ACCIDENT DETECTION & NCDB ANALYSIS

Capstone Project
Group 1

WHY THIS ANALYSIS ?

High Rate of Motor Vehicle Collisions

Economic loss, human loss, trauma

Need for Proactive and Reactive Measures

Prevention and efficient emergency response

Implementation of Data-Driven Strategies

Use of NCDB for predictive modeling

Detect Accidents Using CNN

Proactive Measure : Prevention of Accidents & Reduction of Severity Level

Reactive Measure : Detection of Motor Vehicle Accidents

Problem

Action

Solution

Output

EVERY LIFE MATTERS

Between 2000 to 2018

6,913,204

Accidents Reported

Fatality 46,735

Injured 3,617,076

Analyzing the Key Trend

Yearly Trend: A **decreasing trend in accidents** from 2000 to 2018 may reflect improved safety measures or reporting changes.

Monthly Peaks: Higher accident rates in **January, July, and October** may be due to seasonal driving conditions and travel habits.

Weekly Highs: More accidents on **Thursdays and Fridays** could be linked to increased travel and changes in driving behavior near weekends.

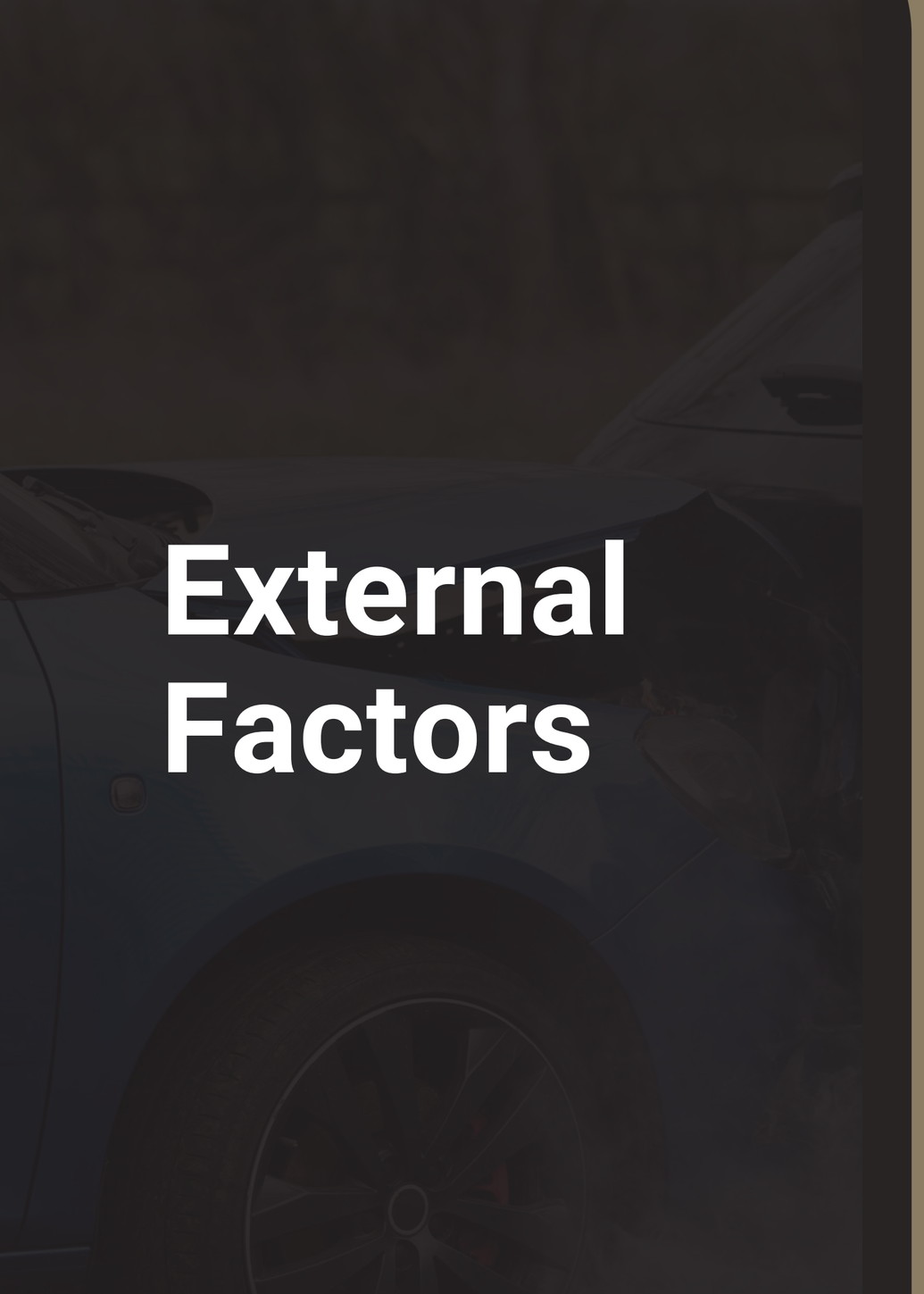
Hourly Spike: A rise in accidents from **3 PM to 8 PM** coincides with the evening rush hour and diminishing daylight.

