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Analyzing Crime Rates in Kansas, USA Using Machine Learning

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Kansas, USA Chapter

The problem

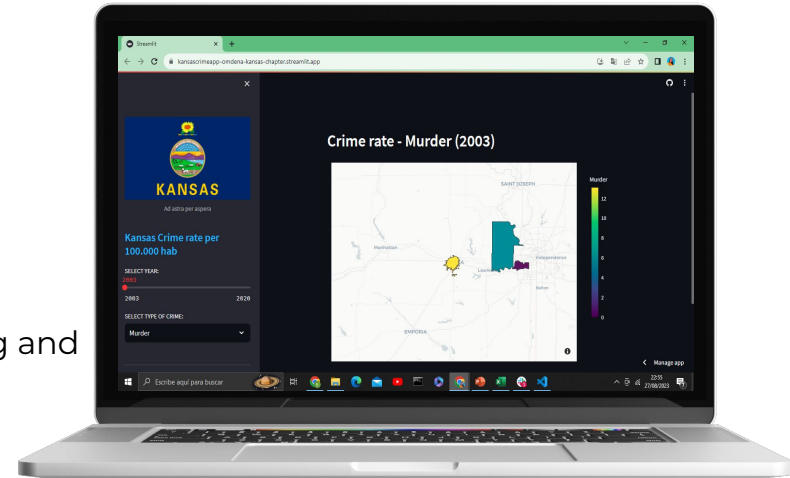
The state of Kansas is located in the Midwest region of the country, Northwest Central division.

Kansas has a population of approximately 2.9 million people and is known for its agriculture, aviation, and energy production. However, like any other state, Kansas has its share of crime problems, which include property crimes such as theft, burglary, and motor vehicle theft, and domestic crimes too.

In this project we want to determine which crimes have increased over time and which have decreased.

Project Goals

1. Analyze relevant data about victims, offenders, type of weapons, places and dates of the incidents.
2. Analyze crime rate by type: Murder, Arson, Motor vehicle theft, Theft, Burglary.
3. Compare the crime rate between 8 of the cities Most populous state of Kansas.
4. Predict the crime rate in Kansas, USA.
5. Create an application in Streamlit for forecasting and the comparison of the rate of crimes in the Kansas cities.



Data Collection

URL	Description
https://cde.ucr.cjis.gov/LATEST/webapp/#/pages/home	<ul style="list-style-type: none">Dataset from the NIBRS (National Incident-Based Reporting System).
https://www.statista.com/	<ul style="list-style-type: none">Poverty rates for the state of Kansas.
https://datacommons.org/	<ul style="list-style-type: none">Population records in the state of Kansas.
https://www.macrotrends.net/	<ul style="list-style-type: none">Crime rates by city.
https://fred.stlouisfed.org/	<ul style="list-style-type: none">Home vacancy and unemployment rate.
https://usafacts.org/	<ul style="list-style-type: none">Race and ethnicity records
https://datos.bancomundial.org/	<ul style="list-style-type: none">Inflation rate records.
https://apps.bea.gov/	<ul style="list-style-type: none">Personal income, and GDP information.

Our Process

WEEK 1

Research work and data collection

WEEK 2

Data pre-processing

WEEK 3

Exploratory Data analysis

WEEK 4

Model development and training

WEEK 5

Combine every collaborators findings and develop a final Streamlit web app.

Final Report.

