Capstone Project:

San Francisco Crime Classification

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Problem to be solved and Motivation

- From 1934 to 1963, San Francisco was infamous for housing some of the world's most notorious criminals on the inescapable island of Alcatraz.
- Although today, the city is known more for its tech scene than its criminal past, there is no scarcity of crime in the city by the bay.
- From Sunset to SOMA, and Marina to Excelsior, the dataset I worked on provides nearly 12 years of crime reports from across all of San Francisco's neighborhoods.
- The objective of this project is to predict the category of crime that occurred at a given time and location.

Client

- City and County of San Francisco is trying to make the city and the neighborhoods more safe by leveraging the past crime data over the years.
- The City authorities and the San Francisco Police Department will be the client for whom the conducted data analysis as part of the capstone project will be beneficial.
- This analysis can also be helpful for residents, policymakers and the government to create awareness and take the necessary measures.

Feature Engineering

- **Dates**:
  - day(day of month as **Day**),
  - hour
  - minute
  - Dayofweek (**day_num**)
  - weekofyear
  - Dayofyear
  - year
  - Month
- PdDistrict(**District_num**)
- **Season:**
  - Fall
  - Winter
  - Spring
  - Summer
- **Address**:
  - Intersection / Residential
  - Latitude(**X**)
  - Longitude(**Y**)
- **Weekend:**
  - Friday
  - Saturday
  - Sunday

