

San Francisco's Opioid Crisis and Drug Problem and effects on public safety

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1 Problem:

The War on Drugs is a phrase used to refer to a government-led initiative that aims to stop illegal drug use, distribution, and trade by increasing and enforcing penalties for offenders. The movement started in the 1970s and is still evolving today. Consequently, numerous US are experiencing an opioid crisis in recent times. There is an ongoing debate, the opioid crisis is the product of Mexican and Central American migration - rather than the deregulation of Big Pharma and the failures of a private health care system. Consequently, at this instance, San Francisco is facing a major drug problem and opioid crisis.

San Francisco (SF) has a long history of pushing the envelope on progressive public health solutions, including medical cannabis and needle exchange, before either was legal or broadly embraced. It is so out of proportion, that California passed a bill allowing SF to open Safe Injection Sites (SIS).

Safe injection sites (SIS):

Safe injection sites are medically supervised facilities designed to provide a hygienic and stress-free environment in which individuals are able to consume illicit recreational drugs intravenously and reduce nuisance from public drug use. They are part of a harm reduction approach towards drug problems. North America's first SIS Insite opened in the Downtown Eastside (DTES) neighborhood of Vancouver in 2003.

2 Potential Questions:

- I. Comparing types of crime across different neighborhoods. What are the top 5 neighborhoods, where you can get assaulted? Do certain "pairs" of crime frequently co-occur together in a certain neighborhood?
- II. Identifying potential neighborhoods for installing SIS for San Francisco government

3 Target Variables:

- I. Correlation between types of crime and neighborhoods from 2003 to 2018
- II. Do certain types of crime co-occur together frequently, or co-occur together in particular neighborhoods (i.e. association rule mining)
- III. Correlation between types of drugs used and neighborhoods from 2003 to 2018
- IV. Identify potential neighborhoods/areas for San Francisco's government to build safe injection sites
- V. Predict the type/category of crime-based on spatial and temporal features provided

4 Data:

Our data is collected from the San Francisco police department's database. It is historical data regarding crimes from 2003 to May 2018. The dataset has 13 columns.

Column name	Definition	Type	Scale
IncidentNum	Incident Number: The number issued on the report, sometimes interchangeably referred to as the Case Number	long integer	Continuous
Category	Incident Category: A category mapped on to the Incident Number used in statistics and reporting. Mappings provided by the Crime Analysis Unit of the Police Department.	string/text	Categorical
Description	Incident Description: The description of the incident that corresponds with the Incident Number. These are generally self-explanatory.	string/text	Continuous
DayofWeek	The day of the week the incident occurred	string	Categorical
Date	The date the incident occurred	DateTime	Continuous
Time	The time the incident occurred	DateTime	Continuous
PdDistrict	The Police District reflecting current boundaries (boundaries changed in 2015). These are entered by officers and not based on the point. One can refer to them as "county" names	string/text	Categorical

Resolution	<p>The resolution of the incident at the time of the report. Types:</p> <ul style="list-style-type: none"> - Cite or Arrest Adult - Cite or Arrest Juvenile - Exceptional Adult - Exceptional Juvenile - Open or Active - Unfounded <p>Note: once a report is filed the resolution does not change on the filed report later. Updates to a case will be issued later as Supplemental reports if there's a status change.</p>	string/text	Categorical
Address	Incident Address: One or more street names that intersect closest to the original incident separated by a forward slash (\)	string/text	Continuous
X	The longitude coordinate in WGS84, the spatial reference is EPSG: 4326	longitude	Continuous
Y	The latitude coordinate in WGS84, the spatial reference is EPSG: 4326	latitude	Continuous
Location	The point geometry used for mapping features in the open data portal platform. Latitude and Longitude are provided separately as well as a convenience	Point type object	Continuous
PdId	Precinct ID at which precinct was the incident reported	Long integer	Categorical

5 Analysis Approach:

- I. Perform data profiling using frequent statistics, and detect any outliers. For example, EDA/visualizations, null analysis. Semantic profiling to identify homogeneous columns - to eliminate extraneous features
- II. Create cluster-maps between crime type/category and neighborhoods – perform data normalization/standardization as necessary. Cluster-maps i.e. unsupervised

learning will help us to find the correlation between different neighborhoods and type of crime.

- III. Since this is a classification problem, we are using algorithms like XGBoost, CatBoost, Naive Bayes and Random Forest classifier with the response/target variable as the category/type of crime, and predictors as spatial-temporal columns. Hyperparameter tuning using k-folds cross-validation
- IV. Preprocess data to filter out crimes that involved Drugs/Narcotics. Perform Step 1 on this subset again. Perform aggregations as necessary to get granular information i.e. Narcotics based crimes categorized by types of drugs i.e. opioids, marijuana, etc.
- V. Create cluster-maps between different types of drugs and neighborhoods. Normalize or standardize data as required
- VI. Encode the data to a transactional form - execute Apriori and FP-growth to find interesting patterns (i.e., association rules). Comparative study : FP- Growth vs Apriori

References

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