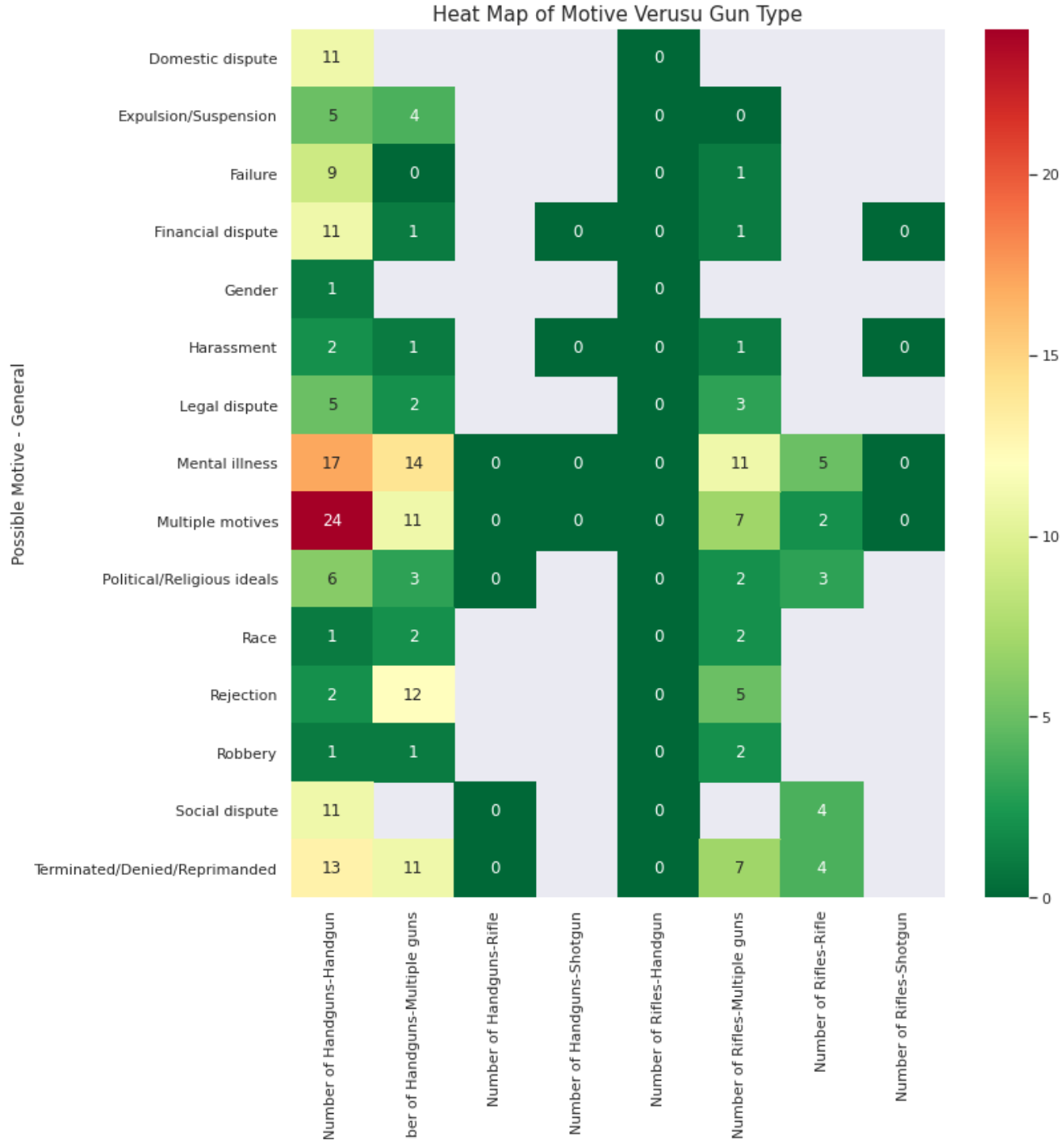


Looks like mental illness is the top causes with multiple causes in second, yet mental illness it more a concern when it comes to gun safety -- even background checks. It would be nice to know which motives were linked to a certain type of gun

```
plt.figure(figsize=[11,12])

sns.heatmap(mass_shootings.groupby(['Type of Gun - General','Possible Motive - General']) \
['Number of Handguns','Number of Rifles'].agg('sum').unstack('Type of Gun - General'),cmap='R
plt.title("Heat Map of Motive Verusu Gun Type", size=15)
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:3: FutureWarning: Indexing
  This is separate from the ipykernel package so we can avoid doing imports until
Text(0.5, 1.0, 'Heat Map of Motive Verusu Gun Type')
```



