# **Assignment 3**

**REPORT AND ANALYSIS OF WILDLIFE FIRES.**

**Team Members:**

**Name: Harivardhana Naga Naidu Polireddi**

**ID: 017437238**

**Name: Yashasvi Kotra  
ID: 17466436**

**About the Dataset:**

This dataset gives a lot of information about wildfires, like how big they were, what caused them, where and when they happened, the weather conditions at that time, and how hard it might have been to reach the fires. It's really useful for understanding wildfires better.

1. **fire\_name**: The name given to each wildfire.
2. **fire\_size**: How big the fire was in terms of area covered.
3. **fire\_size\_class**: A category that shows the size of the fire. It's like a grading system with letters (like B, C) to indicate how large or small the fire was.
4. **Cause**: What caused the fire. For example, it could be due to debris burning or other reasons.
5. **latitude** and **longitude**: These are numbers that tell the exact location of the fire on the globe.
6. **state**: The US state where the fire happened.
7. **discovery\_month**: The month when the fire was first found or reported.
8. **putout\_time**: How long it took to put out the fire.
9. **discovery\_year**: The year when the fire was discovered.
10. **Vegetation**: A number that represents the type of plants and trees in the area where the fire happened.
11. **fire\_mag**: A measure that shows the intensity or magnitude of the fire.
12. **Temp\_cont**, **Wind\_cont**, **Hum\_cont**: These are numbers that tell about the temperature, wind, and humidity conditions when the fire was being contained. They give an idea about the weather during the fire.
13. **remoteness**: This number shows how far away or isolated the fire was from populated areas.

**Code Explanation:**

This code is for a web app that shows different pictures, like charts and maps, about wildfires. It uses a tool called Streamlit, which is great for making interactive apps.

Here's what happens in the app:

1. Choose What to See: On the side of the page, you can pick the kind of picture you want to see. You can look at all the pictures or just one kind, like a bar chart or a map.
2. Pick a Year: There's also a slider on the side that lets you choose a year. This way, you can see what happened in that year.
3. The Pictures:
   * Bar Chart: Shows how big the wildfires were in each state.
   * Scatter Plot: Puts dots on a map where the fires were. Bigger dots mean bigger fires.
   * Violin Plot: This has a shape that helps you see how wildfire sizes change.
   * Heatmap: Uses colors to show when and where fires happened.
   * Pie Chart: Like a pie cut into slices, it shows which states had more or fewer fires.
   * Linear Regression: A special chart that tries to see if there's a pattern between the weather and how big the fires get.
4. Download the Picture: Under each picture, there's a link to save it to your computer.
5. Learn from the Data: At the end, the app shows a summary with numbers that tell you about the wildfires.

The app takes the wildfire information, does some math and drawing to make the pictures, and lets you interact with it to explore the data in a fun and easy way.

**Code:**

import streamlit as st

import pandas as pd

import plotly.express as px

from sklearn.linear\_model import LinearRegression

import base64

# Helper function for creating a downloadable link for images

def get\_image\_download\_link(figure, filename):

    encoded\_fig = base64.b64encode(figure.to\_image(format="png")).decode()

    href = f'<a href="data:image/png;base64,{encoded\_fig}" download="{filename}.png">Download Image</a>'

    return href

# Load the dataset

df = pd.read\_csv("wildlife\_fire\_project.csv")

# Sidebar with radio buttons and year slider

selected\_chart = st.sidebar.radio("Select Visualization", ["All", "Chart 1", "Chart 2", "Chart 3", "Chart 4", "Chart 5", "Linear Regression"])

selected\_year = st.sidebar.slider("Select Year", min\_value=df['discovery\_year'].min(), max\_value=df['discovery\_year'].max(), value=df['discovery\_year'].min())

# Main content

st.title("Wildlife Fire Project Dashboard")

# Filter data based on selection

df\_filtered = df[df['discovery\_year'] == selected\_year]

# Visualization 1: Bar Chart

if selected\_chart == "Chart 1" or selected\_chart == "All":

    st.subheader("Bar Chart")

    fig1 = px.bar(df\_filtered, x="state", y="fire\_size", title=f"Fire Size by State in {selected\_year}")

    st.plotly\_chart(fig1)

    # Download link

    st.markdown(get\_image\_download\_link(fig1, "bar\_chart"), unsafe\_allow\_html=True)

