**Title:** An Analysis of Houston Police Department Officer-Involved Shootings

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**My Contribution:**
I completed all aspects of the project from start to finish with the guidance of my research advisor, Dr. Grossman. I proposed the idea for the project, wrote all of the code, generated the graphs, and performed the analyses. I formed all of the conclusions and created the final abstract and research poster that I presented at the 2018 Rice Data Science Conference.

**Abstract:**
Officer-Involved Shootings (OIS) continue to be a prevalent issue, the potential involvement of racial discrimination sparking protests across the US. In an effort to increase transparency, the Texas State Legislature passed Art. 2.139 of the Texas Code of Criminal Procedure on September 1st, 2015, which (among other things) requires law enforcement agencies to report details of all officer-involved shootings. Since then, officer-involved shootings per year in Houston have greatly decreased.

A previous study by researchers at Northwestern University analyzed trends in the Houston OIS dataset from 2005 to 2013. In contrast, our work analyzes many of the same metrics in the OIS dataset but from after the passage of the law in 2015, while comparing these metrics with the previous study.

In addition, this work generates new insights and explores machine learning models for predicting different attributes of OIS, such as a suspect's injury. The results in this report align closely with the trends found in the previous study, except for certain differences regarding the percentage of male officers and officer ages. Notable trends in the data include a disproportionate number of black suspects compared to suspects of other races. Using a Decision Tree Classifier, we are able to predict suspect injury with 91.67% accuracy, based on other attributes of the OIS. The results from this work provide a greater understanding of the factors contributing to Houston officer-involved shootings, and they may be useful for the Houston Police Department when deciding future policies.

# An Analysis of Houston Police Department Officer-Involved Shootings

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## Background

- Officer-involved shootings (OIS) have been an issue since the establishment of the first American police department in Boston in 1838

- Nationwide attention escalated following incidents such as the death of Michael Brown in Ferguson, MO

- Texas State Legislature passed Art. 2.139 of the Texas Code of Criminal Procedure on 9/1/2015, which requires law enforcement agencies to report details of all officer-involved shootings

- Since then, OIS per year in Houston has been monotonically decreasing



Total HPD shooting incidents
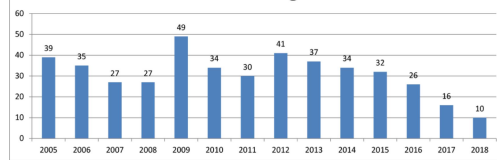
## Dataset & Previous Literature

- HPD maintains open records of all OIS in Houston
- A previous study by researchers at Northwestern University analyzed trends in the Houston OIS dataset from 2005 to 2013

## Questions

- How much of the decrease in Houston OIS can be attributed to Article 2.139?
- How do the trends of this data relate to the trends found in the previous study?
- What are some new trends, if any, in this data?
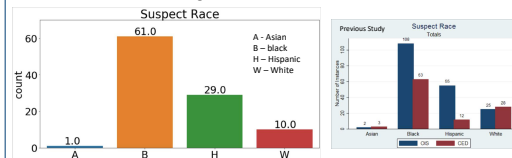- What are the factors in a suspect being injured or killed in an encounter?

## Features Considered & Tools Used

- Suspect/officer sex, race, age, injury
- Suspect weapon, officer on duty, # of officers, and response type
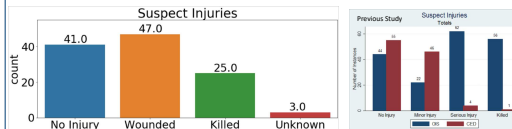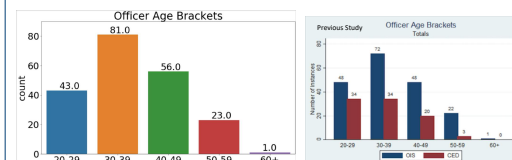- Used Python, Pandas, matplotlib, Seaborn plots
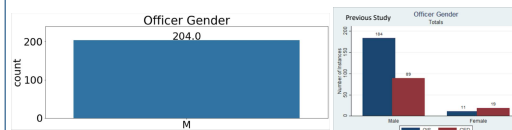
## Geocoding the Data



## Suspect Statistics



Suspect Race

A – Asian
B – black
H – Hispanic
W – White
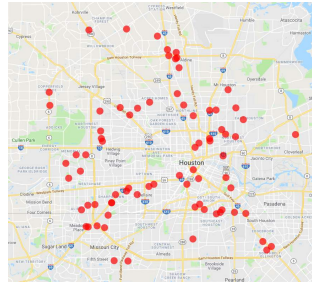
- In both graphs, Black suspects make up 55-60% of OIS and Hispanic suspects around 28%
- White suspects only make up 9-13%



Suspect Injuries

## Officer Statistics



Officer Age Brackets

- Both graphs have peaks at 30-39 years
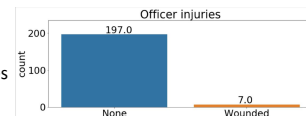


Officer Gender

- Current data – 100% male officers
- Previous study – 94% male officers
- Male-dominated officer force

## Additional Statistics

- Blacks are killed at a disproportionate number with respect to the population size of each race in Houston



Suspects as a proportion of their respective race
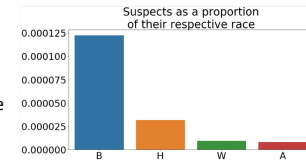
- 96.6% of officers in OIS sustain no injuries



Officer injuries

- White suspects are on average around 10 years older than Black and Hispanic suspects



Age distribution by race

- Insufficient data on Asian suspects
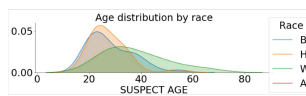
Average age of victims:

| | |
|---|---|
| Black – 28.1 | White – 37.9 |
| Hispanic – 27.4 | Asian – 21.0 |

## Models

- Tried different models to predict suspect injury
- Decision Tree Classifier yielded a 91.67% accuracy score
- Decision Tree first divides the population by suspect age with a pivot point of 23.5 years
- Younger suspects are then divided by suspect weapon, and older suspects are divided by suspect age of 36.5 years
- Decision Tree contains 7 layers and is divided by 11 different variables

## Findings

- No significant differences between the graphs of this data and those of the previous study
- Lack of change adds evidence that the Act did in fact cause the sharp decline in police shootings
  - Could not have been caused by race, gender, etc. because those features did not change
- Corroborate national police shooting trends such as evidence of racial bias, non-white suspects killed at younger age, and officers rarely injured

## Future Steps

- The results of this study may be shared with the HPD, which could be useful when deciding future policies