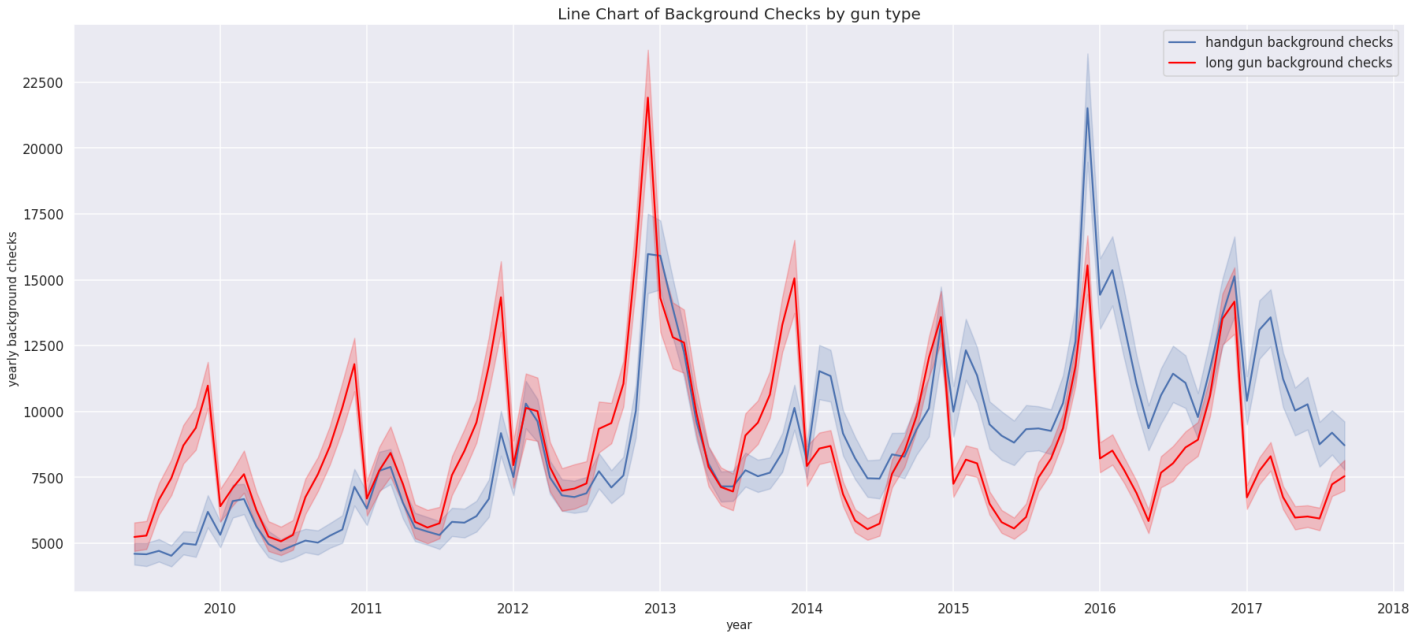
Looks like the number handguns and multiple guns used mass shootings are used by people with mental illness, multiple guns, or various disputes as seem in the heat map above.