Tools used

1. Web-scraping:

- Request
- OSMnx

2. Data Pre-processing & Manipulation

- Pandas
- Geopandas
- Datetime

3. Data Visualization

- Matplotlib
- Seaborn
- Plotly

4. Modelling

- Neural Prophet

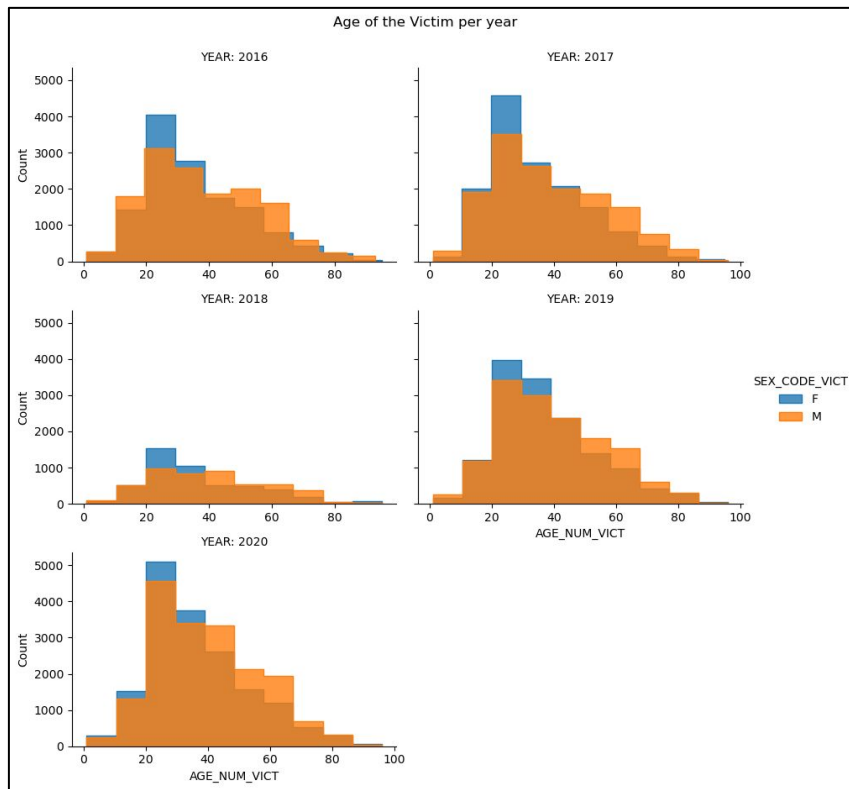
5. App

- Streamlit

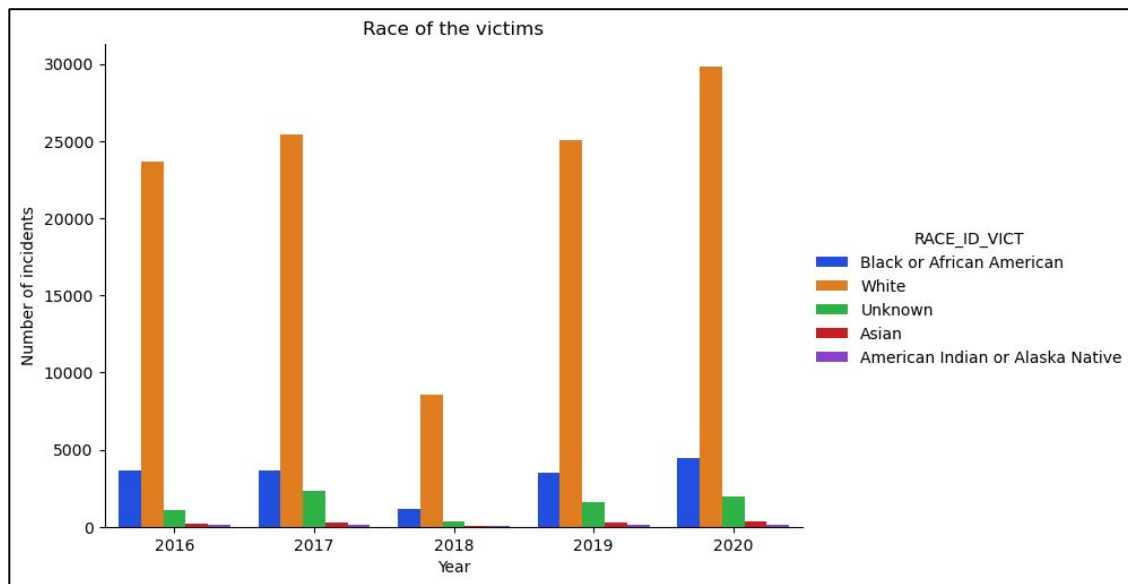
Findings

In the plot above we can observe:

1. Annually, in the range of 0 to 30 years, the highest number of victims are female.
2. In the ages older than 30 years, the majority of victims are male.
3. We observe the highest number of victims in the years 2017 and 2020.
4. The largest group of victims is within a range between 10 and 50 years.