January, July, and October
Thursdays and Fridays

3 PM to 8 PM

21 Yr to 30 Yrs - 22%

Male 56.07%



External Factors

The majority of accidents occur under clear and sunny conditions on dry, straight, and level roads at intersections.

Accidents predominantly happen at intersections on straight roads without traffic controls.

Areas without traffic controls, especially non-intersections, experience the highest number of accidents, with a significant spike at intersections featuring parking and on curved roads.

A lack of traffic control is commonly associated with a higher incidence of accidents.

The risk of accidents escalates markedly during freezing rain when traffic controls are not in place.

Internal Factors

The **driver's seat** is the most common position for both non-fatal injuries and fatalities in accidents.

The unsafe positions, with the highest numbers of fatalities, are the **driver’s, front row and second-row right position and passengers in motorcycle.**

Most of the accidents are due to the **Light Duty Vehicles** and the involvement of these vehicles in accidents are decreasing over the years.

The vehicle model years **2000-2003** had the highest number of accidents compared to other years in the past decade.

PREDICTING SEVERITY

Data from 2015 -2018

Feature Selection: Selected the top 15 features with the strongest relationships to the severity of collisions using the ChiSquare test.

Class Imbalance: Implemented Near Miss undersampling to balance both class.

MODEL TRAINING AND HYPERPARAMETER TUNING

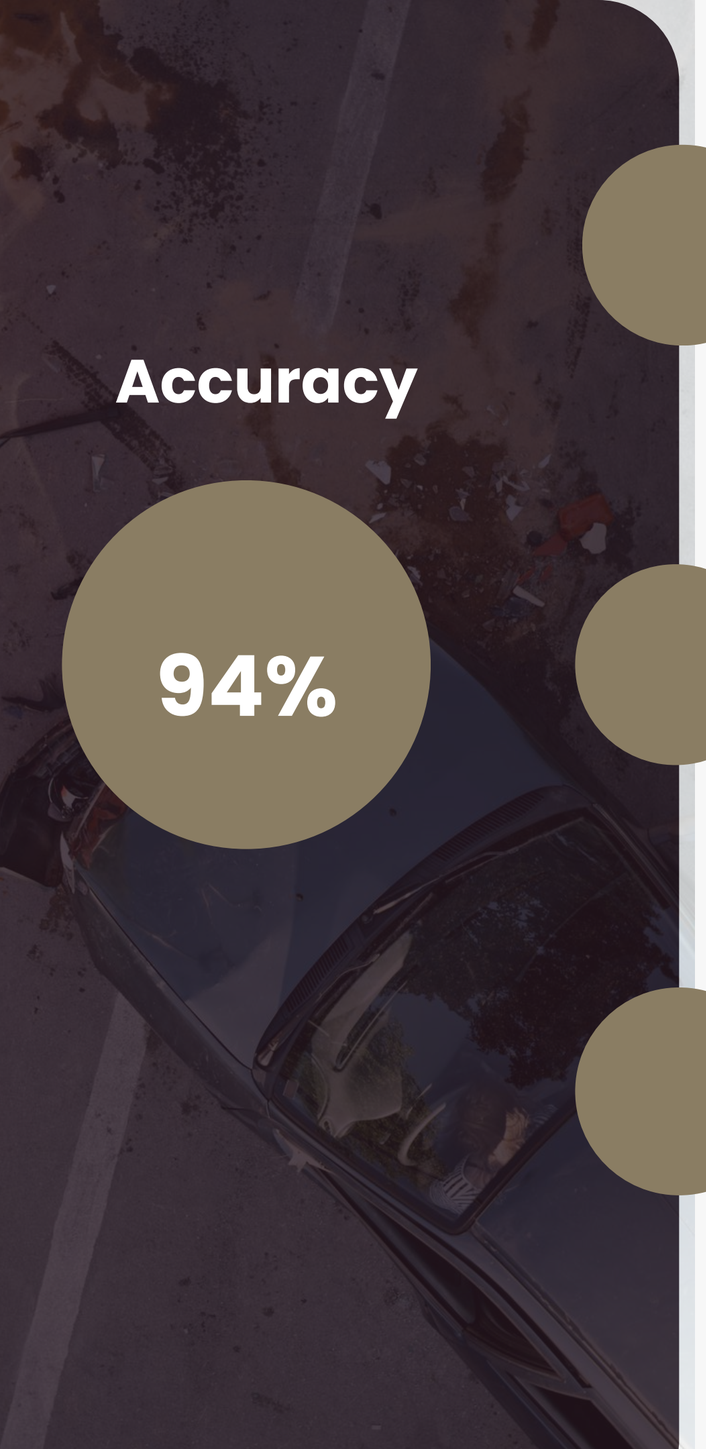
Evaluated three models:

- Decision Tree
- Logistic Regression
- **Random Forest**

using key metrics to select the most effective model.

	Model	Accuracy_Training_Set	Accuracy_Test_Set	Precision	Recall	f1_score
0	LogisticRegression	0.744701	0.742228	0.838720	0.601412	0.700514
1	DecisionTreeClassifier	0.948978	0.934617	0.977229	0.890311	0.931747
2	RandomForestClassifier	0.948978	0.937825	0.980625	0.893622	0.935104

Random Forest Optimization: hyperparameter tuning using **RandomizedSearchCV** with **3-fold cross-validation.**



Accuracy

94%

Random Forest

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Model Performance
Accuracy = 0.94
Precision = 0.98
Recall = 0.89
F1_Score = 0.94
```

CNN TO DETECT ACCIDENTS

Human Safety: Early detection of accidents can facilitate prompt emergency response, potentially saving lives and reducing injury severity.

Traffic Management: Accident detection helps in managing traffic flow, reducing congestion and secondary accidents.

CNN

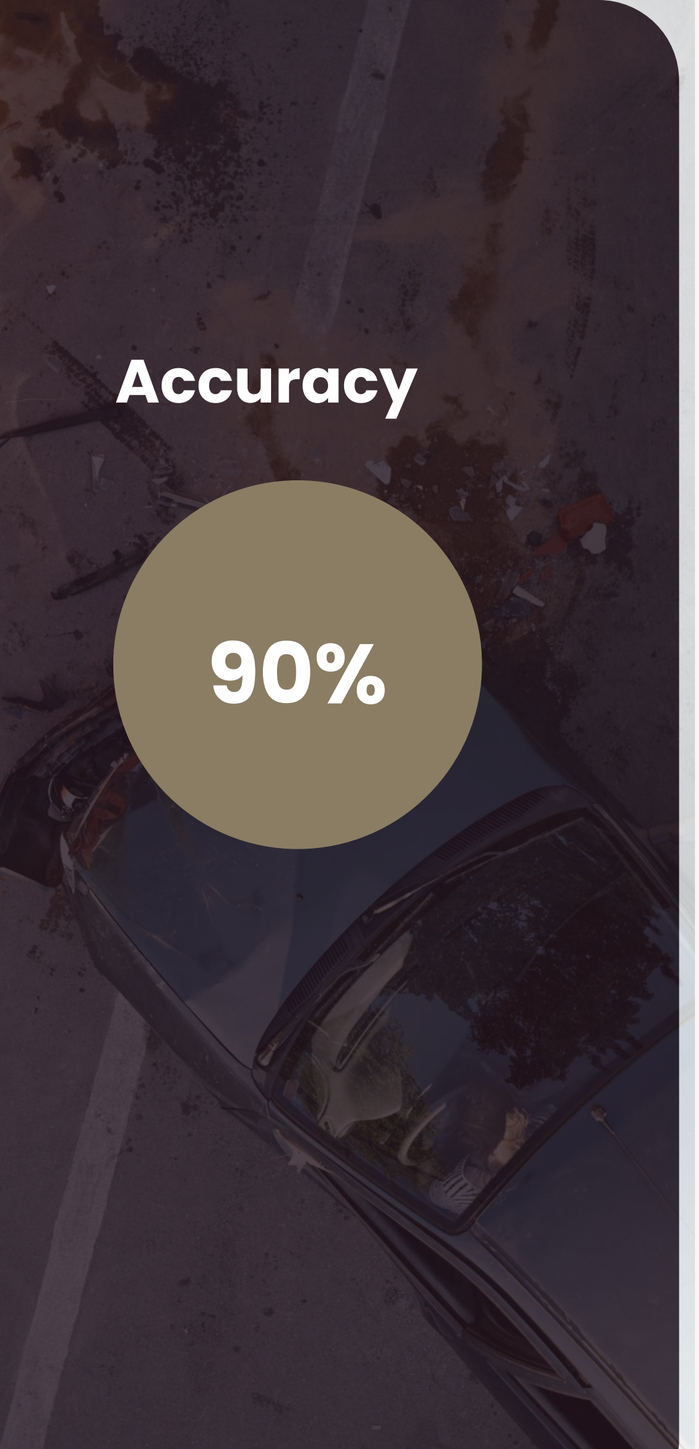
Two Classes
'Accident' and 'Non-Accident'.

Image Processing

Model Architecture:
3 convolutional layers