# Visualization 2: Scatter Plot

if selected\_chart == "Chart 2" or selected\_chart == "All":

    st.subheader("Scatter Plot")

    fig2 = px.scatter(df\_filtered, x="longitude", y="latitude", color="fire\_size\_class", size="fire\_size", title=f"Scatter Plot in {selected\_year}")

    st.plotly\_chart(fig2)

    # Download link

    st.markdown(get\_image\_download\_link(fig2, "scatter\_plot"), unsafe\_allow\_html=True)

# Visualization 3: Violin Plot

if selected\_chart == "Chart 3" or selected\_chart == "All":

    st.subheader("Violin Plot")

    fig3 = px.violin(df\_filtered, y="fire\_size", box=True, points="all", title=f"Violin Plot of Fire Size in {selected\_year}")

    st.plotly\_chart(fig3)

    # Download link

    st.markdown(get\_image\_download\_link(fig3, "violin\_plot"), unsafe\_allow\_html=True)

# Visualization 4: Heatmap

if selected\_chart == "Chart 4" or selected\_chart == "All":

    st.subheader("Heatmap")

    heatmap\_fig = px.density\_heatmap(df\_filtered, x="discovery\_month", y="discovery\_year",

                                     marginal\_x="histogram", marginal\_y="histogram",

                                     title=f"Heatmap of Fire Discoveries Over Months and Years in {selected\_year}")

    st.plotly\_chart(heatmap\_fig)

    # Download link

    st.markdown(get\_image\_download\_link(heatmap\_fig, "heatmap"), unsafe\_allow\_html=True)

# Visualization 5: Pie Chart

if selected\_chart == "Chart 5" or selected\_chart == "All":

    st.subheader("Pie Chart")

    pie\_fig = px.pie(df\_filtered, names="state", title=f"Distribution of Fires by State in {selected\_year}")

    st.plotly\_chart(pie\_fig)

    # Download link

    st.markdown(get\_image\_download\_link(pie\_fig, "pie\_chart"), unsafe\_allow\_html=True)

# Visualization 6: Linear Regression (Scatter Plot with Fitted Line - Red Color)

if selected\_chart == "Linear Regression" or selected\_chart == "All":

    st.subheader("Linear Regression")

    X = df\_filtered[['Temp\_cont', 'Wind\_cont', 'Hum\_cont']]

    y = df\_filtered['fire\_size']

    model = LinearRegression()

    model.fit(X, y)

    scatter\_fig = px.scatter(df\_filtered, x='Temp\_cont', y='fire\_size', title=f'Linear Regression in {selected\_year}', trendline='ols')

    scatter\_fig.update\_traces(line=dict(color='red'))  # Set trendline color to red

    scatter\_fig.update\_layout(xaxis\_title='Temperature (Cont.)', yaxis\_title='Fire Size')

    st.plotly\_chart(scatter\_fig)

    # Download link

    st.markdown(get\_image\_download\_link(scatter\_fig, "linear\_regression"), unsafe\_allow\_html=True)

# Data Summary/Insights

st.subheader("Data Summary/Insights")

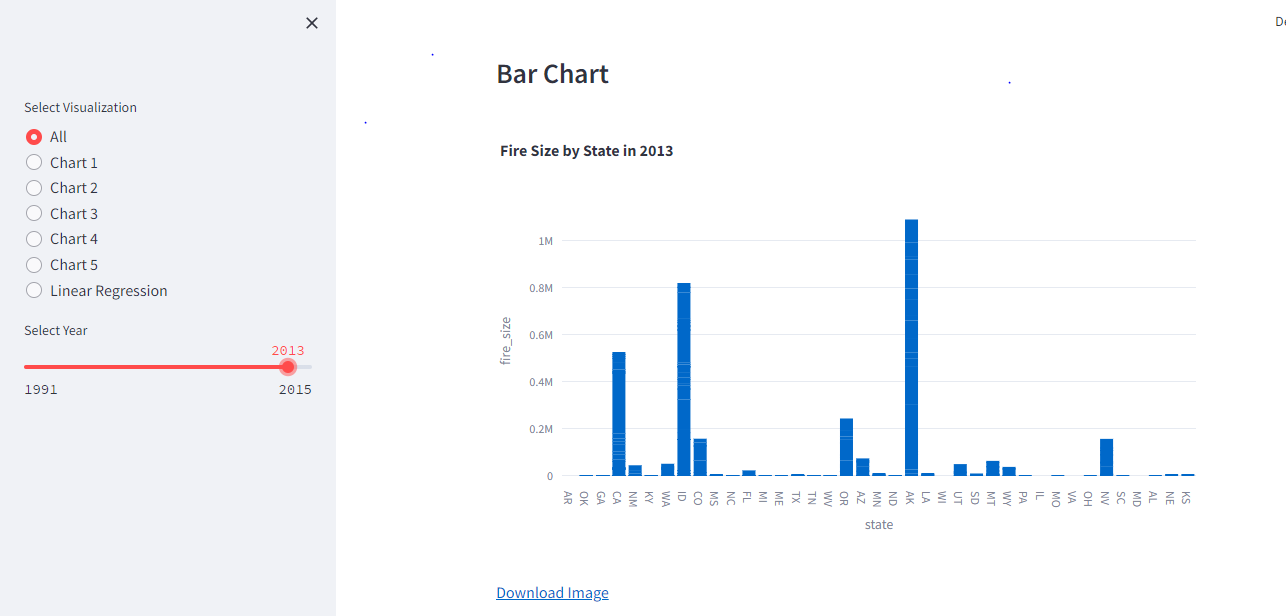
st.write(df\_filtered.describe())

