



# Predicting the Criminality of Car Accidents: An Aid for Investigation

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# Introduction: Chicago's Vision Zero

- Approach death and serious injury from traffic crashes as a public health issue.
- Design streets so that speeds are safe for all users of the roadway.
- Lead by example on vehicle safety equipment and driver training.
- Police traffic laws, focusing on dangerous driving behaviors that cause most severe crashes.
- Commit to investing resources equitably



# To Investigate or Not Investigate?

- In Chicago, any accident that results in a fatality requires a mandatory investigation, but this creates a problem: Dangerous drivers are only investigated after a person is killed.
- A model is needed to identify dangerous drivers after all accidents, including minor ones.
- With over 80,000 accidents occurring in Chicago a year, the model would aid CPD in deciding whether to investigate an accident or not.



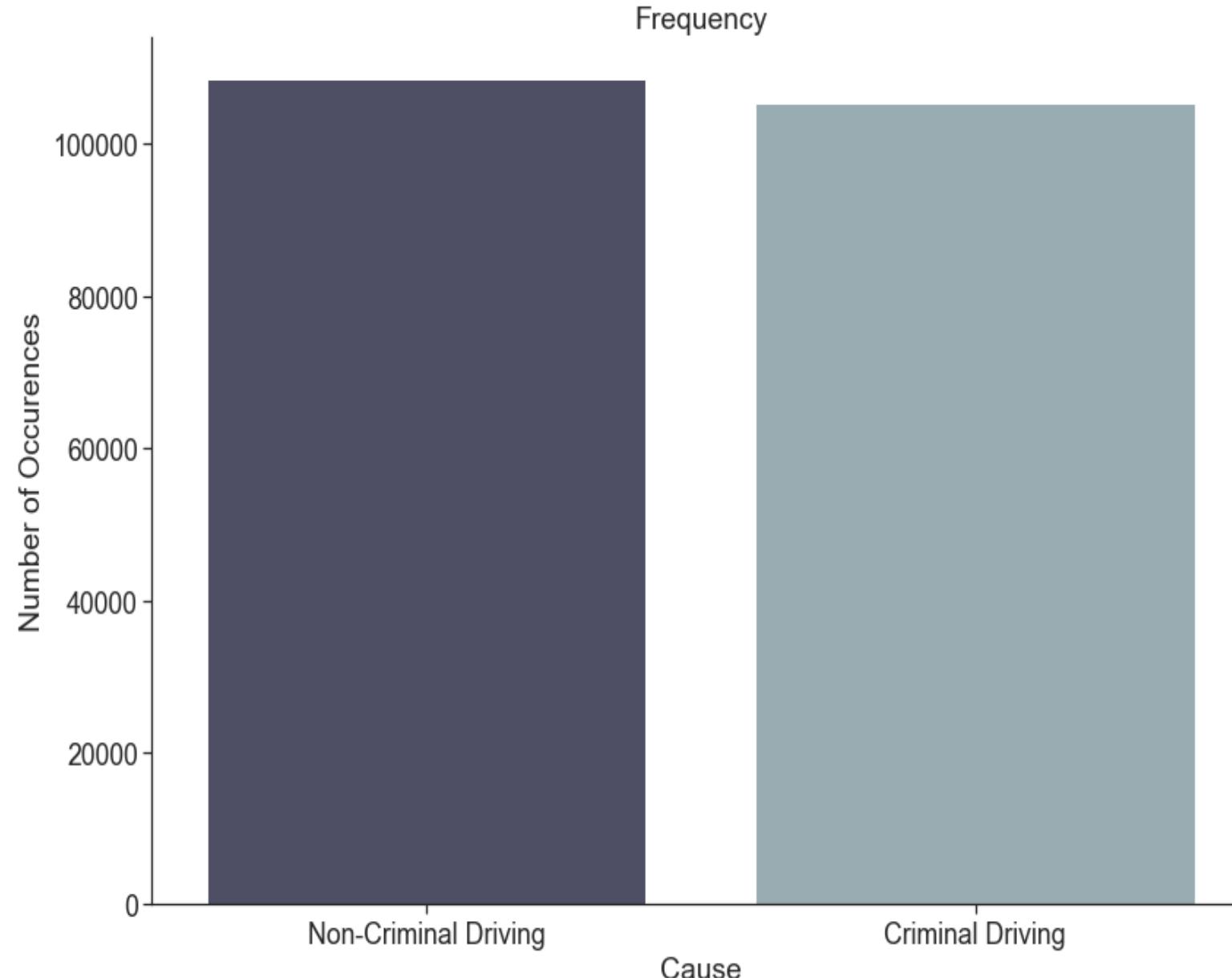
# Model Objective: To Identify Accidents Caused by Criminal Traffic Offenses

- Currently Chicago assigns 1 of 40 different ‘Primary Cause of Accident’ labels to the crash.
- The model takes these 40 values and assigns it to 1 of 2 categories: Criminal Driving and Non-Criminal Driving.

