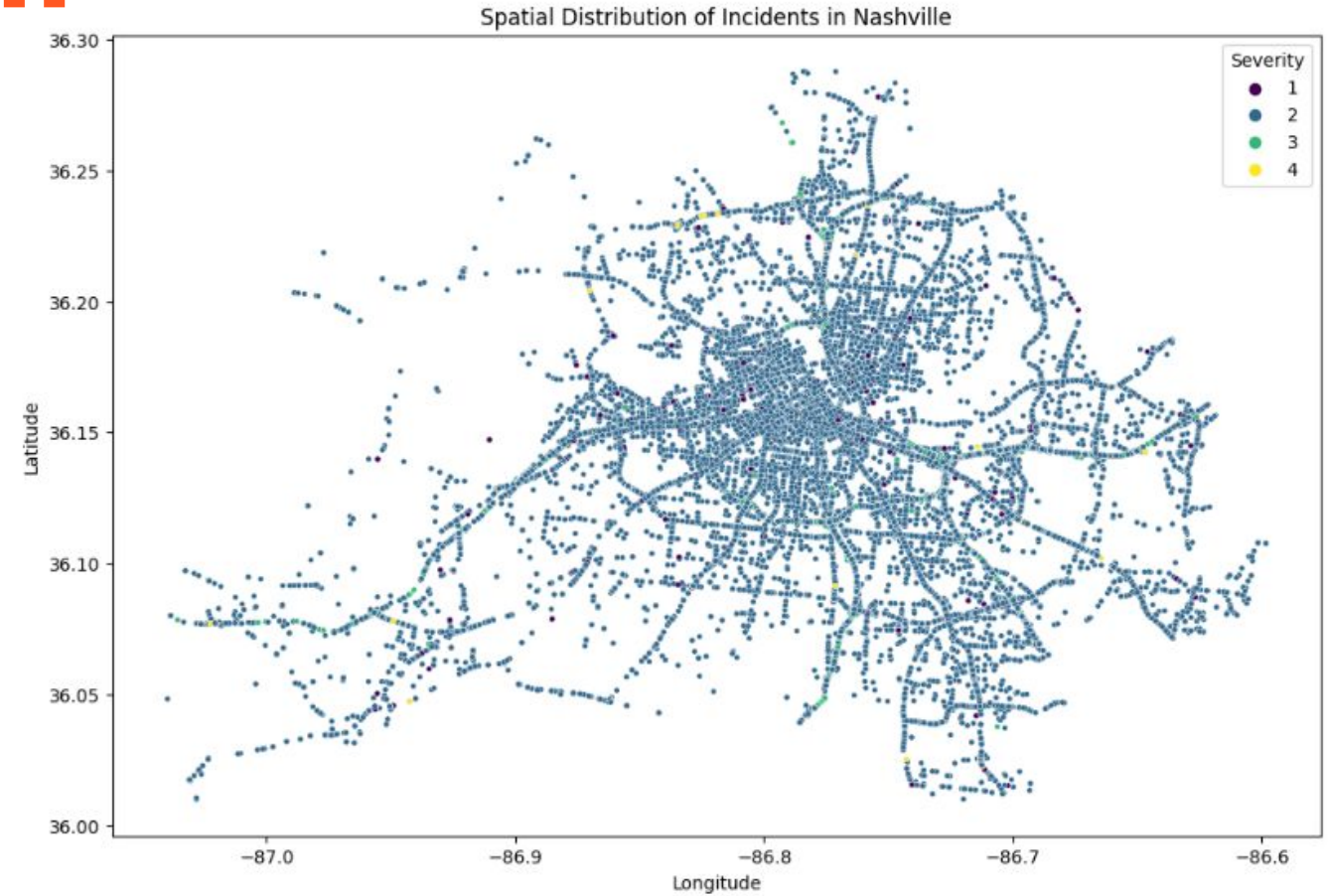
Analyzing Climate's Role in Accidents in Nashville, U.S.A.

