By Michael Saccio

# *Predicting CAHOOTS:*

# Analyzing Temporal and Climatic Patterns in Call Data

# Background

- **Temporal Patterns in Call Data**
  - Understanding how call volumes change by time of day, day of the week, season, and year helps optimize resource allocation and response strategies
- **Impact of Climate on Emergency Calls**
  - Investigating how weather conditions affect the frequency and types of calls
- **Predicting Future Call Volumes**
  - Utilizing live weather forecasts and machine learning to anticipate high call volumes

# Data

- **CAHOOTS**
  - 66,461 calls (with time info) spanning between 2021 and 2023
- **Climate**
  - Source: Visual Crossing Weather API
  - Features: temp, humidity, feels-like, dew, etc. (22 in total)
- **Air Quality Index (AQI)**
  - Source: The World Air Quality Index Project
  - Features: ‘pm25’

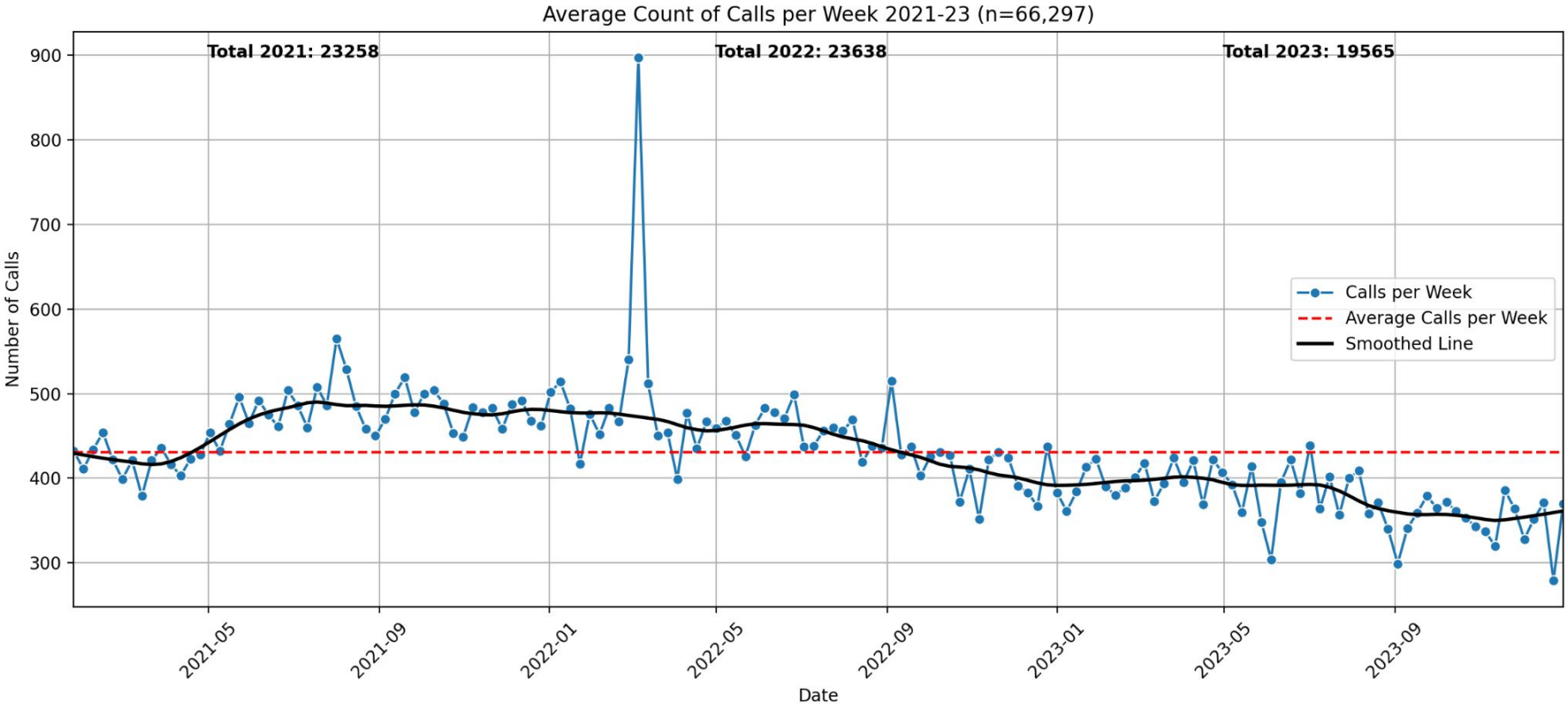
| *Age* | *Season_Winter* | *Season_Spring* | *...* | *uv index* |
|---|---|---|---|---|
| 39 | 1 | 0 | ... | 2 |
| ... | ... | ... | ... | ... |
| 23 | 0 | 1 | ... | 4 |

