

Terry Stops Data Science Project (Classification Project)

Authors:

Nahum odemba

Jeremy Nguyo

Monicah Okodoi

Majorie Opiyo

Betty Bett

Bradley Azegele

Business Understanding

1.1 Overview

Traffic stops usually create a feeling of anxiety in drivers, especially when the driver doesn't know why he or she was pulled over and then starts getting questioned by the police. Even more disturbing is if the police begin to search the vehicle. It's not uncommon for police in these situations to cite the "Terry Rule" as justification for the illegal search and questioning.

The Terry Rule:

The Terry Rule, also referred to as the Terry Stop or Terry Search is another term for a stop and frisk. The name comes from the U.S Supreme Court case *Terry v. Ohio* which determined that when a police officer has a reasonable suspicion, he or she can temporarily question and detain drivers or passengers, even without an arrest, in a public place for a reasonable amount of time. A Terry Stop is considered a seizure under the Fourth Amendment and should only happen when the officer has reasonable suspicion and/or the occupant(s) has attempted to flee the officer. In order for police to conduct a search under the Terry Rule, the person stopped must be a valid suspect. That means the officer cannot conduct a stop for no reason. The officer must have reasonable suspicion for conducting the stop.

1.2 Problem Statement

The stakeholders for this project are the Public and the Law Enforcement Agencies.

Terry Rule has had a fair share of support and criticism from the public. On the positive side, Terry Stops have been seen as life savers as police officers can quickly stop a criminal before taking part in a crime.

Unfortunately, the rule has also received significant criticism, for example, the Terry Stops have also been criticized on the grounds of racial discrimination against minority communities.

In a recent case, *Floyd v. City of New York* 813 F. Supp.2d 417 (2011), the court held the New York stop-and-frisk policy violated the Fourth Amendment because it rendered stop-and-frisks more frequent for blacks and Hispanics.

Second, this rule has also been criticized as many stop-and-frisks have not led to arrests. This may mean that police officers only conduct stop-and-frisk based on mere suspicion and not reasonable suspicion.

1.3 Objectives

General Objective

The objective of this project, therefore, is to build a classifier to see which factors mostly define whether an individual's stop-and-frisk will lead to an arrest. The project is aimed to bring harmony between the public and law enforcement. A classifier that will lead to higher arrest accuracy will mean that law enforcement will be able to arrest only possible criminals and not disrupt law-abiding citizens.

Specific Objectives

1. To investigate what factors that highly influence a Terry Stop arrests.
2. To find out whether Terry Stops are biased towards minority groups.

1.4 Research Questions

1. Which model best has the highest F1 score for Terry Stops?
2. What factors would highly result to a person being stoped, frisked, and arrested after a Terry Stop?
3. Are Terry Stops biased towards minority groups?

Metric of Success

The success metric for this project is an F1 score of 95% or more.

Data Understanding

2.1 Overview

This data represents records of police reported stops under Terry v. Ohio, 392 U.S. 1 (1968). Each row represents a unique stop.

- Each record contains perceived demographics of the subject, as reported by the officer making the stop and officer demographics as reported to the Seattle Police Department, for employment purposes.

- Where available, data elements from the associated Computer Aided Dispatch (CAD) event (e.g. Call Type, Initial Call Type, Final Call Type) are included.

This data is available [here](#).

2.2 Exploring Data

The dataset includes fields that represent all of our primary data related to Terry Stops.

- Data contains 5, 3654 entries and 23 columns
- Flag Arrest column is prediction column which has 2 categories:
 - A. Y - An arrest was made after a Terry Stop
 - B. N - there was no arrest made after a Terry Stop
- There are missing values in various columns. The target variable did not have any missing or NaN values.
- This data set contains both categorical and numerical data.

2.2.1 Data Description

Column	Description
Subject Age Group:	Subject Age Group (10 year increments) as reported by the officer.
Subject ID:	Key, generated daily, identifying unique subjects in the dataset using a character to character match of first name and last name. "Null" values indicate an "anonymous" or "unidentified" subject. Subjects of a Terry Stop are not required to present identification.
GO / SC Num:	General Offense or Street Check number, relating the Terry Stop to the parent report. This field may have a one to many relationship in the data.
Terry Stop ID:	Key identifying unique Terry Stop reports.
Stop Resolution:	Resolution of the stop as reported by the officer.

Weapon Type:	Type of weapon, if any, identified during a search or frisk of the subject. Indicates "None" if no weapons was found.
Officer ID:	Key identifying unique officers in the dataset.
Officer YOB:	Year of birth, as reported by the officer.
Officer Gender:	Gender of the officer, as reported by the officer.
Officer Race:	Race of the officer, as reported by the officer.
Subject Perceived Race:	Perceived race of the subject, as reported by the officer.
Subject Perceived Gender:	Perceived gender of the subject, as reported by the officer.
Reported Date:	Date the report was filed in the Records Management System (RMS). Not necessarily the date the stop occurred but generally within 1 day.
Reported Time:	Time the stop was reported in the Records Management System (RMS). Not the time the stop occurred but generally within 10 hours.