A Deep Dive into Weather's Impact on Traffic Safety

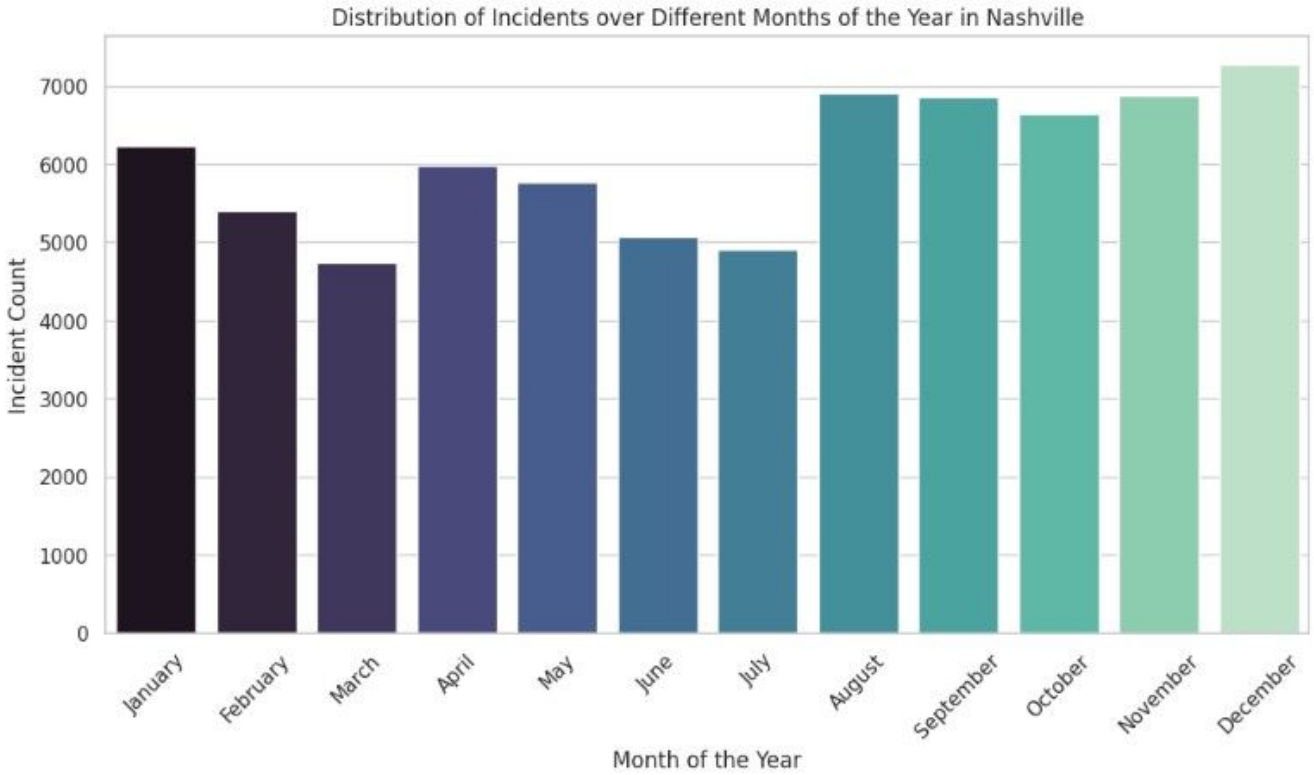
Objective & Approach

- **Objective:** Determine the relationship between weather conditions and traffic accidents.
- **Approach:** Extensive data analysis, including exploration, cleaning, transformation, statistical testing, model building, and evaluation.
- **Primary focus:** Nashville
- **Comparative insights:** Madison and Boise