66461 rows × 72 columns

# Methods

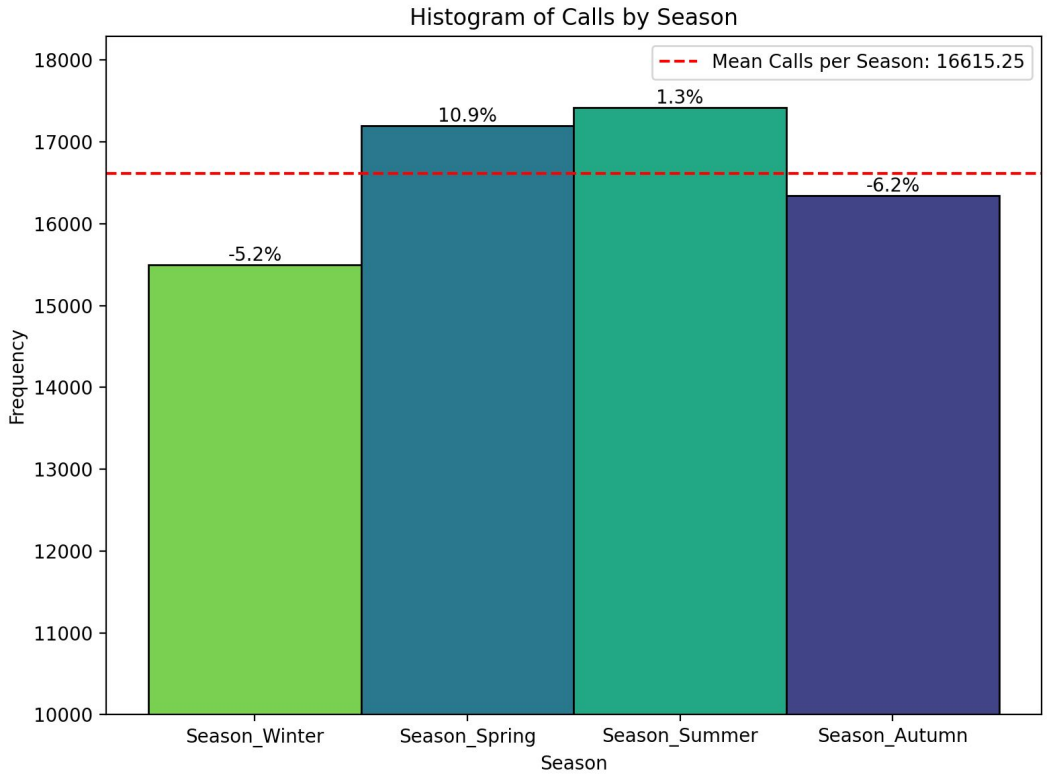
1. **Data Visualization**
    - Created plots to visualize call volumes and classification trends
2. **Correlation Analysis**
    - Examined the correlations between weather features and ‘Reasons for Dispatch.’
3. **Machine Learning Predictions**
    - Used a Random Forest model to predict call volumes based on weather forecasts.
4. **OLS Regression Analysis**
    - Used regression to understand the impact of individual weather features on call volumes