Initial Call Type:	Initial classification of the call as assigned by 911.
Final Call Type:	Final classification of the call as assigned by the primary officer closing the event.
Call Type:	How the call was received by the communication center.
Officer Squad:	Functional squad assignment (not budget) of the officer as reported by the Data Analytics Platform (DAP).
Arrest Flag:	Indicator of whether a "physical arrest" was made, of the subject, during the Terry Stop. Does not necessarily reflect a report of an arrest in the Records Management System (RMS).
Frisk Flag:	Indicator of whether a "frisk" was conducted, by the officer, of the subject, during the Terry Stop.
Precinct:	Precinct of the address associated with the underlying Computer Aided Dispatch (CAD) event. Not necessarily where the Terry Stop occurred.
Sector:	Sector of the address associated with the underlying Computer Aided Dispatch (CAD) event. Not necessarily where the Terry Stop occurred.
Beat:	Beat of the address associated with the underlying Computer Aided Dispatch (CAD) event. Not necessarily where the Terry Stop occurred.

Data Preparation

- **Validity** - We started with keeping only the most relevant columns for this project. Next, we rearranged the data in order to make it easier to check relevance and validity of the data provided. All columns in the rearranged file would be relevant to our analysis and modelling. Besides, we also checked the sensibility of data and corrected it accordingly. For instance, we found that some of the officers' year of birth was indicated as 1900. This does not make sense. We made this column valid by replacing officers who aged 122 years with the column mode.
- **Consistency**-we checked for duplicates. We used Terry Stops ID to check for duplicates row-wise. Found 73 duplicates. We dealt with these duplicates by dropping them. After checking for the duplicates, we then dropped the ID column because we did not want to carry the column for modeling as it may affect the quality of the model.
- **Completeness**- We checked for completeness of the data and found that some columns contained either UNKNOWN or data marked with (_). We decided on how to deal with these missing data.
- **Uniformity**- The columns created in the rearranged file were renamed for easier use. We changed the column names to lowercase and added an underscore(_) in between column names. This made it easier for us to use the column names in the further data analysis.

Modeling

Baseline Model

Random Forest

Why Random Forest as Base-Model?

In Data Science, the term **ensemble** refers to an algorithm that makes use of more than one model to make a prediction. Typically, when people talk about ensembles, they are referring to Supervised Learning, although there has been some ongoing research on using ensembles for unsupervised learning tasks. Ensemble methods are typically more effective when compared with single-model results for supervised learning tasks.

Ensemble methods are analogous to "Wisdom of the crowd". This phrase refers to the phenomenon that the average estimate of all predictions typically outperforms any single prediction by a statistically significant margin -- often, quite a large one.

We also used other models such as Decision Tree and K nearest neighbor model. We conducted both initial and tuned model for all the three models and compared the performance of these models based on the F1 score. F1 score was chosen for comparison of the models because the a high F1 score means a higher recall and precision.

The following is the summary of our models:

Forest Initial Model F1 score is: 0.9685279187817258

Forest Tuned Model F1 score is: 0.9915459322494805

Decision Tree Initial Model F1 score is: 0.9693877551020408

Decision Tree Tuned Model F1 score is: 0.9901690838188362

KNN Initial Model F1 score is: 0.6987951807228916

KNN Tuned Model F1 score is: 0.9747538901943056

From the summary, it is evident tha Forest Random Forest Tuned model had the highest F1 score of 0.9901690838188362. We therefore, chose this model as the best performing in predicting who should be arrested during a Terry Stop.

Findings

- Factors that highly influence a Terry Stop arrests Reported Year Reported Month Subject Age Group Weapon Type Reported Time
- factors that highly result to a person being stoped, frisked, and arrested after a Terry Stop? When we look at the data for frisks, we see that the focus is really on just two precincts: the East and South. The number of frisks during Terry stops increased in only those two precincts, and the likelihood that a stop would lead to a frisk also increased in those same two places
- Whether Terry Stops are biased towards minority groups. Overall, the data skews heavily male, and is almost entirely two racial groups: blacks/African Americans and whites. Blacks continue to be over-represented in the Terry stops data compared to their representation in the entire population of Seattle.

Recommendations

- Combined Law Enforcement and Community Policing Members of the community join police officers and observe the officers' activities while working their Beat. This can lead to an increase in public trust, a better understanding of the people in their jurisdiction, as well as educate people about why certain policies are in place.
- In determining whether probable cause exists, courts more readily accept the judgment of a law enforcement officer if it is backed by evidence of a crime/weapon possession.

Future Work

- The dataset contained a lot of NaN or incomplete information. Collect more data that adds more context of the nature of stops
- Audit record system and reduce redundant columns to reduce noise
- Look into data for police reported stops in other regions for comparison
- Collect and analyze data on those arrested and eventually found guilty in court

