UC San Diego

Diving Deeper into Understanding California Fires

COGS219 Final

Contents

Part I. Introduction

Deeper Look into California Forest Fires

- According to CAL Fire 2025 Incident Archive
  - 545 wildfires report with a total of 58,085 acres burned
  - 29 recorded fatalities
- Major damages and costs include
  - $20 billion in insured losses
  - Economic costs to recover totalling to $50 billion

Part II. Datasets

Datasets

- **California wildfire data (2000 - 2022)**

This dataset is based on NADA MODIS satellite NRT near real time data. You will find both USA and California daily wildfire details in this dataset from 2000 - March 25th 2022.

- **California environmental conditions data**

This dataset is an environmental conditions dataframe scraped from CIMIS weather stations using a selenium chromedriver.

Part III. Data Analysis & Results

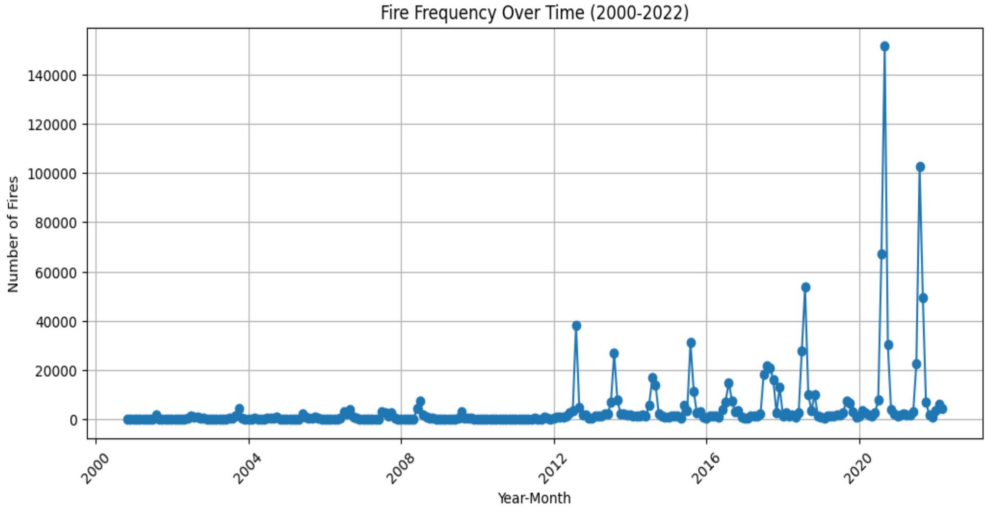
Question 1

Which factors have the greatest influence on fire frequency?

Question 1

How Often Do Fires Occur?

- Fire frequency has fluctuated but generally increased over time.
- Yearly trends show an overall upward trajectory.