# Call Counts 2021-2023

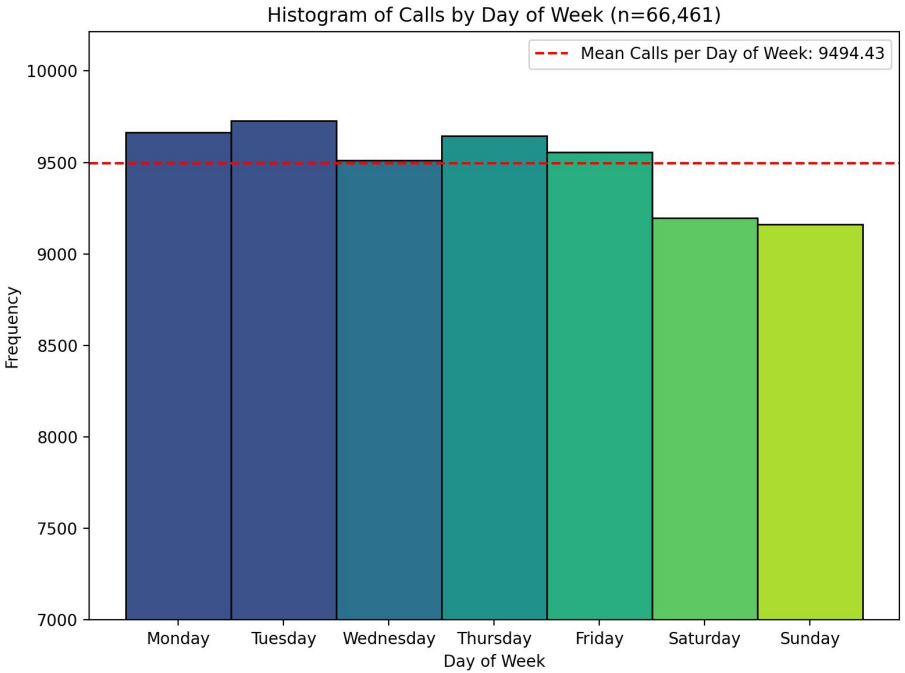


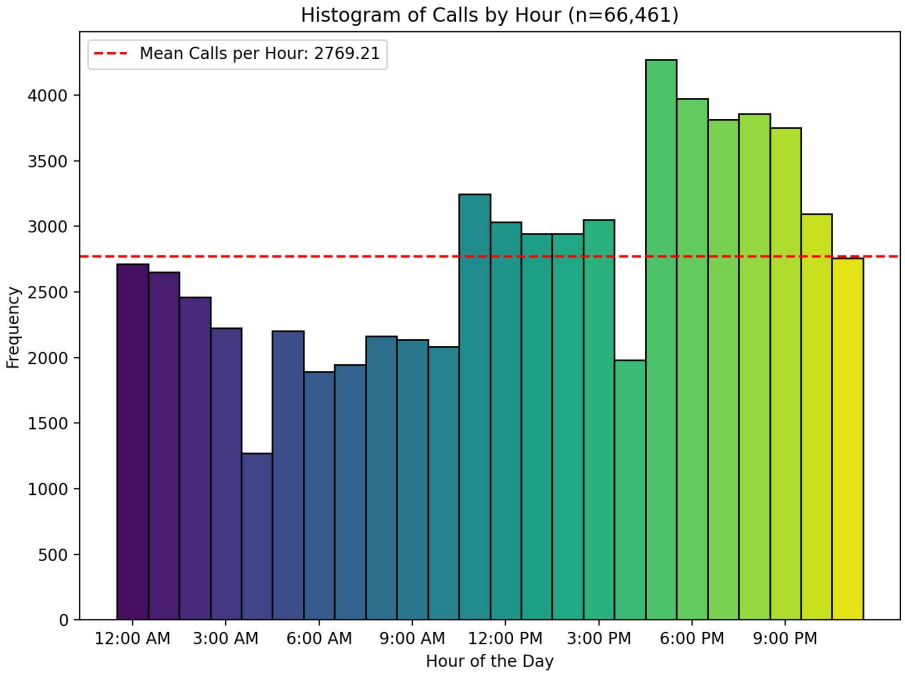
# Seasonal Averages

- **+10.9%** Winter to Spring
- **+1.3%** Spring to Summer
- **–6.2%** Summer to Autumn
- **–5.2%** Fall to Winter