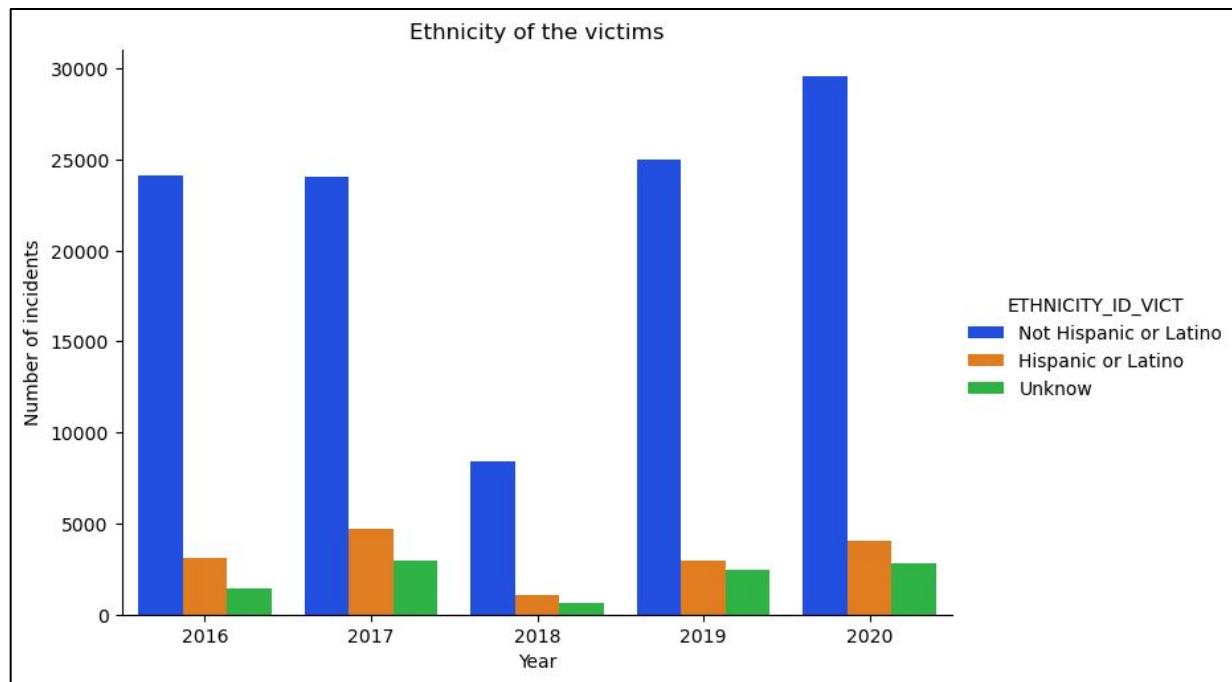
Findings



During the years studied, the largest number of victims are white people.

In second place, we have African Americans.

Findings

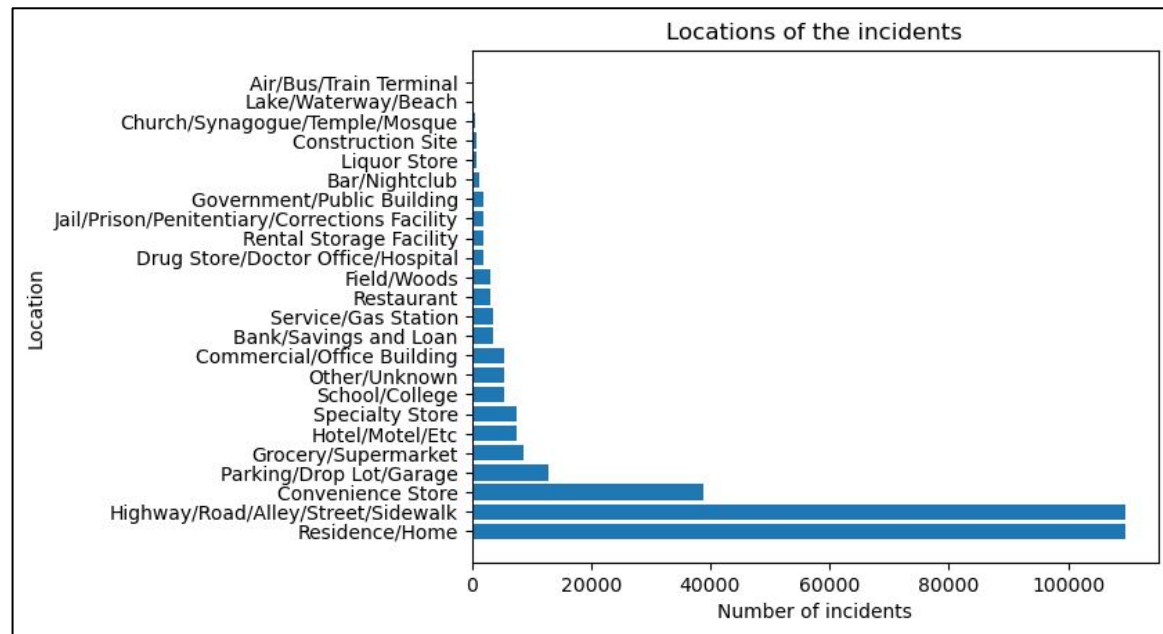


1. The category with the highest number of frequency in all years was: Not Hispanic or Latino.

2. In second place: Hispanic or Latino.

The ratio remained the same for all years.