Question 1

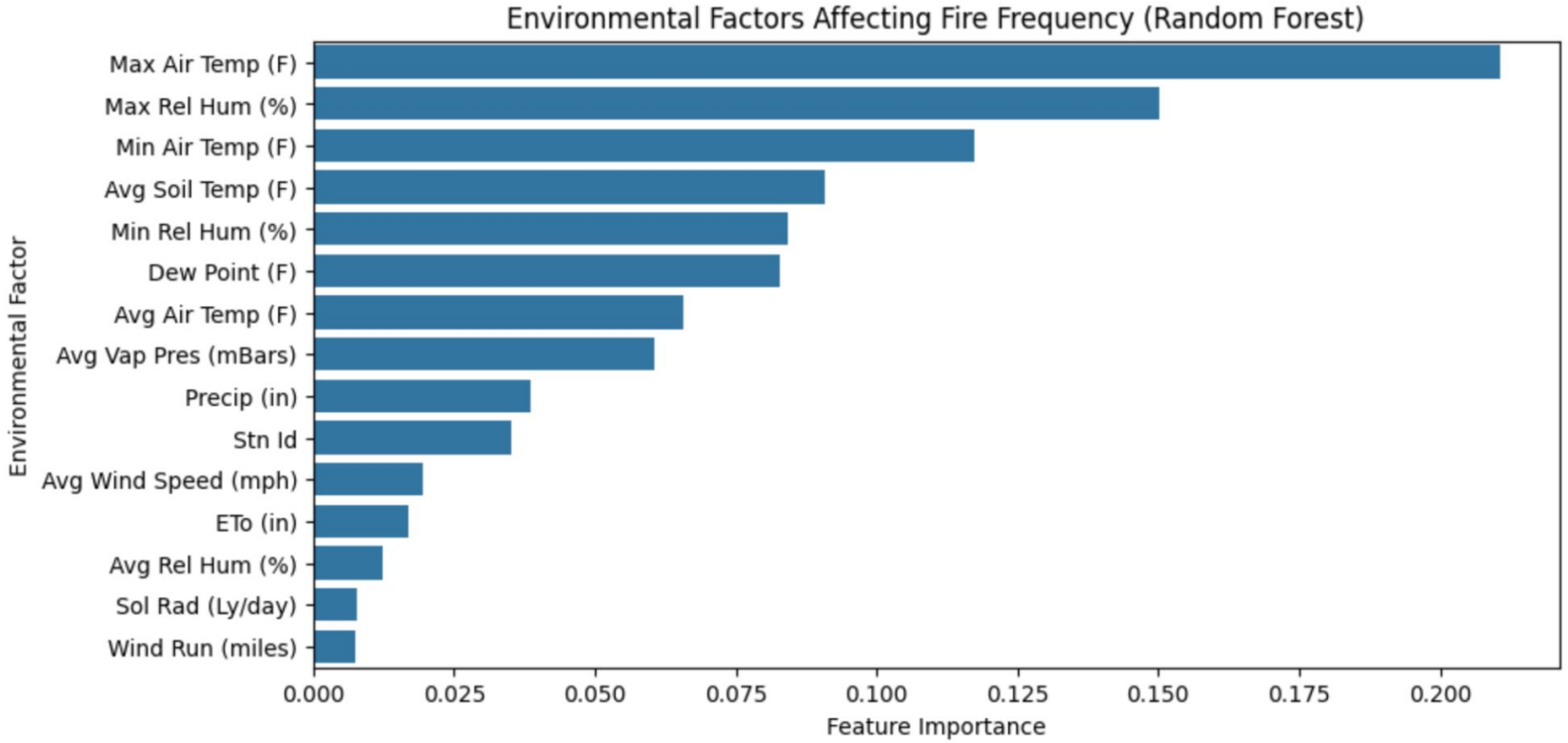
What Factors have the greatest influence?

- Match the fire frequency data and environmental conditions data on **Date** (Year - Month)
- Merged data

Random Forest

- RandomForestRegressor
- X - features
- Y - fire count
- Top environmental factors affecting fire frequency

Question 1

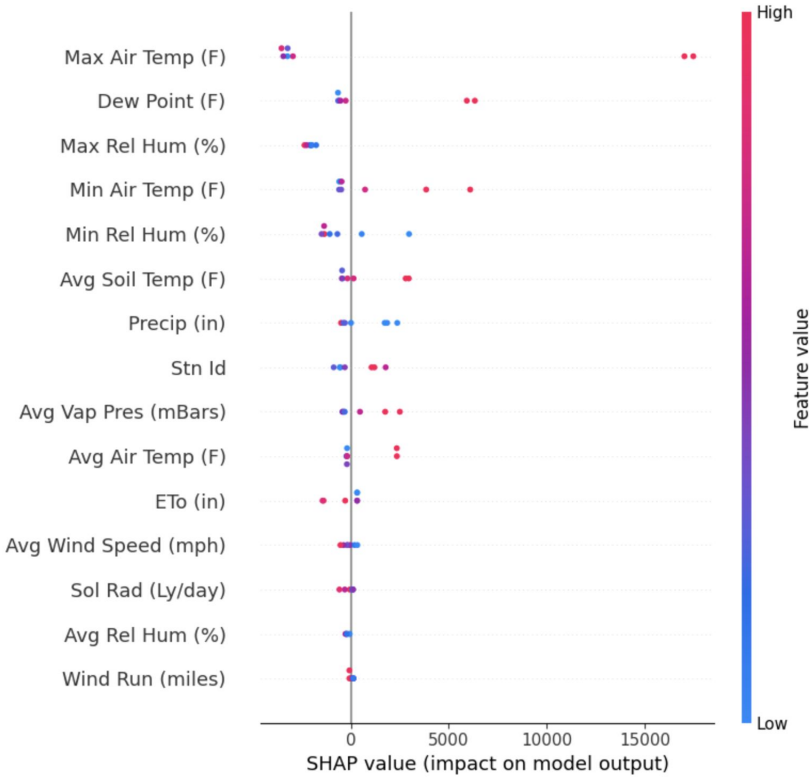

Environmental Factors Affecting Fire Frequency (Random Forest)
Max Air Temp (F)
Max Rel Hum (%)
Min Air Temp (F)
Avg Soil Temp (F)
Min Rel Hum (%)
Dew Point (F)
Avg Air Temp (F)
Avg Vap Pres (mBars)
Precip (in)
Stn Id
Avg Wind Speed (mph)
ETo (in)
Avg Rel Hum (%)
Sol Rad (Ly/day)
Wind Run (miles)
Environmental Factor
0.000
0.025
0.050
0.075
0.100
0.125
0.150
0.175
0.200
Feature Importance