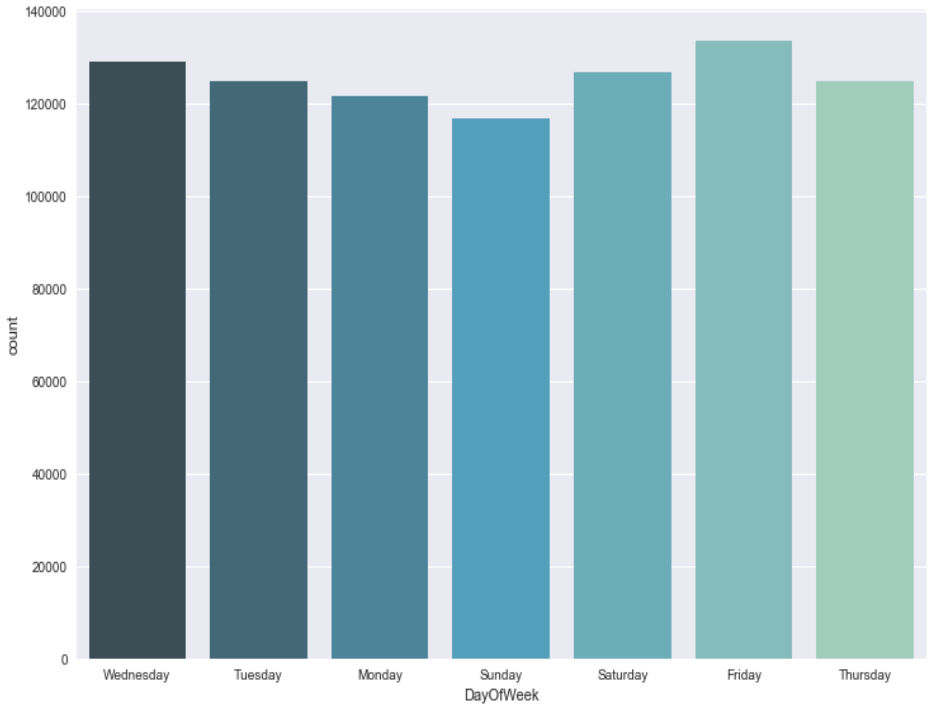
Exploratory Data Analysis

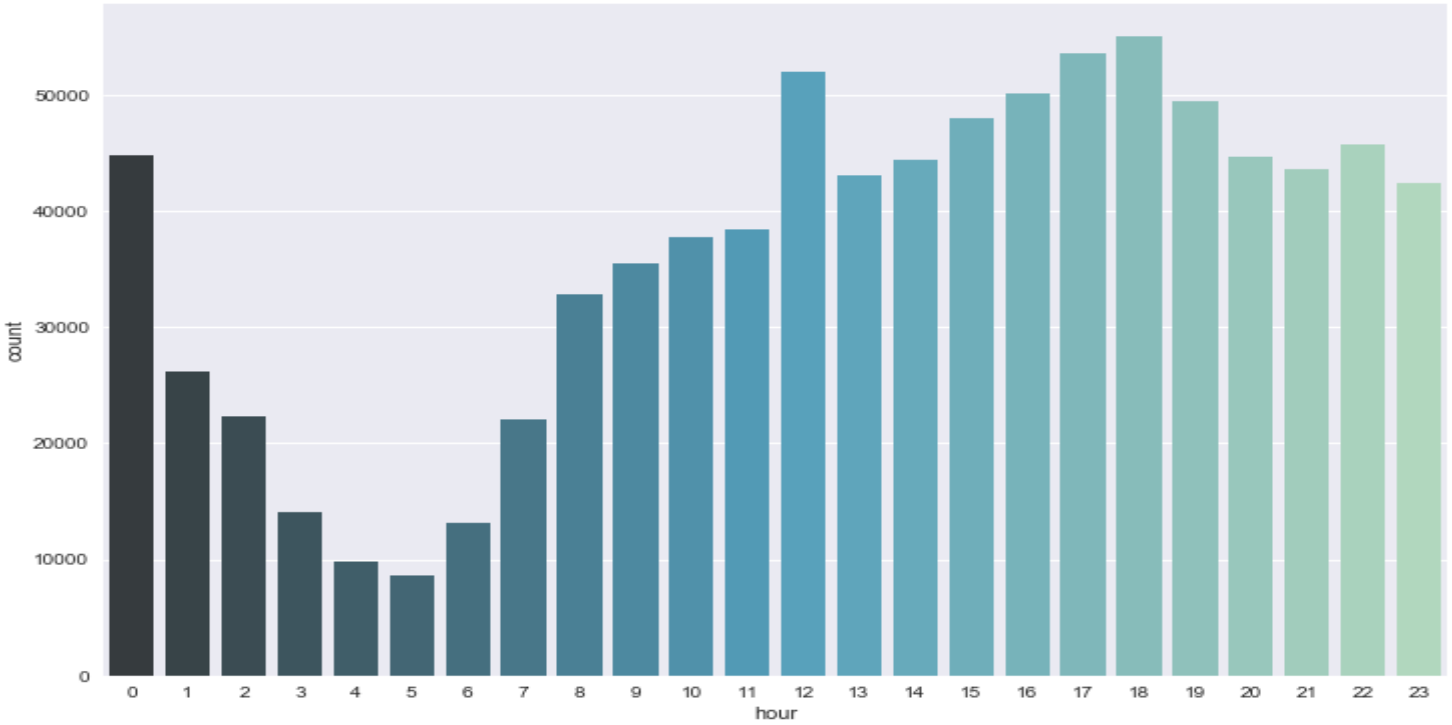
- The number of crimes reached an all-time high in the span of 12 years in 2013
- The number of crimes was high at 2003 after which it was decreasing until 2008 where it increased, after which there was a decrease until 2012-2013.
- A spike in crime rate can be noticed for every 5 years.
- The crime rate is maximum on Friday and Saturday and least on Sundays.
- The months of May and October recorded a high number of crimes.
- Maximum crime activity is around 12pm and in the 5-7pm window the maximum being at 6pm.