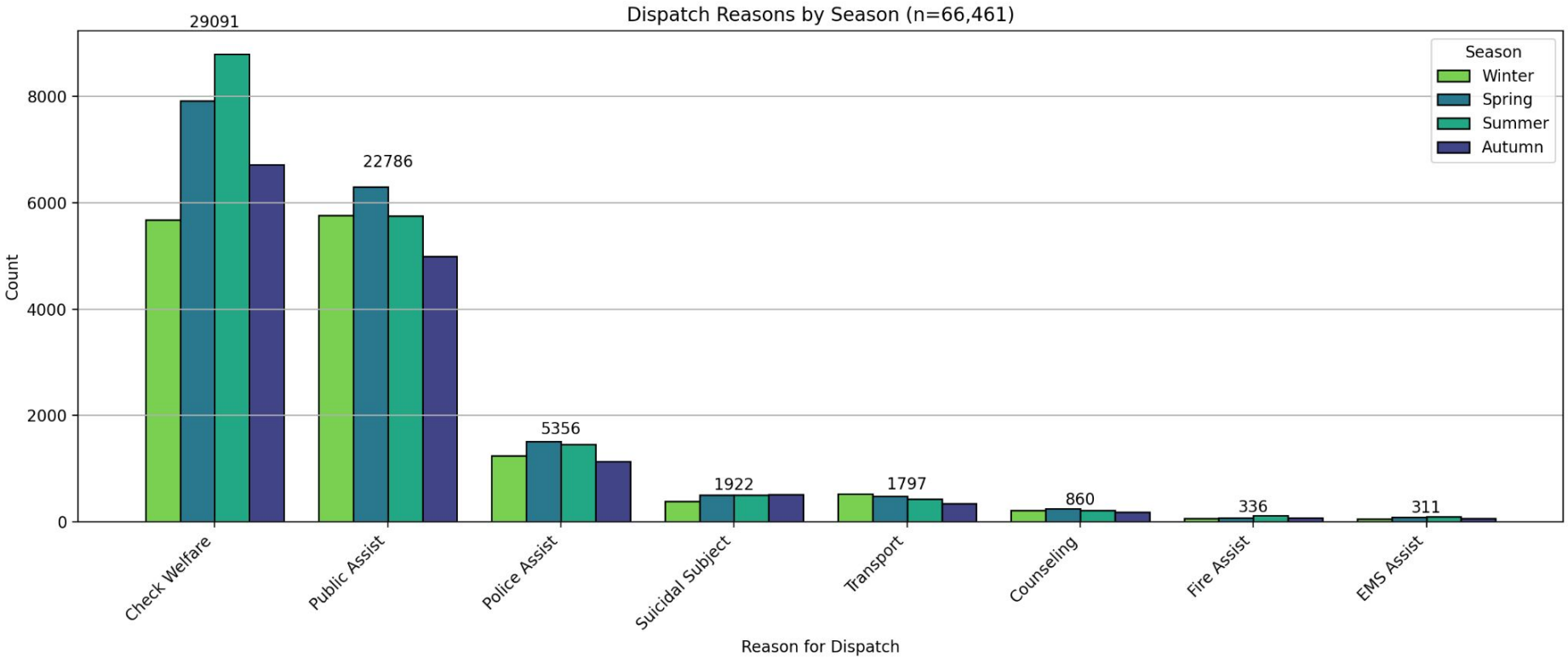


# Daily and Hourly Averages



# Reasons for Dispatch by Season



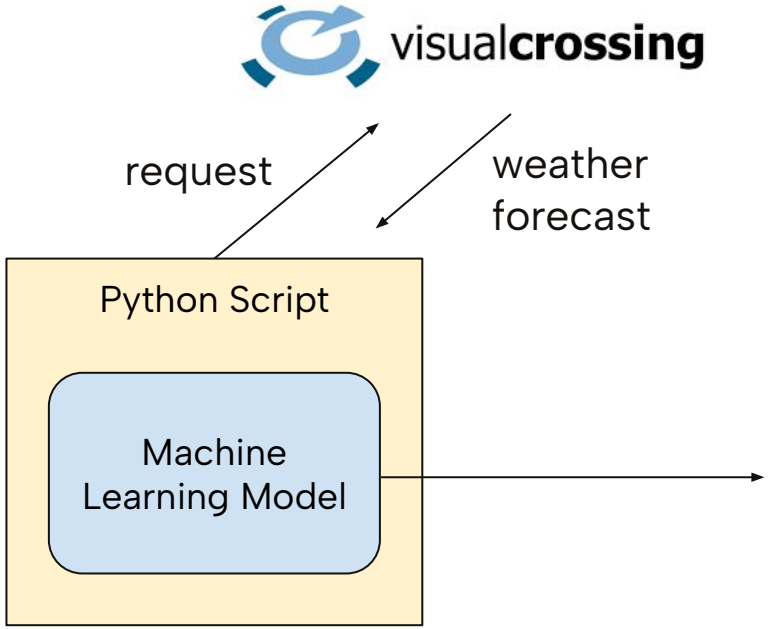
# Reason for Dispatch Correlations

1528 significant correlations found, 381 involving Climate

| *Feature 1* | *Feature 2* | *Correlation* | *P-value* | *Sample Size* |
|---|---|---|---|---|
| Check Welfare | feels_like | 0.081884321 | 2.21E-93 | 62461 |
| Check Welfare | temp | 0.080379998 | 4.84E-90 | 62461 |
| Public Assist | feels_like_max | -0.070922517 | 1.82E-70 | 62461 |
| Check Welfare | solar_radiation | 0.070417611 | 1.72E-69 | 62461 |
| Check Welfare | sunset_hour | 0.06856535 | 5.68E-66 | 62461 |
| Public Assist | temp | -0.068133802 | 3.64E-65 | 62461 |
| Transport | snow | 0.036399071 | 9.05E-20 | 62461 |

*All correlations are statistically significant at the 1% level.