Criminal Driving	Non-Criminal Driving
Exceeding Authorized Speed Limit	Motorcycle Advancing Legally On Red Light
Under The Influence Of Alcohol/Drugs (Use When Arrest Is Effectuated)	Bicycle Advancing Legally On Red Light
Physical Condition Of Driver	Related To Bus Stop
Passing Stopped School Bus	Disregarding Yield Sign
Texting	Turning Right On Red
Distraction - Other Electronic Device (Navigation Device, Dvd Player, Etc.)	Disregarding Road Markings
Had Been Drinking (Use When Arrest Is Not Made)	Disregarding Other Traffic Signs
Cell Phone Use Other Than Texting	Distraction - From Inside Vehicle
Exceeding Safe Speed For Conditions	Disregarding Stop Sign
Driving On Wrong Side/Wrong Way	Disregarding Traffic Signals
Operating Vehicle In Erratic, Reckless, Careless, Negligent Or Aggressive Manner	Driving Skills/Knowledge/Experience
Improper Turning/No Signal	Failing To Reduce Speed To Avoid Crash
Improper Lane Usage	Improper Backing
Improper Overtaking/Passing	Failing To Yield Right-Of-Way
Following Too Closely	

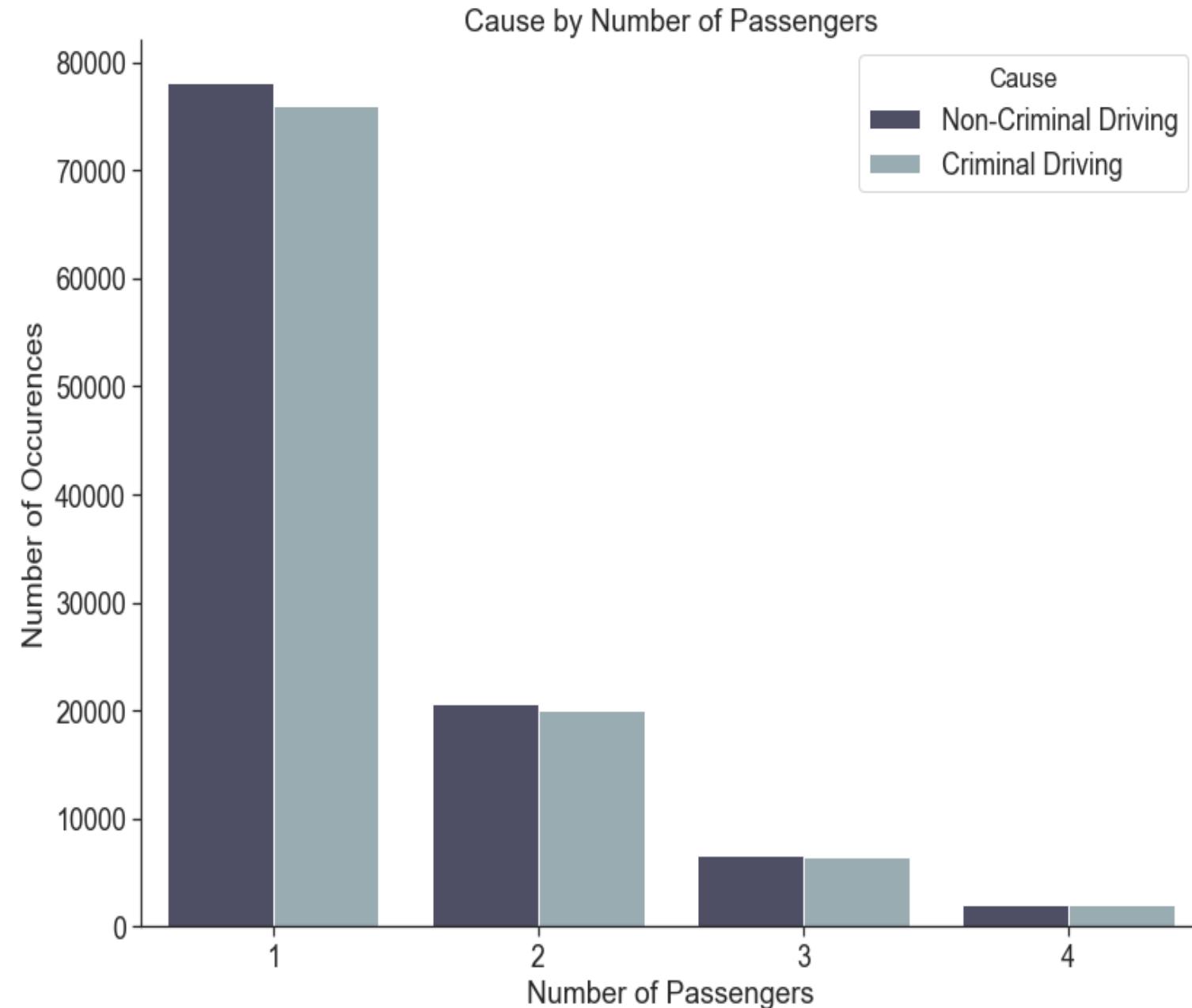
# Frequency of Crashes caused by Criminal Driving