bold text

Conclusions

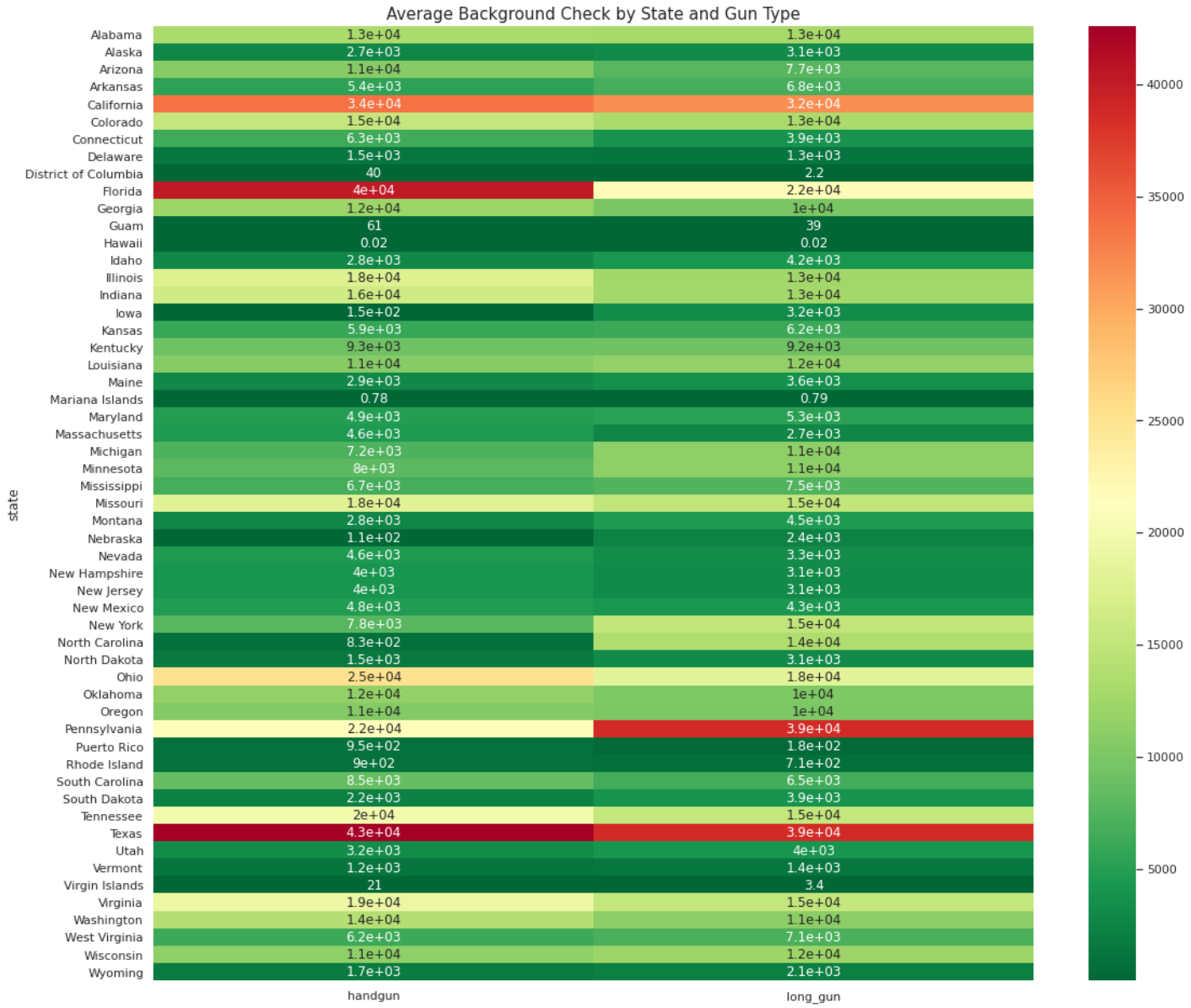
The goal of this project was to look at data trends of specific type of gun backround checks and features of the mass shooting database in regards type, number and motive of various gun background checks as a starting point for further exploration. No statistial methods were used in this analysis.

For the backgroung check data trends with time, there are peaks in 2013 and 2016 as seen in the graph below:



From the graph above we can observe the highest peak values at 2013 and 2016. It unknown from the data what may of caused these spikes. Yet, one factor could be policy changes such as the assault weapons ban in 2016, but investigating this is beyond the scope of the project

Next made a heatmap of the mean of gun background checks by state and type



the highest ones are California, Florida, Texas and Pennsuvania.

Next, explored the mass shooting data set and it was found out that handguns and multpile guns have the highest use in the mass shootings database using a bar graph and a heat map, California had the highest number of mass shootings using handguns. Also, that number of semi-automatic handguns(93) and multiple guns(53) were the most used, while only 4 automatic weapons were used.

In the motives section it was found that mental illness and multiple motives were found be with the highest number of shooting incidents, and specifically with use with handgus and multiple guns(as seen in the bar chart and heat map)

Since no statistics were used, no meaniful conparison with variables can be drawn. Yet, this exploration does start to paint a picture of types of guns, trends and characteristics seen in FBI background check data and the Standford mass shooting databases.

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