ReLU activation
Max pooling.
Flattening layer transitions
Sigmoid activation

Training Approach

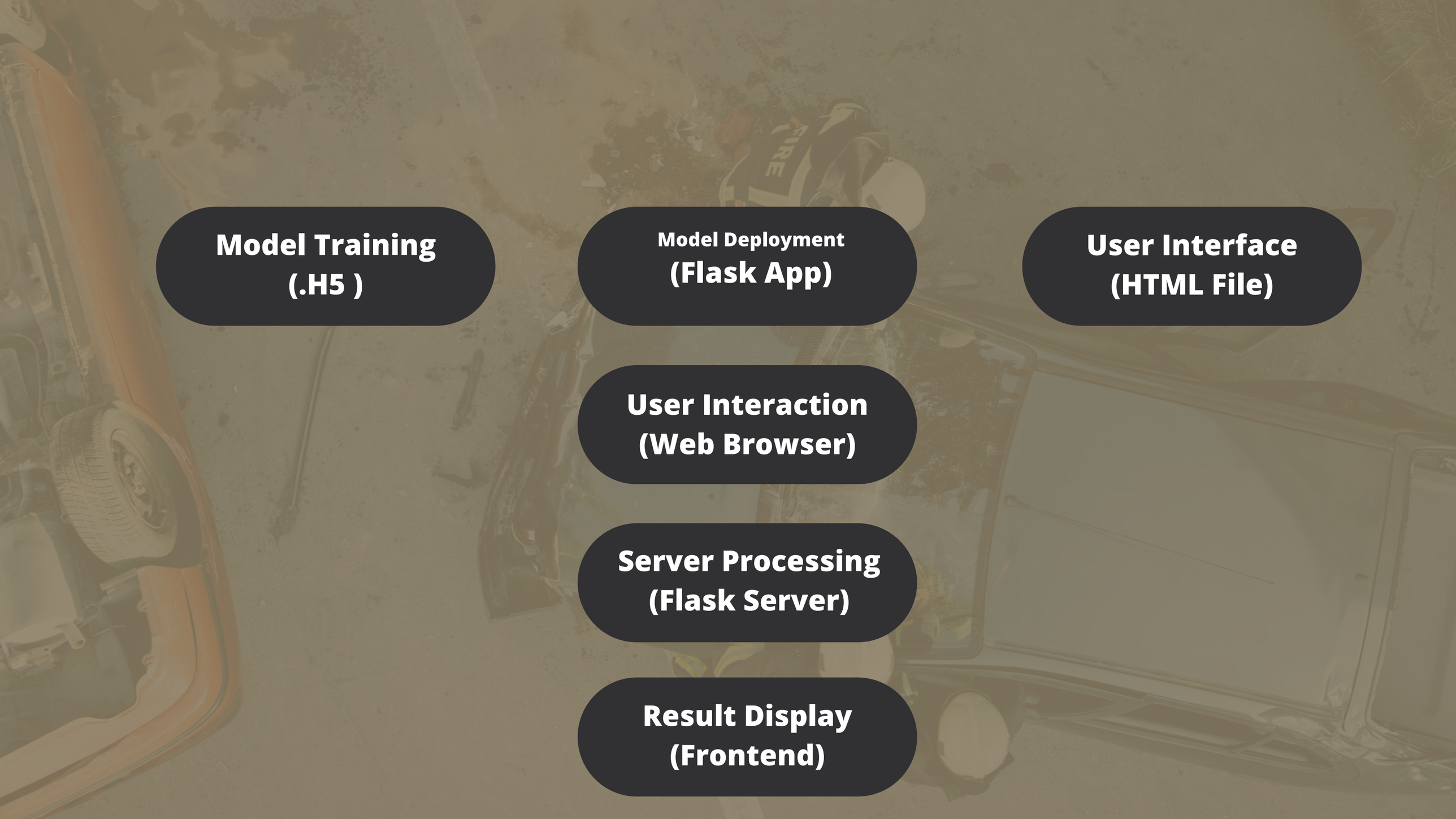
Classify based on y hat value



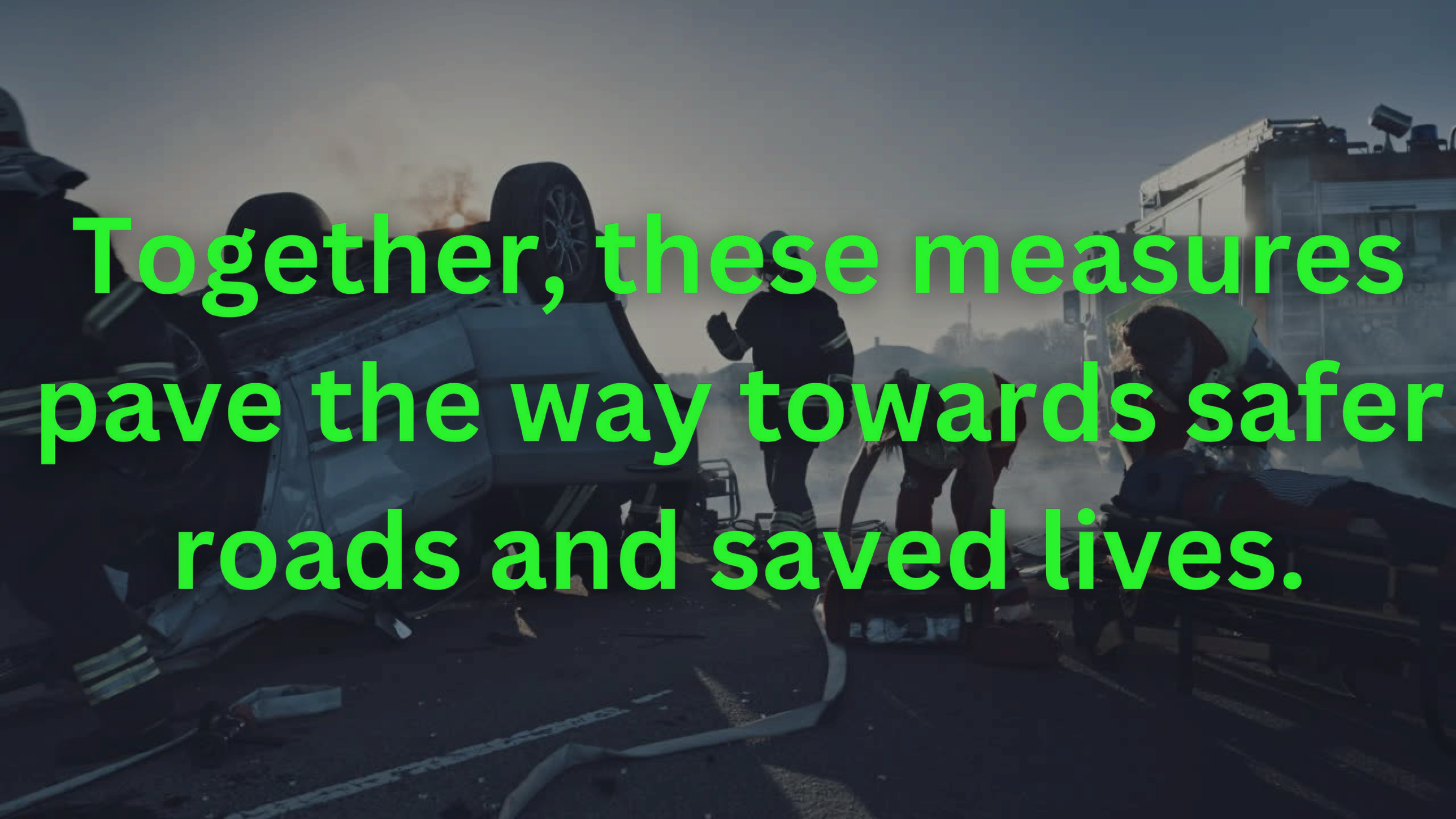
Final Results

Metric	Value
Precision	0.8644
Recall	0.9623
Accuracy	0.9

DEPLOYMENT


Model Training
(.H5)
Model Deployment
(Flask App)
User Interface
(HTML File)
User Interaction
(Web Browser)
Server Processing
(Flask Server)
Result Display
(Frontend)


DEMO


Together, these measures
pave the way towards safer
roads and saved lives.