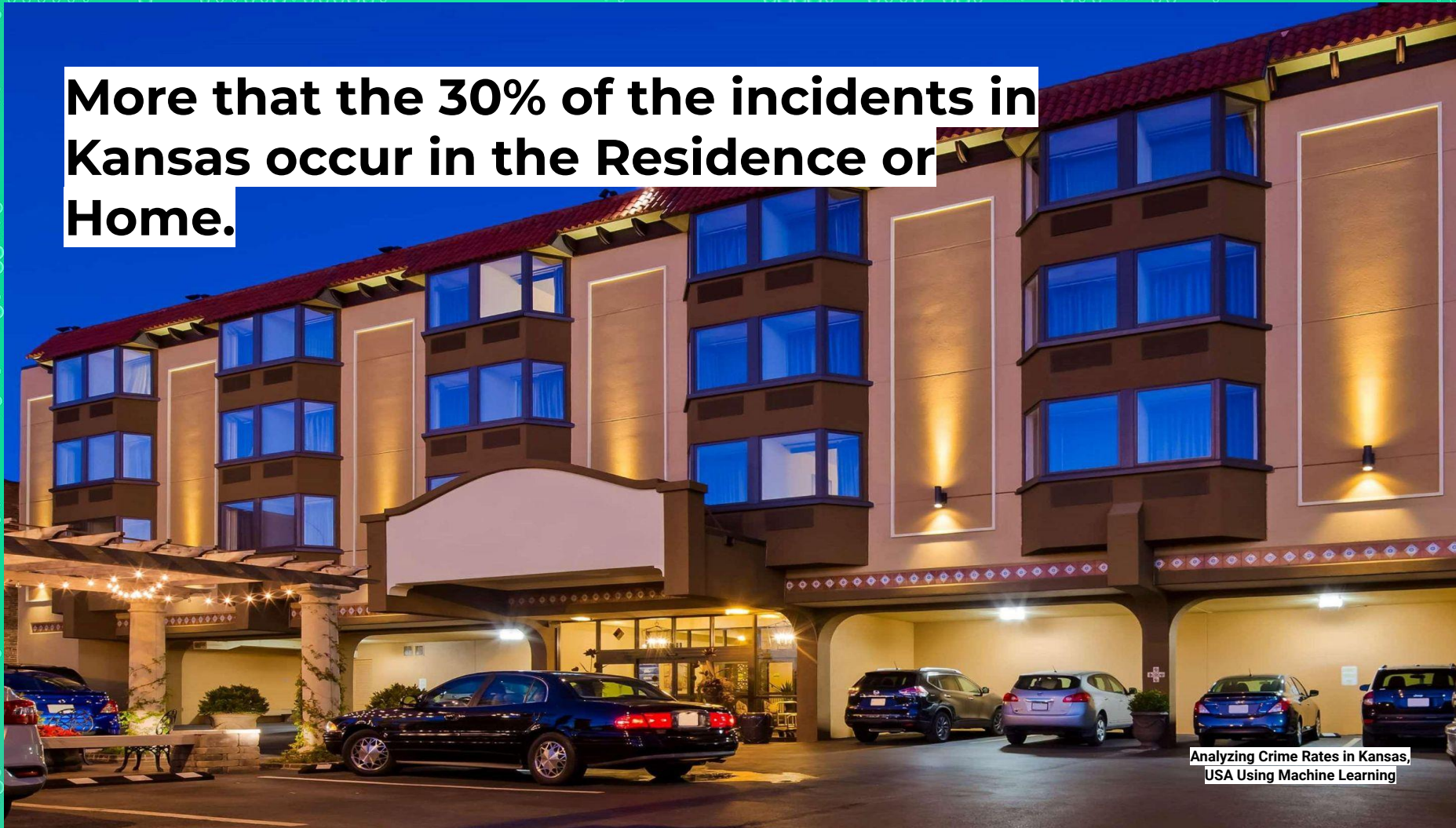
Findings



More than 30% of the cases the victims are attacked in their residences.

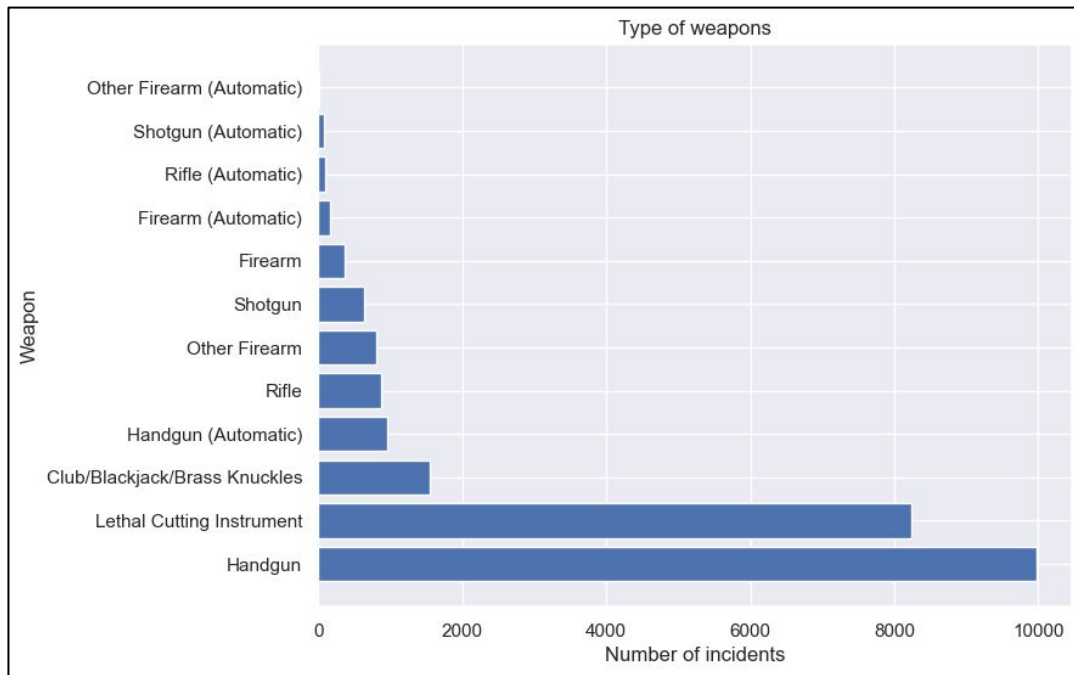
In second place, with 30%, the incidents occur in streets, alleys or sidewalks.