Exploratory Data Analysis

- The Southern region followed by the mission region recorded the maximum crime rate.
- The top 5 categories of crime being Larceny/Theft, Assault, Vandalism, Drug/Narcotic, Vehicle/Theft.
- The burglary rate is maximum on Fridays. On checking the hourly distribution, the conclusion is5pm on Friday is most prone to burglaries.
- Although the overall crime recorded is the least on Wednesday the number of crimes due to drug or narcotic is most on Wednesday and specifically at 2pm.
- Larceny was most recorded on Saturday followed by Friday.
- The maximum crime activity recorded due to vandalism is on Saturday at 10pm.

Visualizing the Crimes in San Francisco





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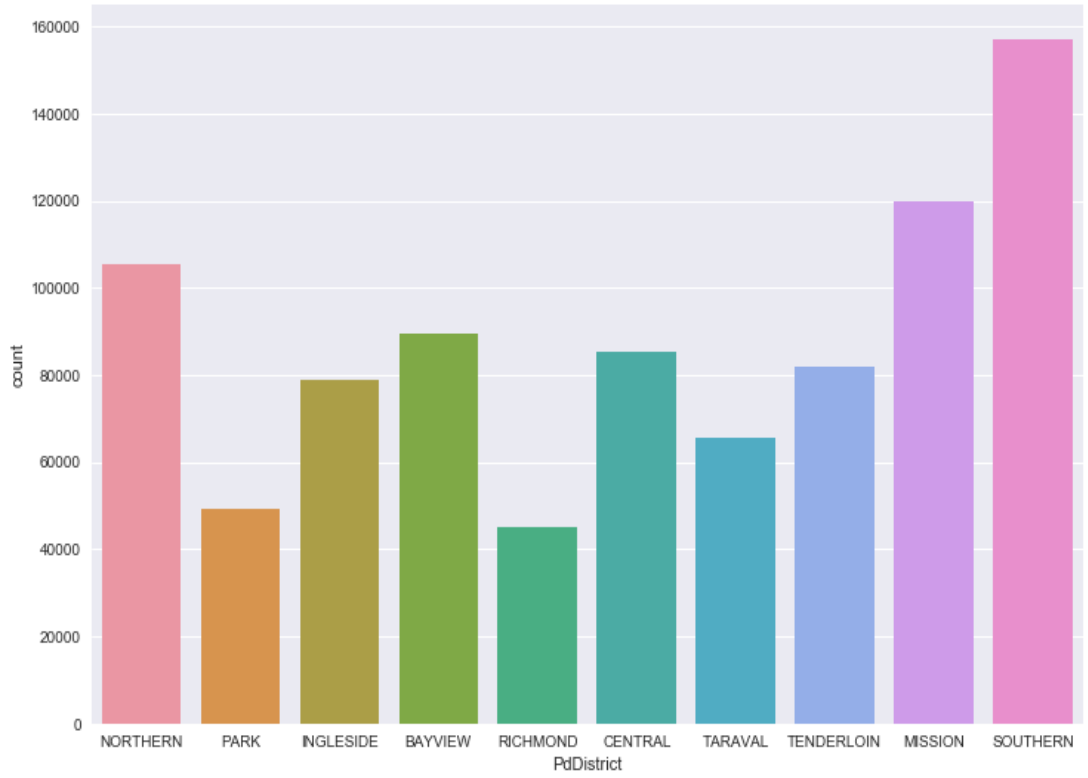