- There is an even split between crashes caused by criminal and non-criminal driving
- Non-criminal driving occurs just slightly more than criminal driving



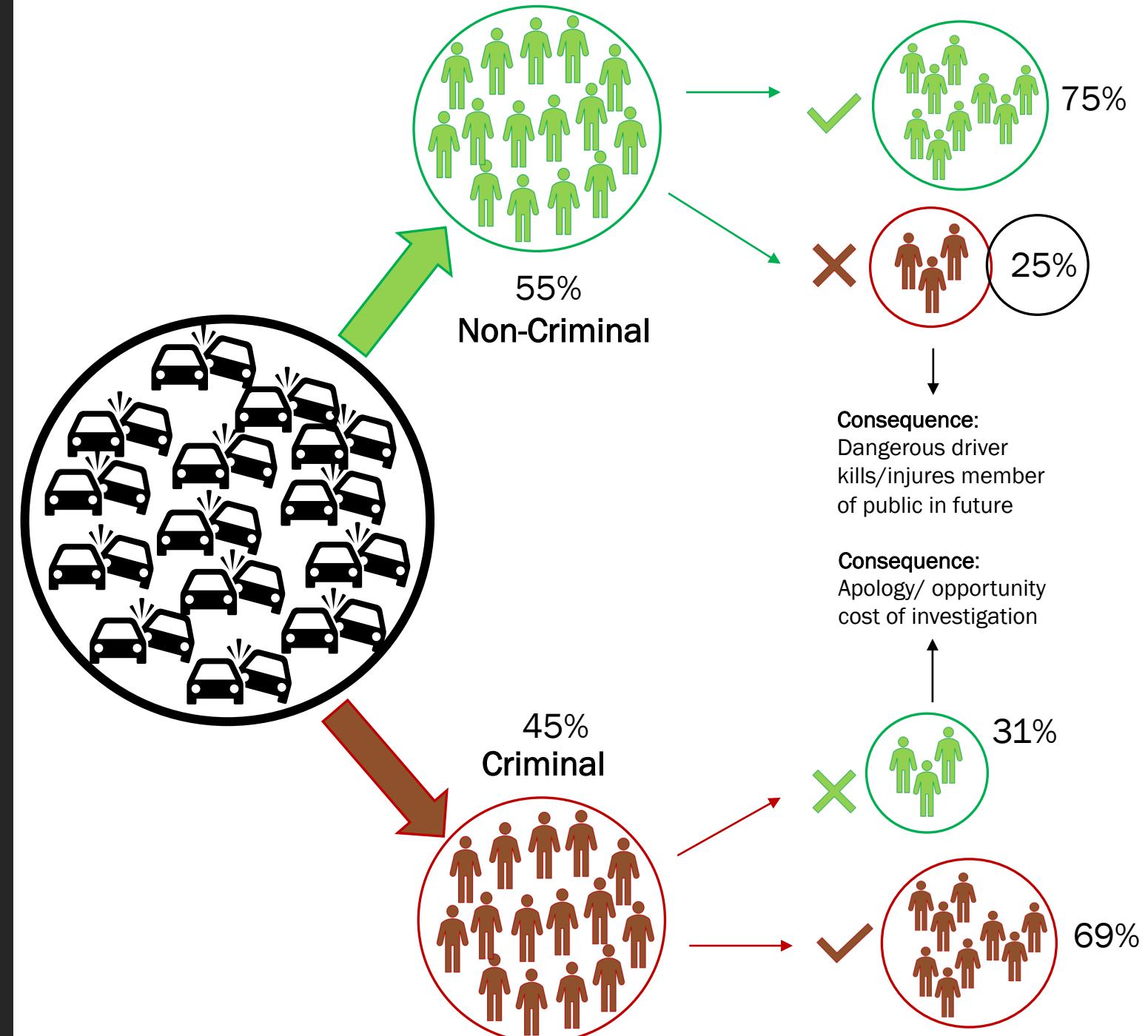
# Lack of visual difference across classes:

- When we inspect the number occurrences of criminal vs non-criminal driving against several variables such as day of week, time of day, and sex, it is hard to discern a clear pattern.
- This is why the need for a model is so crucial



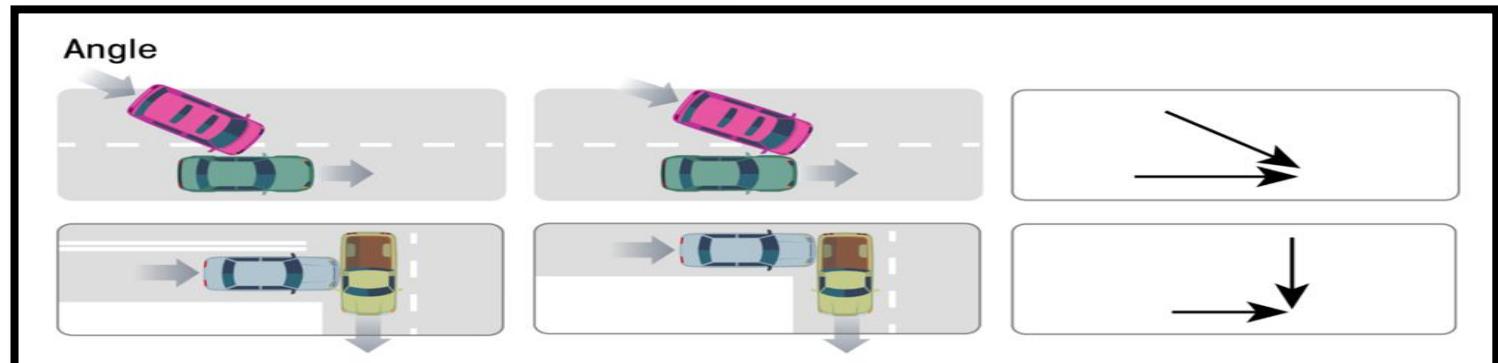
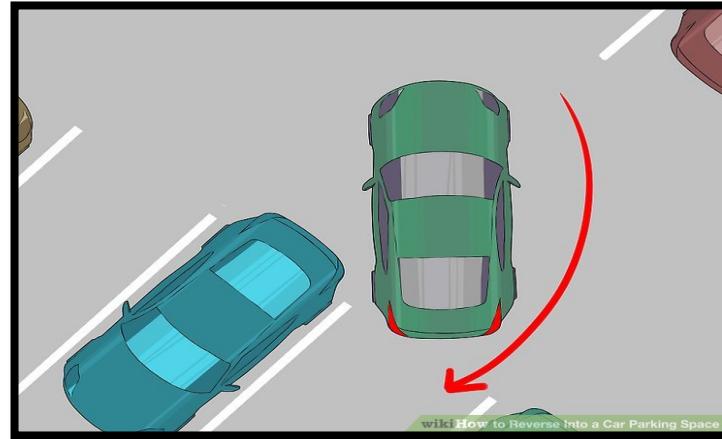
# Model Results

- The model predicts criminal driving behavior from crash data correctly just over 71% of the time.
- The model makes two types mistakes
- We want to minimize the types of mistakes that puts dangerous drivers back on the road