More than the 30% of the incidents in Kansas occur in the Residence or Home.



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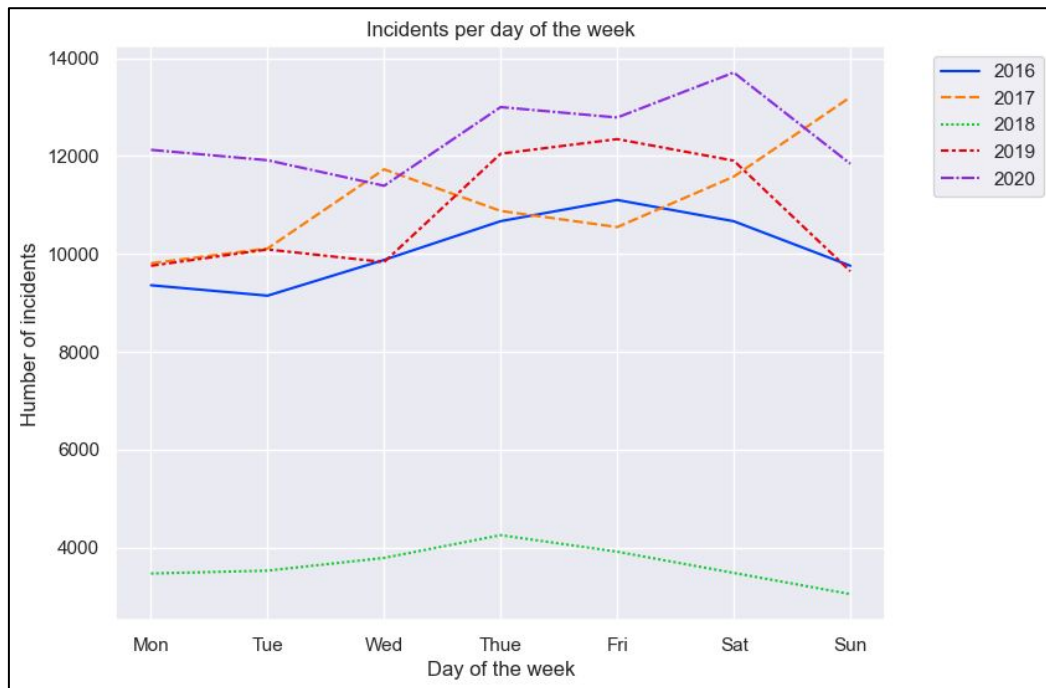
Findings



In the plot above, we can see that the five most use weapons on the attacks are:

1. Handgun.
2. Lethal cutting instrument.
3. Club/Blackjack/Brass Knuckles.
4. Handgun (Automatic).
5. Rifle.

Findings

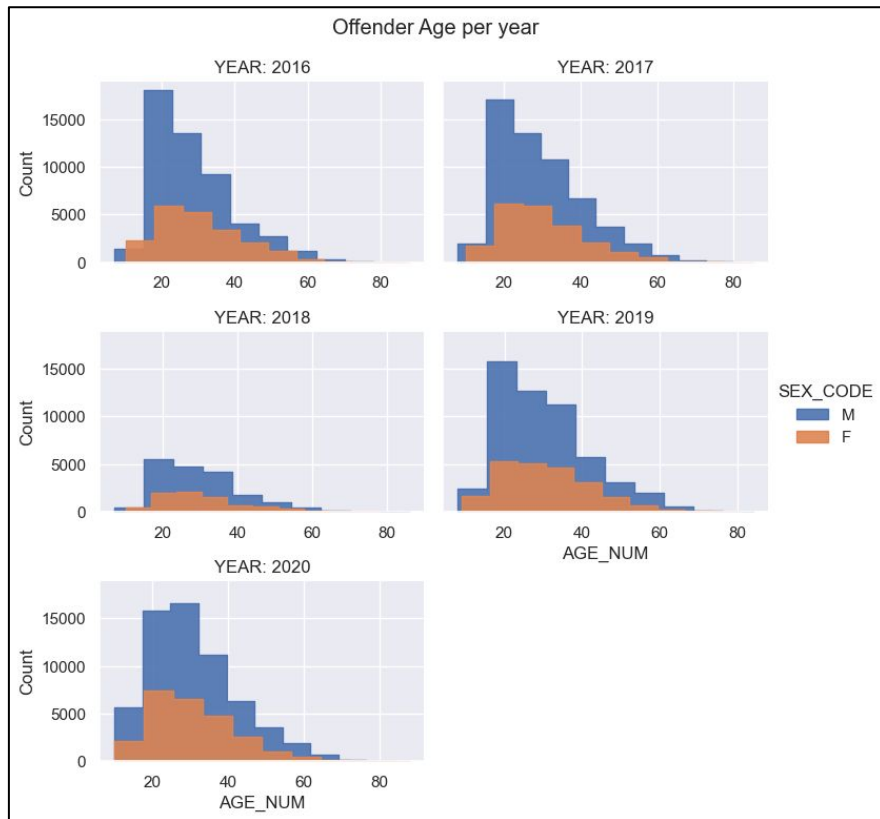


In the plot above we can see that the highest number of incidents on each day of the week were:

1. 2016: Thursday, Friday and Saturday.
2. 2017: Wednesday, Saturday and Sunday.
3. 2018: from Wednesday to Saturday.
4. 2019: Thursday, Friday and Saturday.
5. 2020: Thursday, Friday and Saturday.

In general, we can observe that the weekend and the days close to it are the days in which most incidents occur.

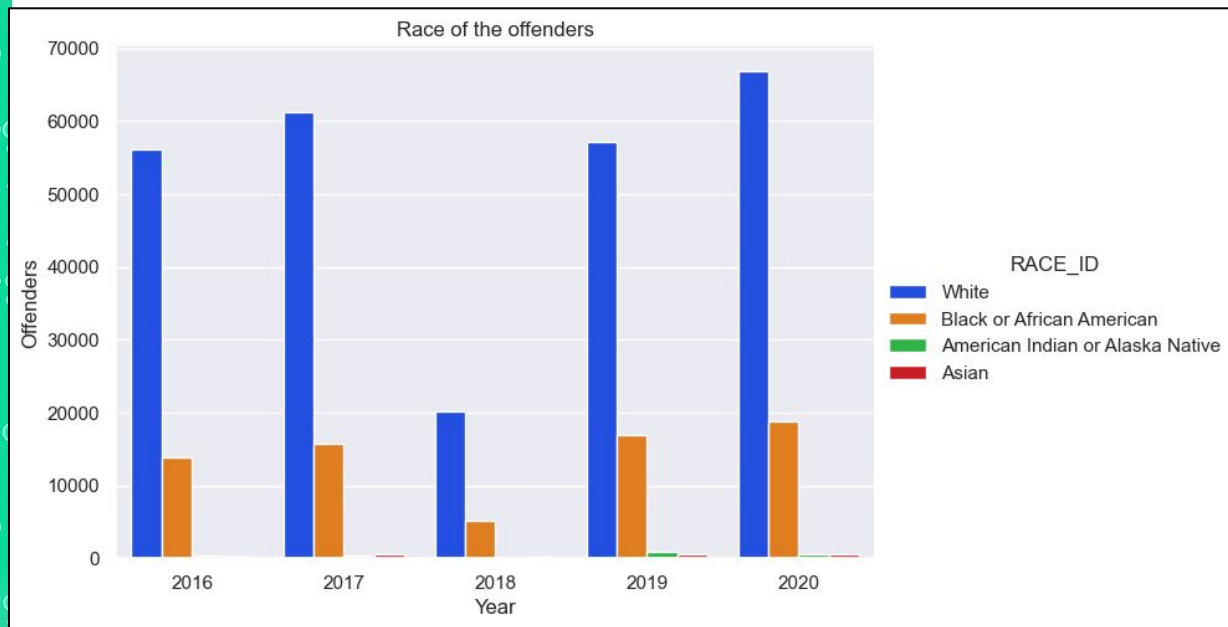
Findings



In this plot we can see that the majority of offenders are male, ranging in age from 20 to 40 years old.

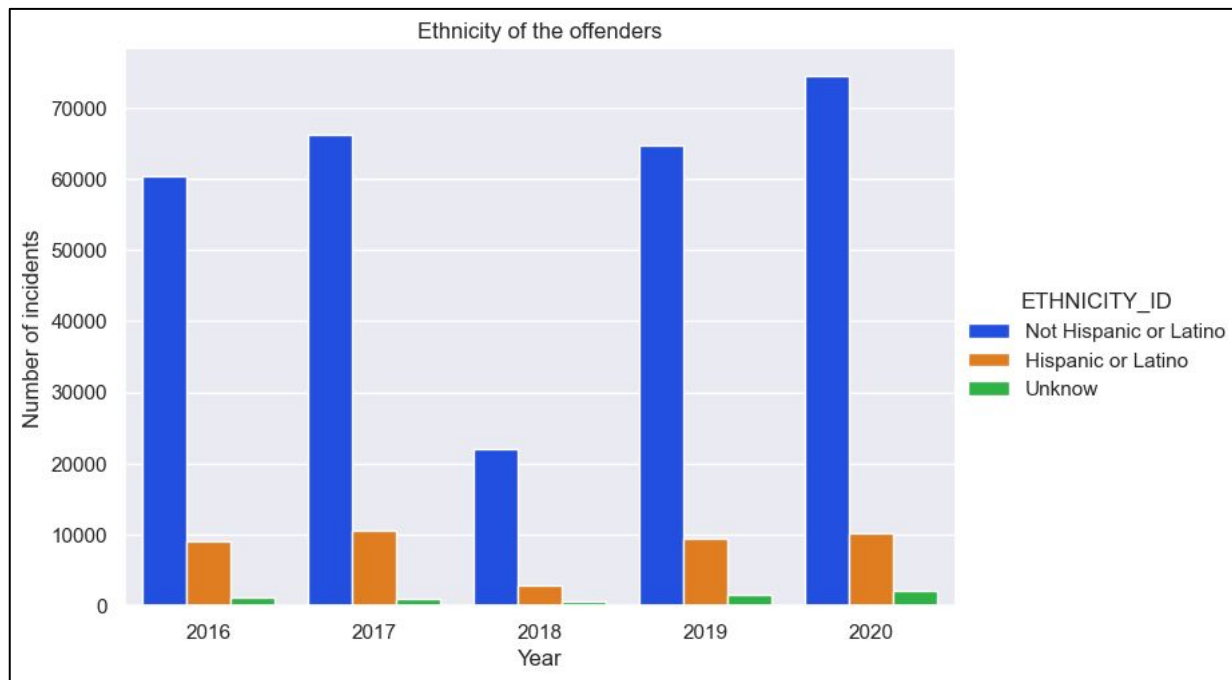
Female offenders tend to be in this age range as well, their frequency is lower in number.