Question 1

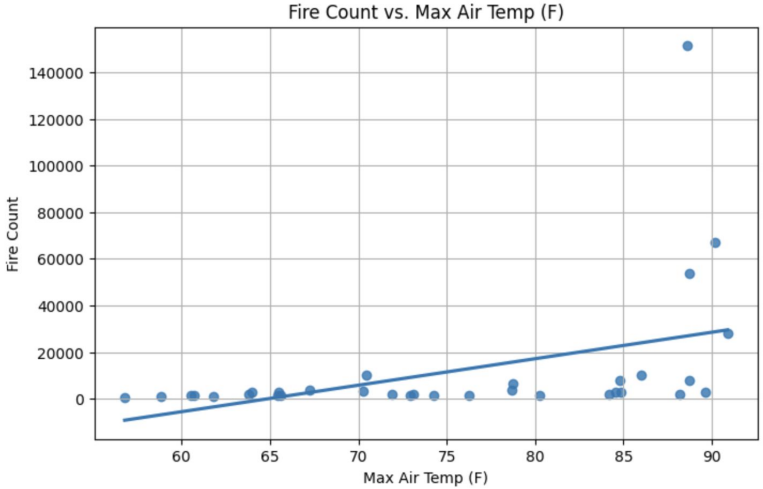
SHAP Analysis

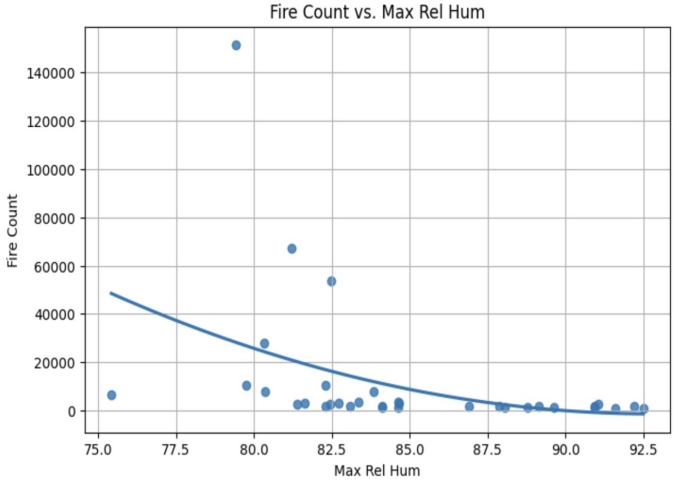
(SHapley Additive exPlanations)

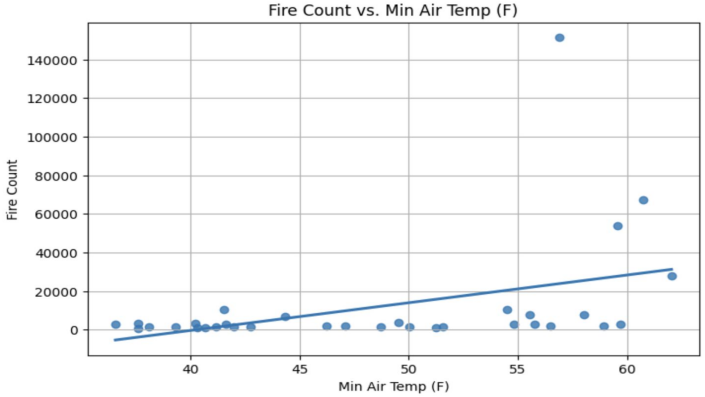
- Max Air Temp
- Dew Point
- Max Rel Hum

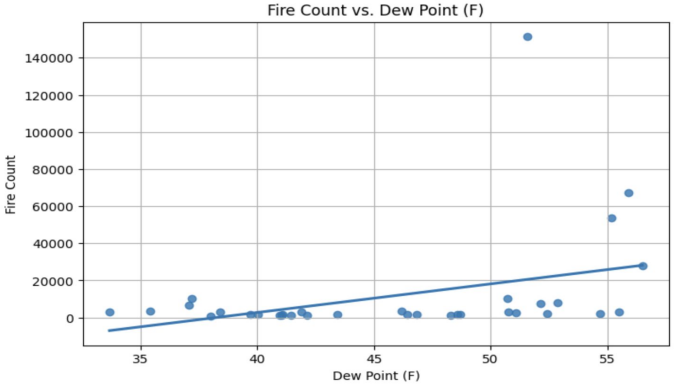


Results


Fire Count vs. Max Air Temp (F)
Fire Count
Max Air Temp (F)