**Understanding the Data Visualizations Wild life fires.**

**1. Bar Chart:**

bar chart titled "Fire Size by State". It's a visual way to compare how much land was affected by wildfires in different US states in the year 2013. Each bar represents a state, and the height of the bar shows the total area of wildfires in that state for the year. The taller the bar, the more land was burned.

From this chart, you can easily see which states had the most land affected by fires. There's one state with a particularly tall bar, meaning it had a significantly larger area burned compared to the others. This kind of chart helps quickly spot which areas had the biggest issues with wildfires in a specific year.

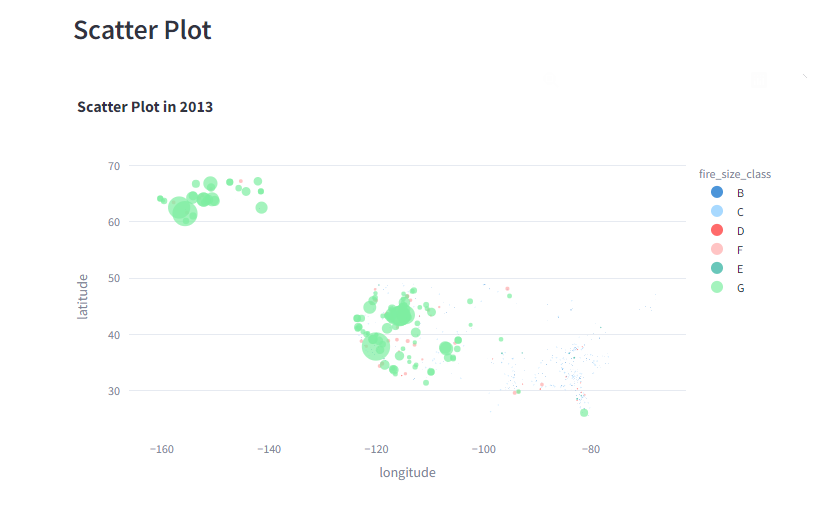


**2. Scatter Plot:**

Scatter plot called "Scatter Plot". It's a type of graph that shows where wildfires happened in 2013 across different places, based on how far north (latitude) and how far west (longitude) they were.

Each dot represents a fire. The size of the dot shows how big the fire was, with bigger dots meaning larger fires. The colors of the dots represent different sizes of fires too, from smaller ones (like those in class B) to the biggest ones (class G).

Looking at this graph, you can see where the most and the biggest wildfires were by the clusters of dots. It's a quick way to visually understand the spread and size of wildfires in that year across different locations.