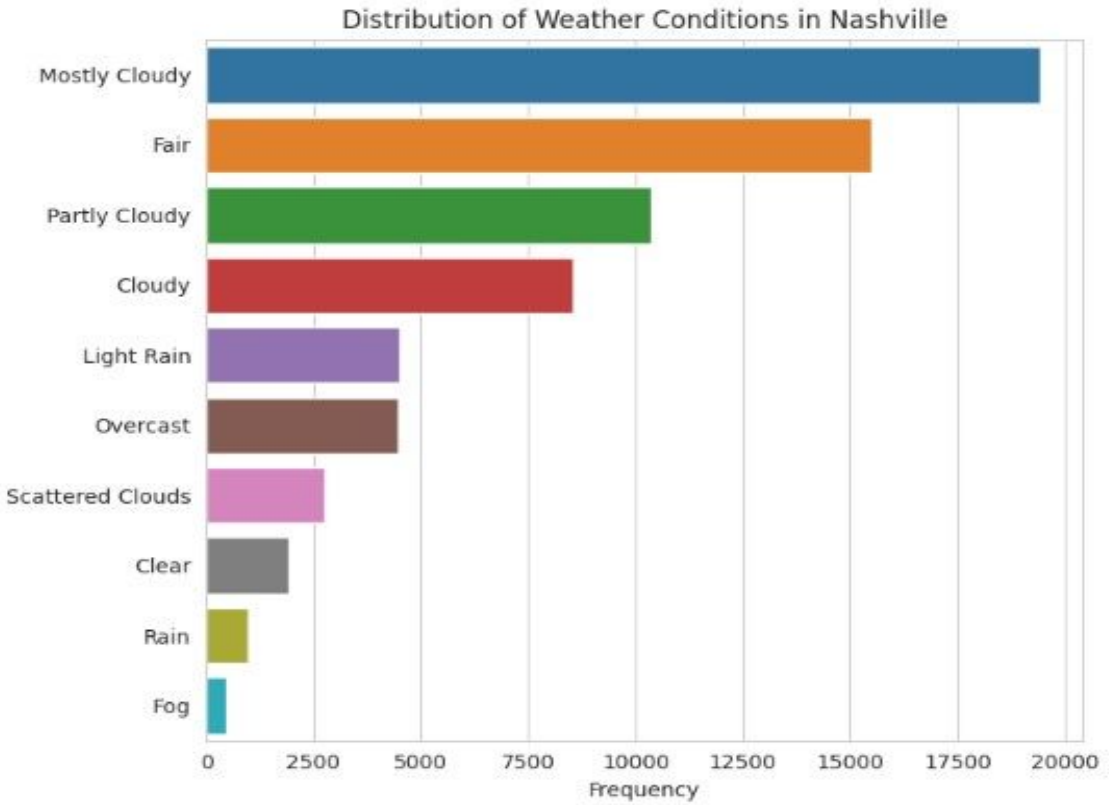


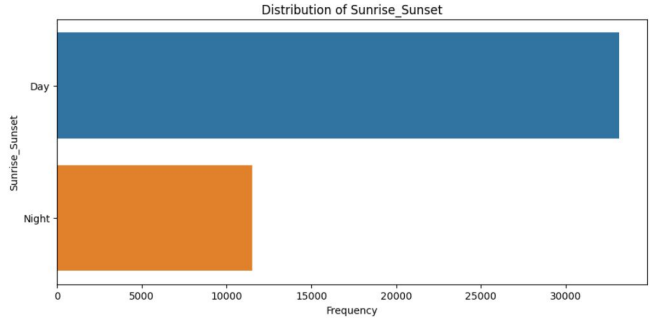
Dataset At a Glance

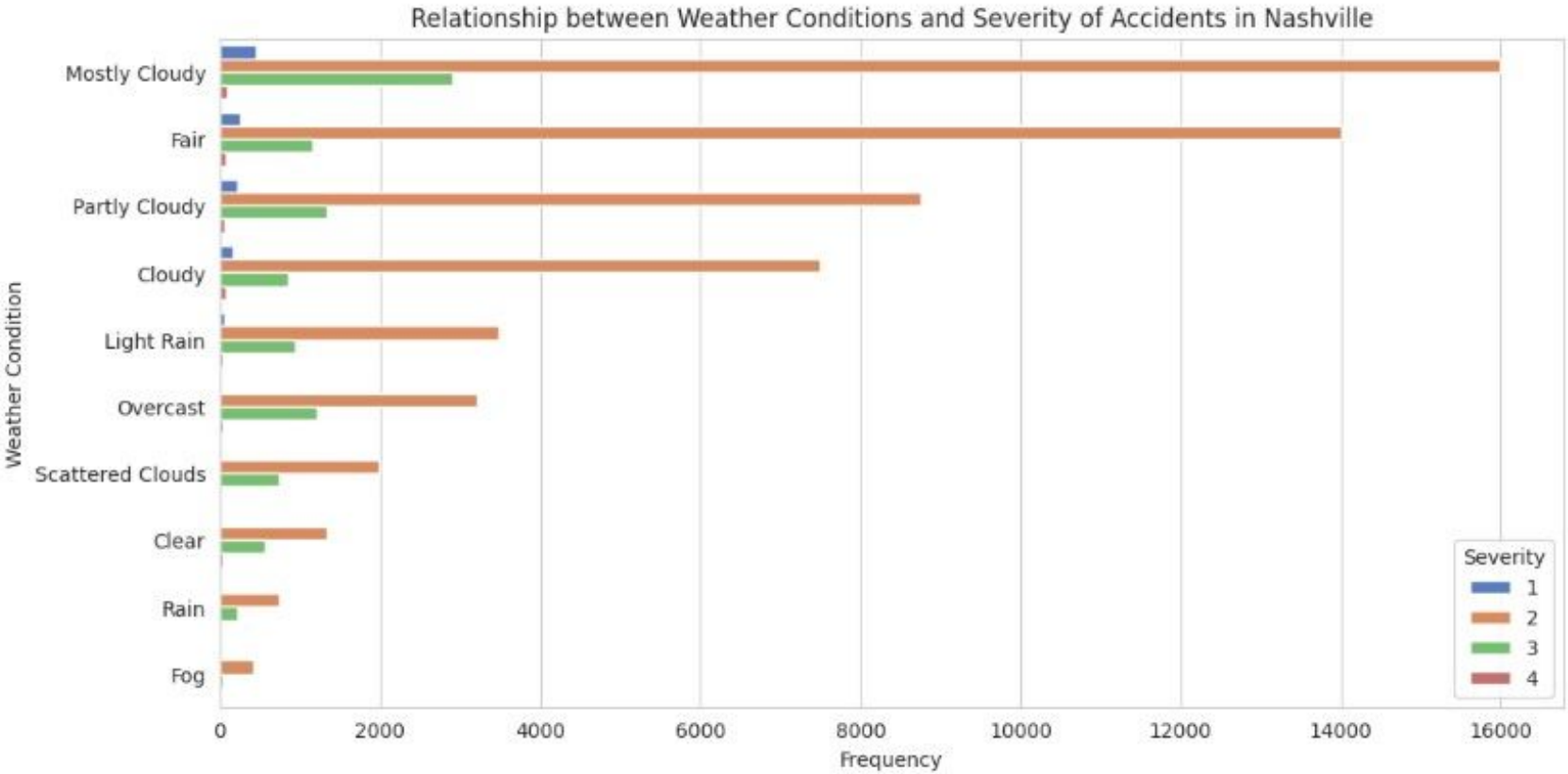
- **Sources:** US traffic accident records, Meteostat weather data.
- **Key Features:** Season, Temperature, Visibility, Weather Condition, Precipitation, Total Accidents.
- **Period:** February 2016 to March 2023.