Findings



1. The highest number of offenders is white race, the trend is maintained during all years of study.
2. The number of black offenders is less than half that of white offenders.
3. The number of incidents caused by American Indians and Asians are less than 1,000 cases in all the years studied.

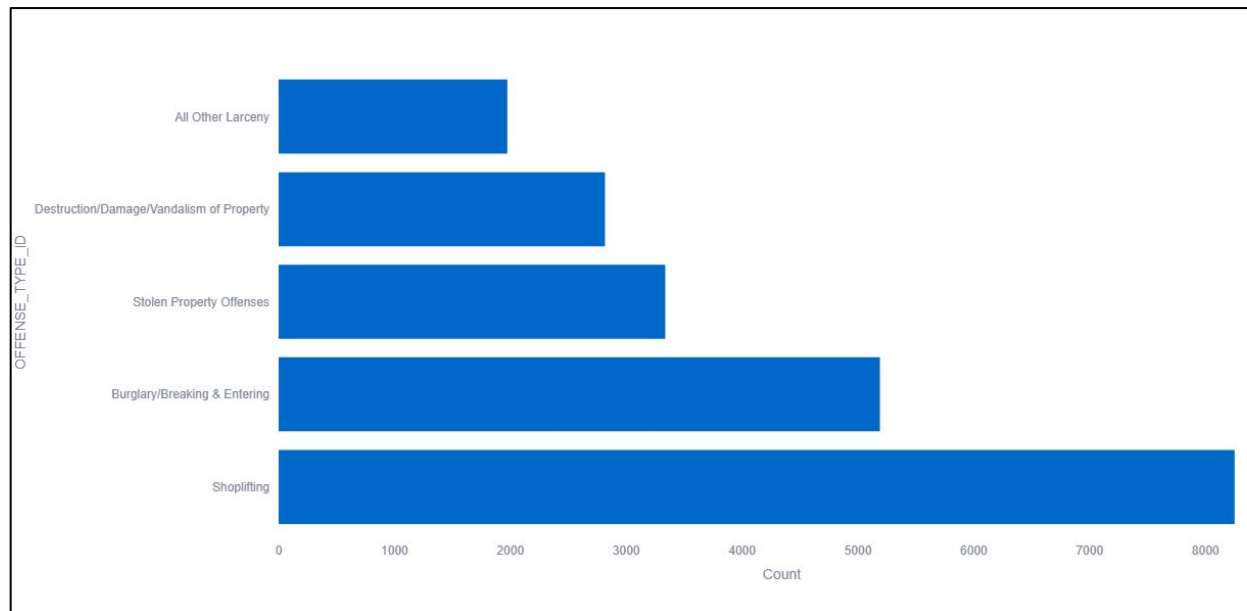
Findings



We can observe in the plot that the majority of offenders were of Not Hispanic or Latino ethnicity, from 2016 to 2020.