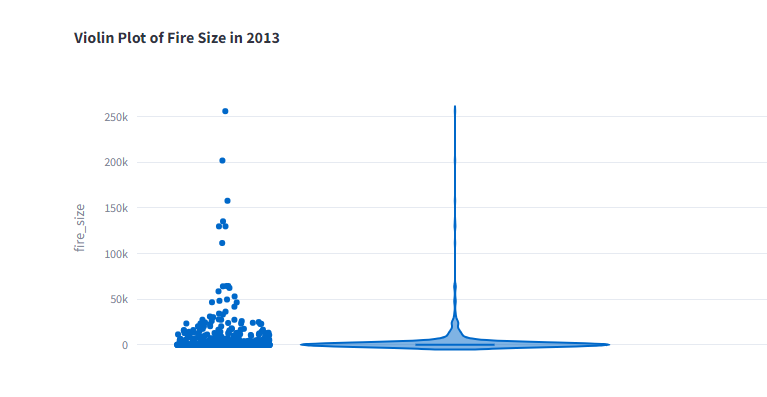
**3. Violin Plot:**

"Violin Plot of Fire Size in 2013." It's a special kind of graph that shows us how big wildfires were in 2013.

Imagine each dot as a wildfire. The place where the dot sits on the vertical line tells us the size of that fire. The lower on the line, the smaller the fire; the higher up, the bigger the fire.

The shape that looks like a violin shows us a lot of fires were small because it's widest at the bottom. That's where most dots are bunched up. As you go higher, the shape gets thinner, which means there weren't as many big fires. But you might notice some dots way up high, which tells us that a few fires were really, really big.

What's cool about this violin shape is it also lets us see if there were any common fire sizes and how much the sizes varied from tiny to huge.

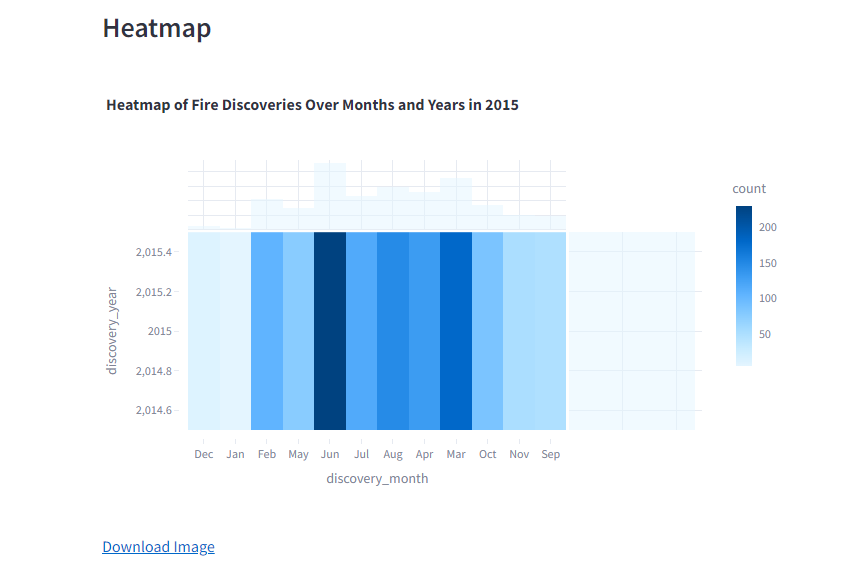


**4. Heatmap:**

"Heatmap of Fire Discoveries Over Months and Years " This type of graph lets us see when most wildfires were found in 2015 by using colors.

Each column represents a month of the year, from January to December. The rows might be showing different times or specific dates in 2015. The deeper the color blue, the more fires were discovered during that time. If the color is lighter, fewer fires were found.

From this heatmap, we can spot which months had the most wildfire discoveries—these will be the darkest columns. It's a handy way to quickly see which times of the year had more wildfires, possibly helping us understand when fires are more likely to happen.