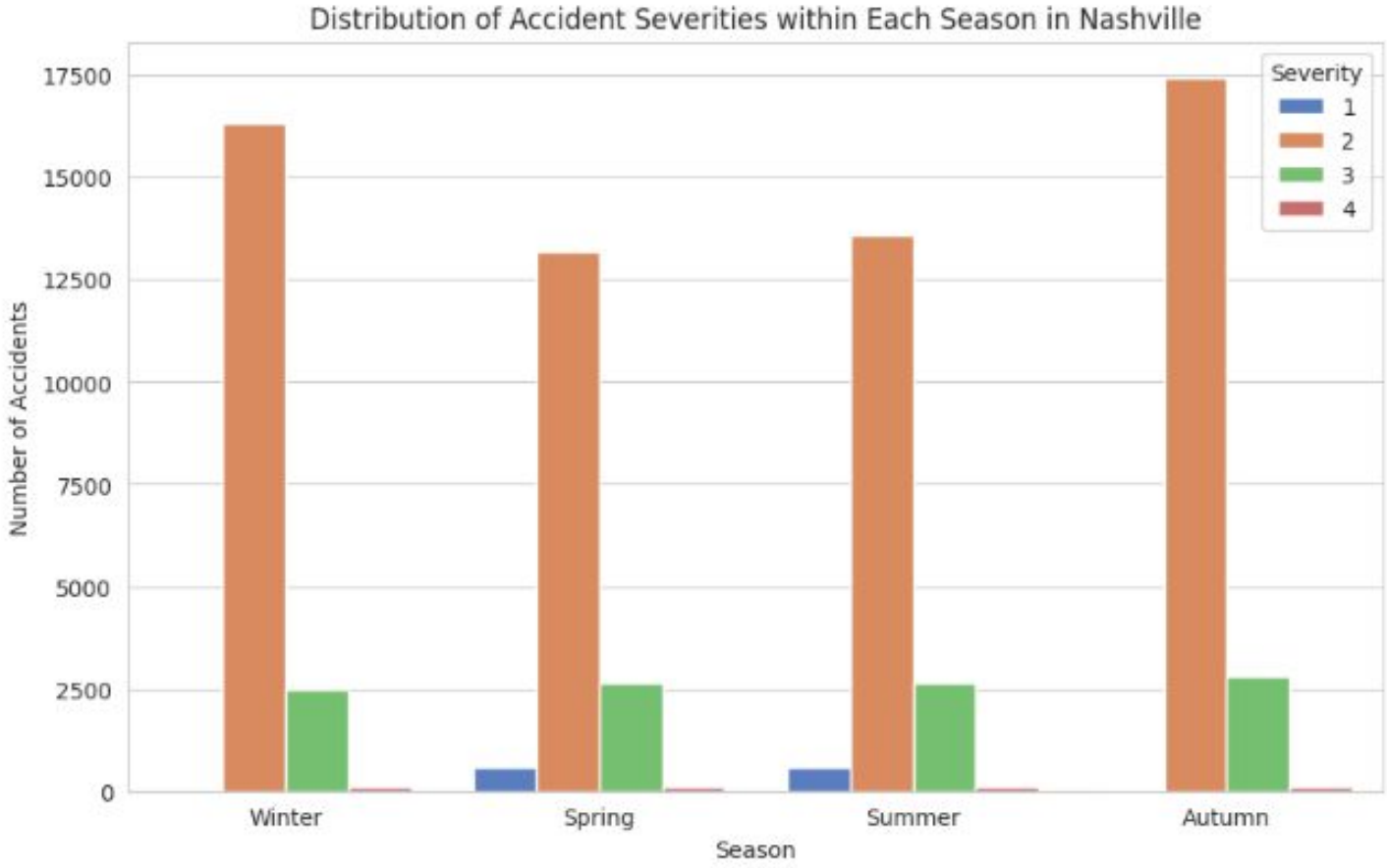


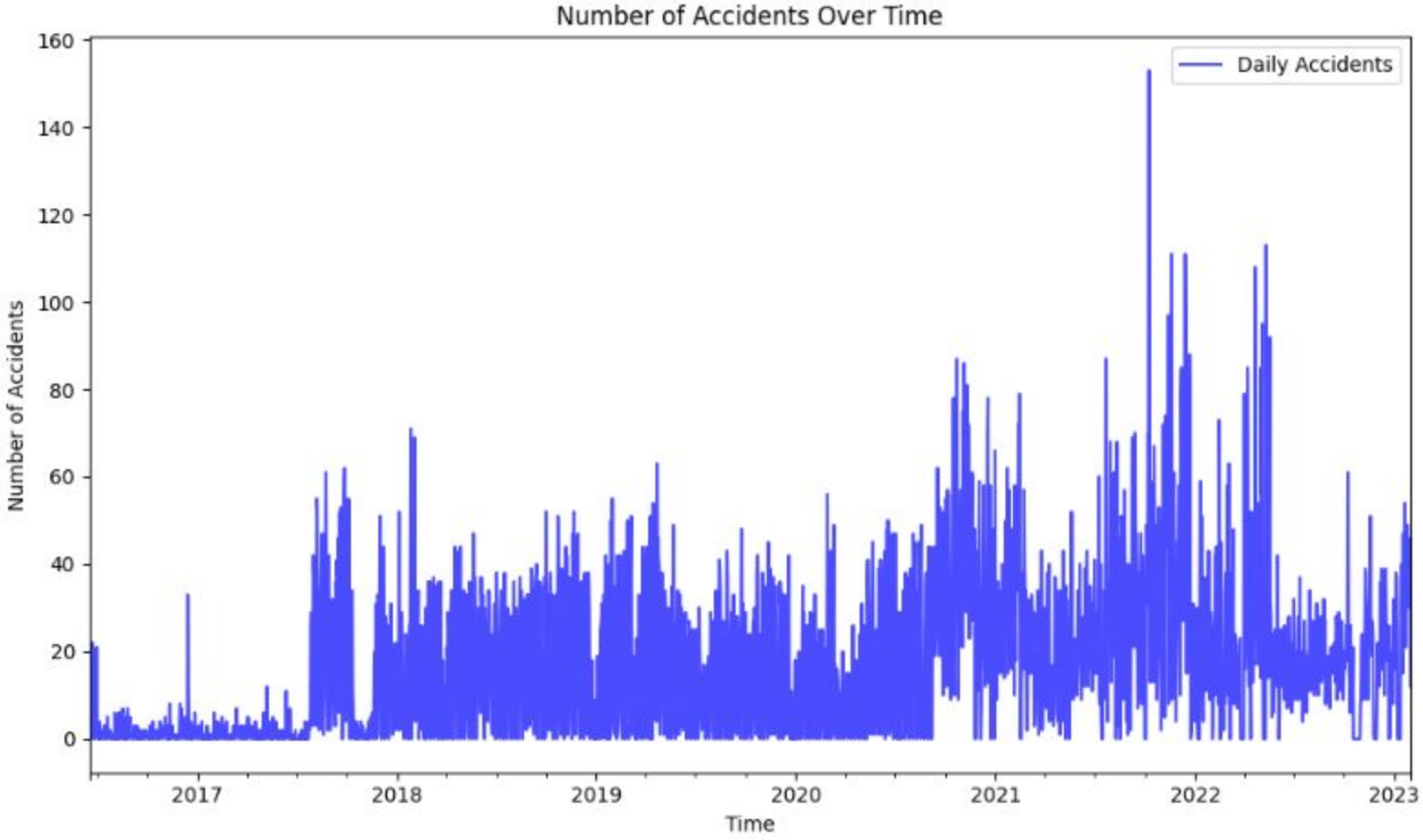
Key Observations





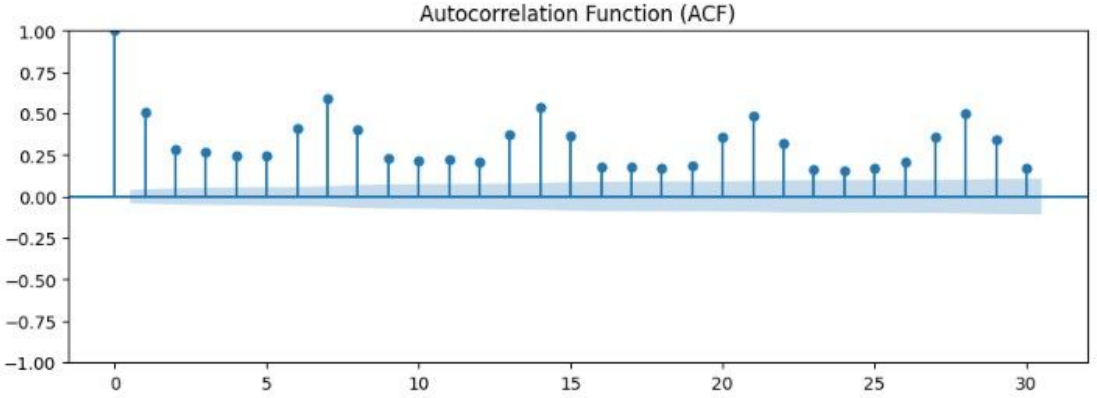

Relationship between Weather Conditions and Severity of Accidents in Nashville
Weather Condition
Mostly Cloudy
Fair
Partly Cloudy
Cloudy
Light Rain
Overcast
Scattered Clouds
Clear
Rain
Fog
0
2000
4000
6000
8000
10000
12000
14000
16000
Frequency
Severity
1
2
3
4

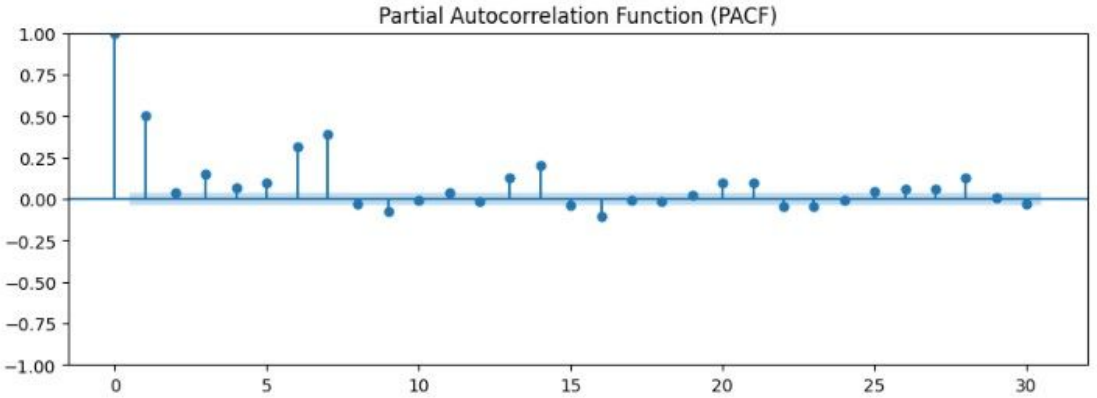

Distribution of Accident Severities within Each Season in Nashville
Number of Accidents
17500
15000
12500
10000
7500
5000
2500
0
Winter
Spring
Summer
Autumn
Season
Severity
1
2
3
4


Number of Accidents Over Time
Daily Accidents
Number of Accidents
160
140
120
100
80
60
40
20
0
2017
2018
2019
2020
2021
2022
2023
Time

Validating Observations

- Correlation tests affirmed weather variables' importance.
- Detected seasonality in accident data.