Findings

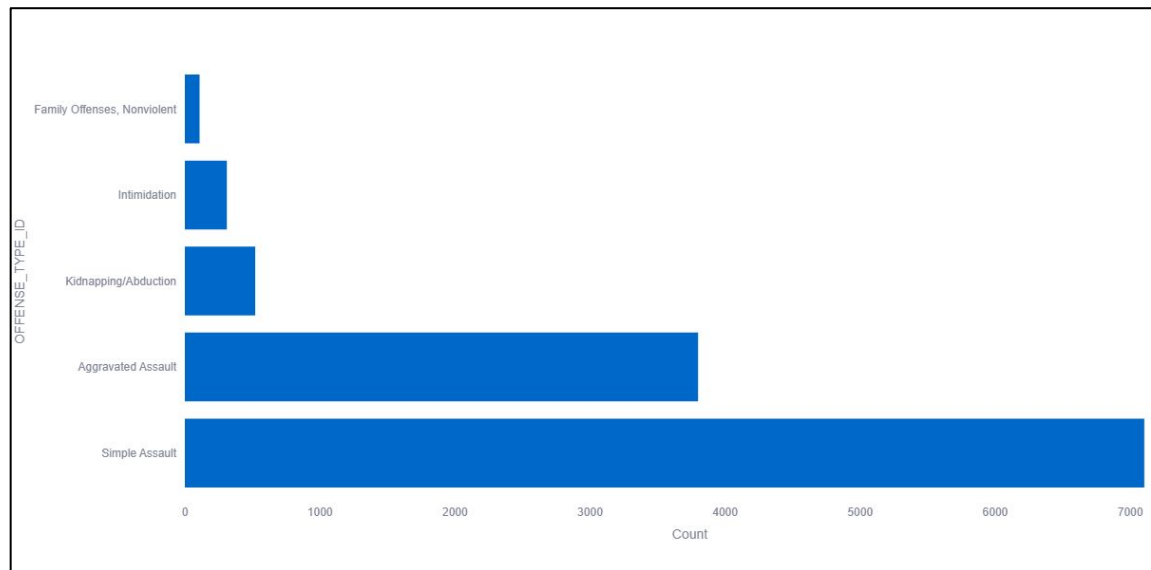
5 most common crimes against Property



In the years of study, more than 8,000 incidents of shoplifting were found, making it the most common crime against property.

Findings

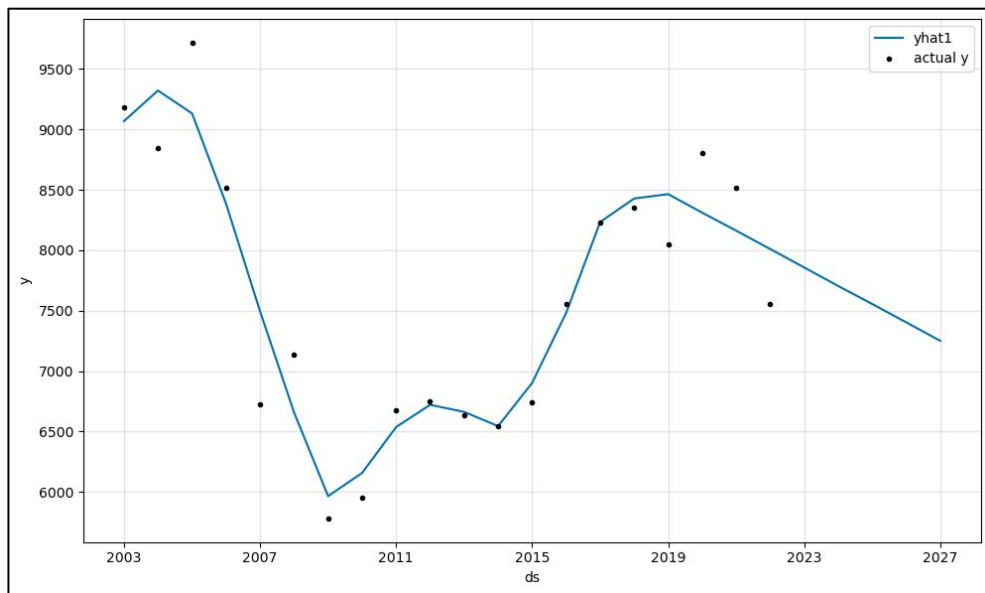
5 most common crimes against Persons



The most common type of crime committed against people is assault.

Modeling phase

Forecasting for Motor_Vehicle_Theft crimes



Two models were used: Linear Regression and Neural Prophet. Due to the amount of data that was available for the forecasting, we determined that the most appropriate model was Neural Prophet.

Forecasting models were performed for each type of crime.

In the Streamlit app you can see all the forecasting.

Demo Record

You can access to the demo recording at this link:

- <https://kansas.zoom.us/rec/share/I3nMjyHS2DSBmA1ghj5bAXgHRwelrS4zCFeVBODzNA-FY-MGIvv9ux0PO5tQER-x.K-GuZmzqTQFQ2StC>

Demo on Youtube: <https://youtu.be/snd3LmCsUws?si=pETmqVr3EI4jZ0R7>

Streamlit App

Crime rate by City:

<https://kansascrimeapp-omdena-kansas-chapter.streamlit.app/>

EDA of the incidents in Kansas:

<https://kansascrimeeda-omdena-kansas-chapter.streamlit.app/>

Recommendations

- Find historical data on crime rates in Kansas counties.
- Create crime prediction models for the most populous cities or counties in Kansas.
- Look for correlations between the increase (or decrease) of crimes and features such as: inflation, poverty rate, home vacancy, educational level, law enforcement, among others.

Big thank you to our collaborators!

- Elianneth Cabrera
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