Fire Count vs. Max Rel Hum
Fire Count
Max Rel Hum

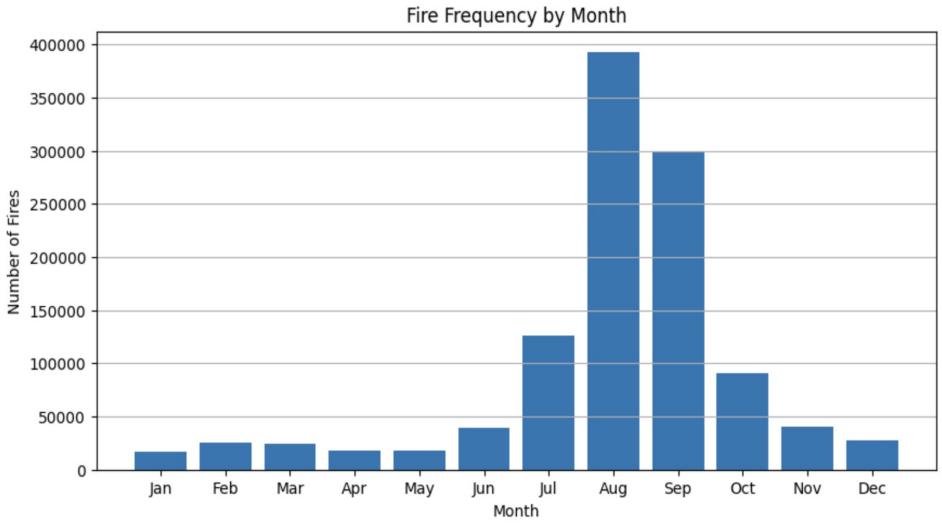

Fire Count vs. Min Air Temp (F)
Fire Count
Min Air Temp (F)

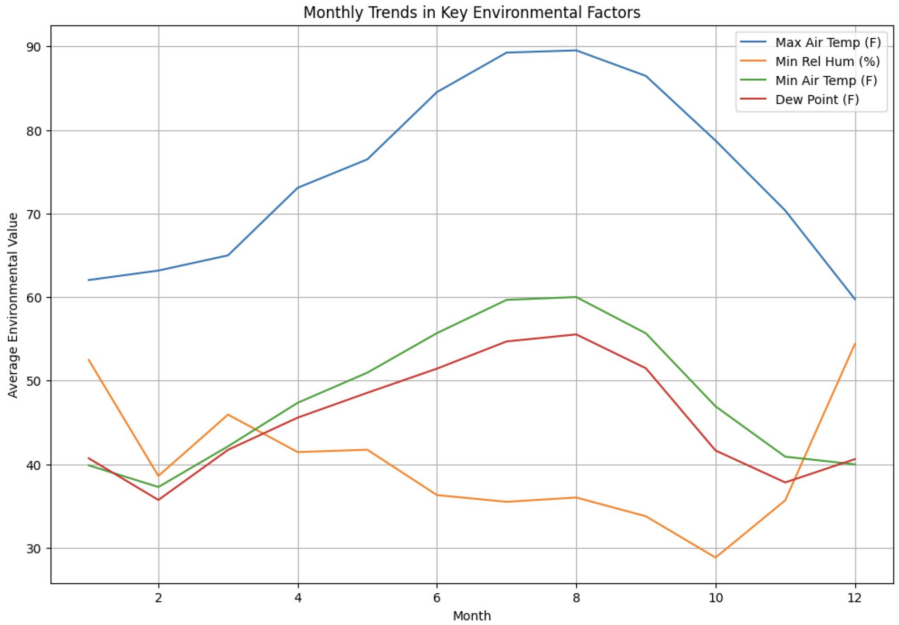

Fire Count vs. Dew Point (F)
Fire Count
Dew Point (F)

Question 2

Can environmental factors help predict the frequency of fires in a given month?

Question 2


Fire Frequency by Month
Number of Fires
400000
350000
300000
250000
200000
150000
100000
50000
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month


Monthly Trends in Key Environmental Factors
Max Air Temp (F)
Min Rel Hum (%)
Min Air Temp (F)
Dew Point (F)
Average Environmental Value
90
80
70
60
50
40
30
2
4
6
8
10
12
Month

Part IV. Conclusions & Discussion

Sources

1. https://www.fire.ca.gov/incidents/2025
2. https://www.latimes.com/business/story/2025-01-24/estimated-cost-of-fire-damage-balloons-to-more-than-250-billion