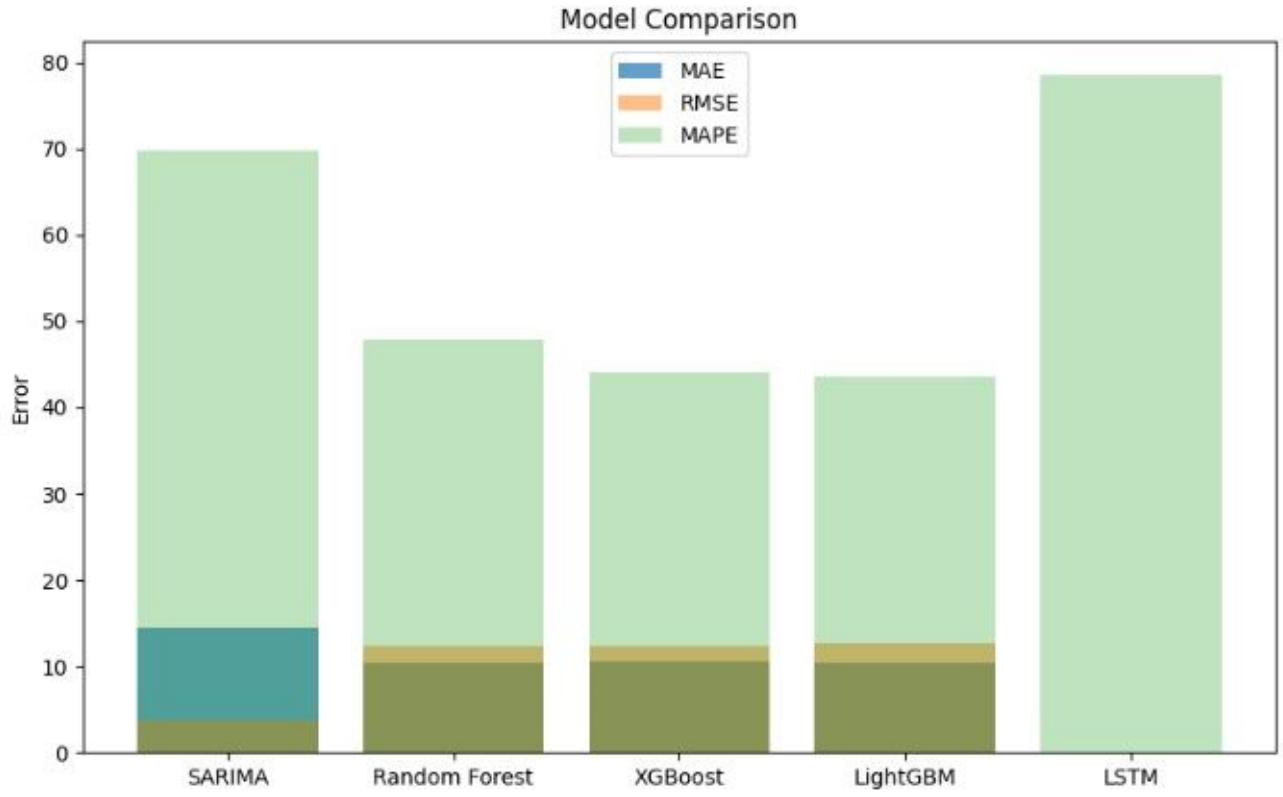


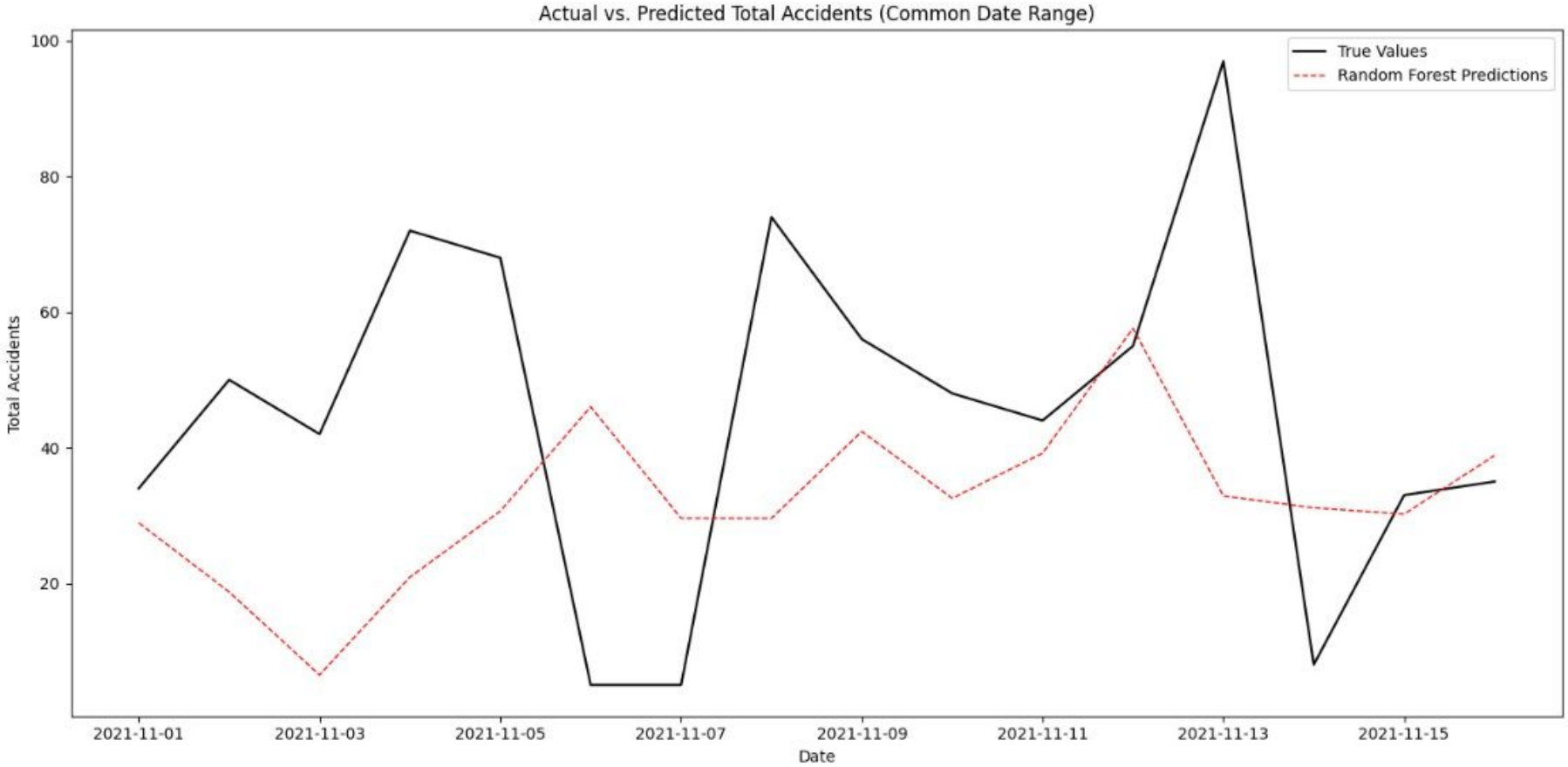


Predictive Modeling

- **Models used:**
  - SARIMA
  - Random Forest
  - XGBoost
  - LightGBM
  - LSTM

- **Evaluation Metrics:**
  - MAE
  - RMSE
  - MAPE




Actual vs. Predicted Total Accidents (Common Date Range)
True Values
Random Forest Predictions
Total Accidents
100
80
60
40
20
2021-11-01
2021-11-03
2021-11-05
2021-11-07
2021-11-09
2021-11-11
2021-11-13
2021-11-15
Date

Conclusions and Path Forward

- Weather has a tangible impact on accident occurrences.
- Seasonal trends notable, especially in winter months.
- Predictive models showcase potential for real-time accident risk assessment.

- **Recommendations:** weather-based traffic management, public awareness, predictive interventions, and infrastructure improvements.
- **Limitations:** Exclusion of factors like tourism, road maintenance, traffic jams.
- **Future Scope:** Incorporate additional data, refine models, real-time risk assessment.

Thank You!

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