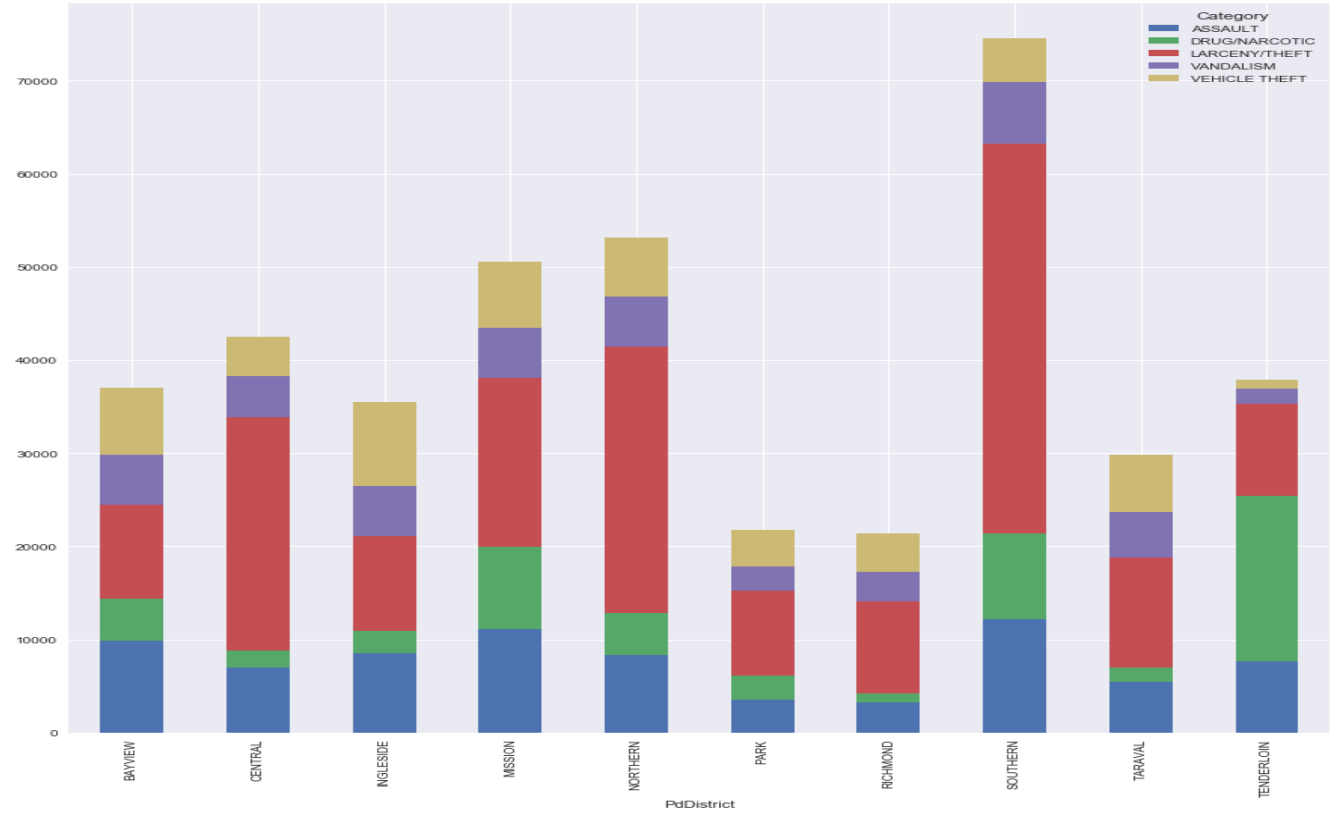

Algorithms and Results

Models	Log loss score on Kaggle
Random Forest Classifier with all features	2.41
Random Forest Classifier with fewer features(excluding weekends and seasons)	**2.38**
AdaBoost Classifier	3.51
AdaBoost Classifier with best parameters using GridSearch Cross Validation	2.83

Recommendations for the Client

- Policymakers can be put forth local policies to ensure the safety of the districts and neighborhoods.
- For law enforcement agencies that are considering adopting predictive policing tools, situational awareness can be increased.
- The police force can be distributed according to the day and type of crime in a particular neighborhood thereby reducing the extent of the damage.
- Advertisement and awareness campaigns can be conducted in different areas for the area specific crime to involve the citizens and work with them.
- Knowing the category of the crime, we can better equip the police force, district wise for better response time.

Future Research

- **Try non-linear models:** The models that were used in here were all linear models. Non-linear models could be implemented to see if better results can be achieved.

- **New features:** New features could be created to help us generalize better on the test dataset thereby achieving better results.