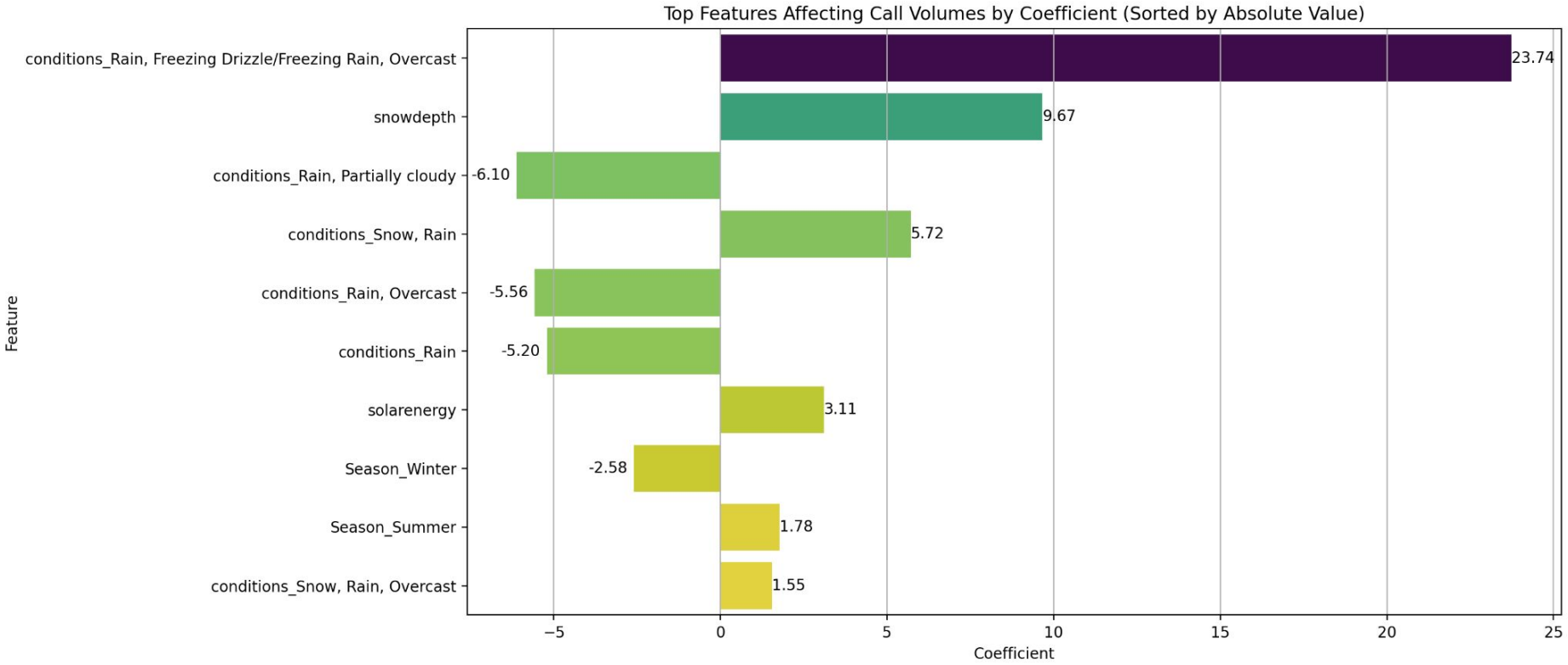
# Risk Assessing Future Days




≥90th percentile

| *Day* | *DayOfYear* | *...* | *High Risk* |
|---|---|---|---|
| Today | 1 | ... | False |
| Tomorrow | 2 | ... | True |
| ... | ... | ... | ... |
| 7 days from Today | 8 | ... | True |

# Learning from an OLS Model



# Conclusion

## Call Volumes

- Decreased in 2023
- Decrease during the weekend
- Increase at 11:00 AM and 5:00 PM
- Increase during Spring, Summer, and Extreme Winter Events

## Call Classifications

- Welfare Checks are more common during the Summer
- Public Assists and Transports are more common during the Winter

## Making Predictions

- We can accurately classify upcoming days as ‘High-risk’ using weather forecasts
    - 191/217 days correctly classified (88% accurate)

# Acknowledgments


- Thanks to Rori
- Thanks to CAHOOTS
- Thanks to the DSCI cohort


Link to Github Repository