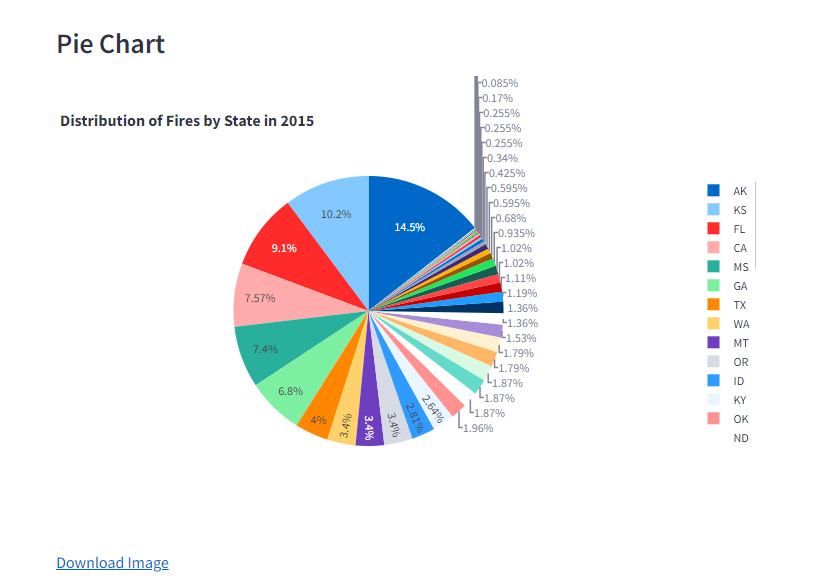
**5. Pie Chart:**

"Pie Chart of the Distribution of Fires by State." It's like a big circular cake cut into slices, where each slice shows how much each state contributed to the total number of fires in a particular year.

Each slice is a different size and color, and the size shows how big a part that state played in the total number of fires. The bigger the slice, the more fires that state had. The percentages on the slices tell us exactly how much of the total each state has.

For example, if one slice says "14.5%" and is the biggest, that state had the most fires. The chart also has a key on the side with colors that match each state, so you can tell which slice is for which state.

Overall, this pie chart helps you see quickly which states had more fires and which had fewer in 2015. It gives a clear picture of how the fires were spread out across different states in that year.



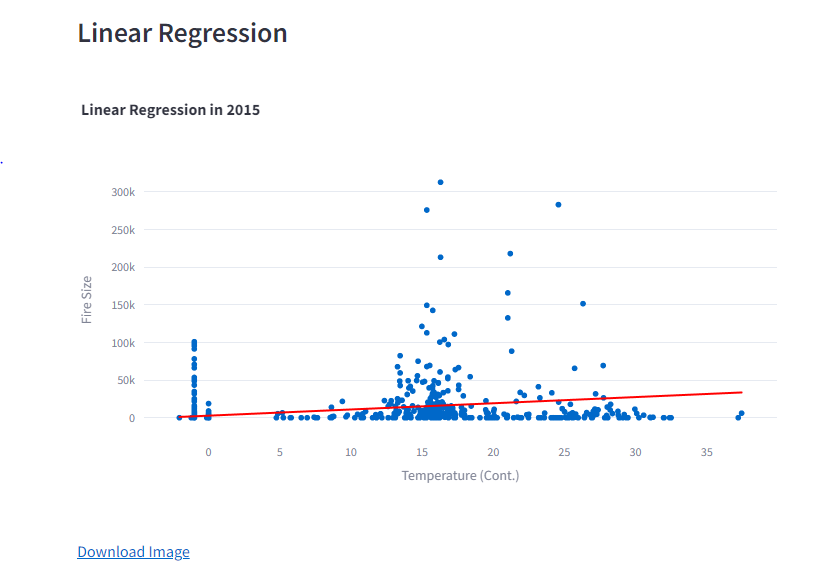
**5. Linear Regression:**

"Linear Regression in 2015" chart. It's a type of graph that tries to show if there's a connection between how hot it is and the size of fires for the selected years.

You can see lots of blue dots. Each dot stands for a fire. Where the dot is placed shows the temperature when the fire was discovered and how big the fire was. The horizontal line (X-axis) at the bottom shows the temperature, and the vertical line (Y-axis) on the side shows the fire's size.

There's also a red line among the blue dots. This line is trying to draw a straight path through all the dots to show a general trend. If the line goes up, it would mean that as it gets hotter, fires tend to get bigger. But here, the line is pretty flat, which suggests that there might not be a strong connection between the temperature and the fire's size.

In simpler terms, this chart is like a detective looking at clues (the blue dots) to solve a mystery: does warmer weather lead to bigger fires? The red line is the detective's best guess, showing what the overall pattern looks like.



**Final Thoughts:**

The data showcased in this app provides valuable insights into the nature of wildfires over time. By interacting with the different visualizations, we can understand not just the 'where' and 'when' of these incidents, but also the 'how much' and 'under what conditions'. This information is key for anyone looking to delve into environmental patterns, assess risk management, or study the impact of climate on wildfire occurrences.

In particular, the ability to trace the size and frequency of fires through the years could reveal trends that might correlate with climate variables or human activities. The app turns complex data into a more digestible form, allowing us to spot these trends at a glance. It's a powerful example of how data visualization can be used to inform and educate on important environmental issues.

Top of Form