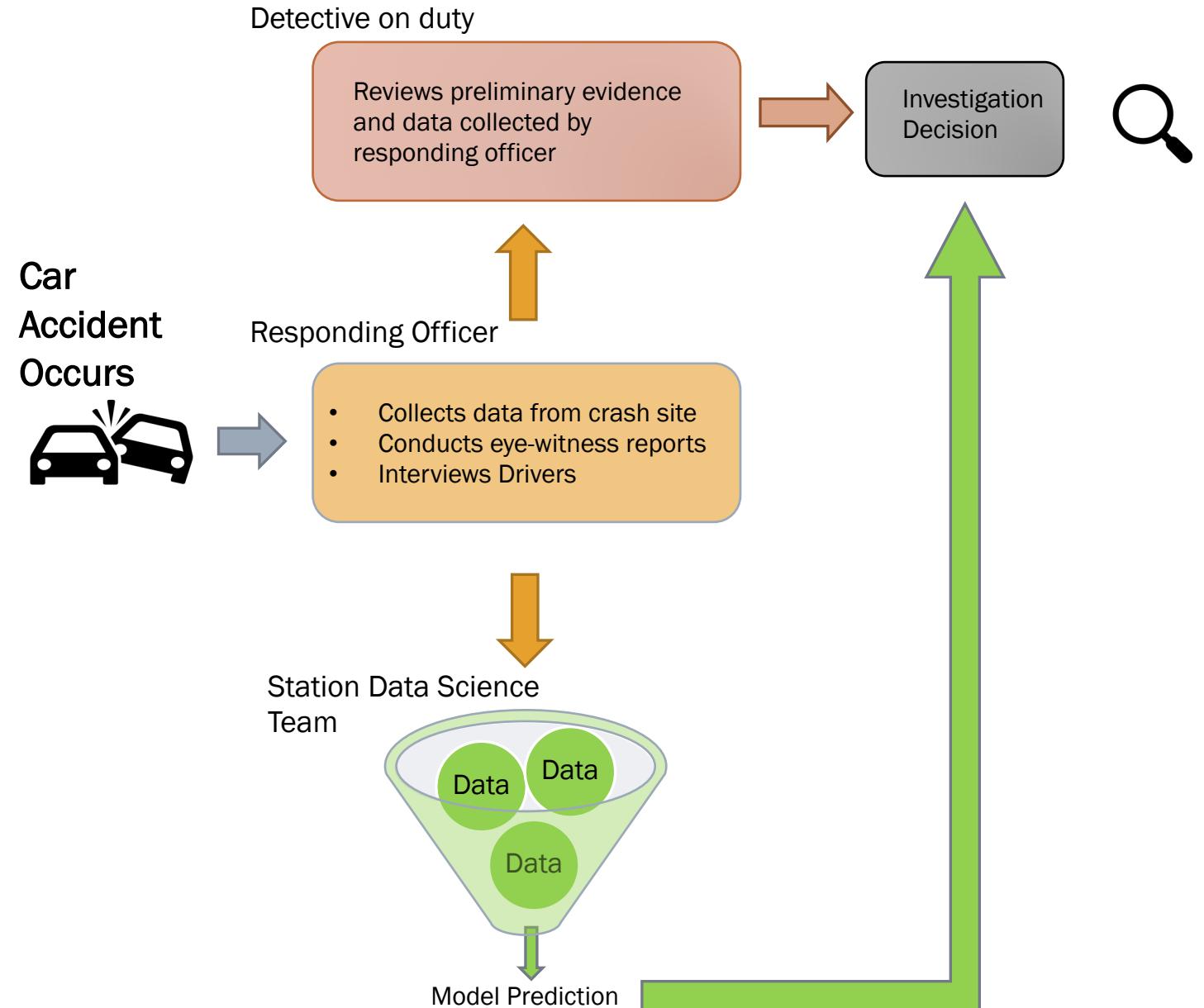
# Model Results: The Five Most Significant Factors in Predicting Criminality of a Car Accident

Factor	Odds Ratio
Crashed at an angle	6.06
Crashed while reversing	5.65
Crashed rear to side	3.88
Crashed at railroad Crossing	3.71
Crashed into pedestrian	3.39



# Implementation of the Model:

- Considering the model is not infallible, it should be used in conjunction with human supervision.
- The model should be used as a part of a multi-step procedure following a car accident to determine if further investigation is needed.



# Limitations of the Model:

- Possibility of Algorithm Bias: Law enforcement datasets are notorious for containing historic bias.
- Limited explanatory power with regards to significant factors
- The need for human supervision due to imperfect classification

# Areas for Improvement:

Encourage Chicago Police Department to collect a data from a car's 'black box' recorder. (Most modern cars are now equipped with this device)

