australian-fires-data-visualizations

December 2, 2023

[10]:
```
import numpy as np # linear algebra
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)
import numpy as np1
import pandas as pd
import plotly.graph_objects as go
import matplotlib.pyplot as plt
import plotly.express as px
import os
```

1 Data columns

- Field name Description
- latitude Center of 1km fire pixel but not necessarily the actual location of the fire as one or more fires can be detected within the 1km pixel.
- longitude Center of 1km fire pixel but not necessarily the actual location of the fire as one or more fires can be detected within the 1km pixel.
- brightness Brightness temperature 21 (Kelvin): Channel 21/22 brightness temperature of the fire pixel measured in Kelvin.
- scan Along Scan pixel size: The algorithm produces 1km fire pixels but MODIS pixels get bigger toward the edge of scan. Scan and track reflect actual pixel size.
- track Along Track pixel size: The algorithm produces 1km fire pixels but MODIS pixels get bigger toward the edge of scan. Scan and track reflect actual pixel size.
- acq_date Date of MODIS acquisition.
- acq_time Acquisition Time: Time of acquisition/overpass of the satellite (in UTC).
- satellite Satellite: A = Aqua and T = Terra.
- instrument Instrument: Constant value for MODIS.
- confidence Confidence (0-100%): This value is based on a collection of intermediate algorithm quantities used in the detection process.
- version Version: Algorithm version used to process the data.
- bright_t31 Brightness temperature 31 (Kelvin): Channel 31 brightness temperature of the fire pixel measured in Kelvin.
- frp Fire Radiative Power (FRP) in Megawatts (MW): FRP is the radiant heat power emitted by the fire, as measured by the MODIS sensor.
- daynight Day/Night: Flag indicating whether the fire was detected during the day (D) or night (N).

Load data

[17]:
```python
df = pd.read_csv("fire_archive_M6_96619.csv")
```

Show first five rows of data

[19]:
```python
df.head()
```

[19]:
```
    latitude  longitude  brightness  scan  track    acq_date  acq_time  \
0   -11.8070   142.0583       313.0   1.0    1.0  2019-08-01        56
1   -11.7924   142.0850       319.3   1.0    1.0  2019-08-01        56
2   -12.8398   132.8744       311.6   3.1    1.7  2019-08-01        57
3   -14.4306   143.3035       310.1   1.1    1.1  2019-08-01        57
4   -12.4953   131.4897       310.3   4.0    1.9  2019-08-01        57

  satellite instrument  confidence  version  bright_t31   frp daynight  type
0     Terra      MODIS          48      6.3       297.3   6.6        D     0
1     Terra      MODIS          71      6.3       297.3  11.3        D     0
2     Terra      MODIS          42      6.3       298.7  23.1        D     0
3     Terra      MODIS          33      6.3       296.1   6.5        D     0
4     Terra      MODIS          36      6.3       298.8  27.6        D     0
```

Information about data

[22]:
```python
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 36011 entries, 0 to 36010
Data columns (total 15 columns):
 #   Column      Non-Null Count  Dtype
---  ------      --------------  -----
 0   latitude    36011 non-null  float64
 1   longitude   36011 non-null  float64
 2   brightness  36011 non-null  float64
 3   scan        36011 non-null  float64
 4   track       36011 non-null  float64
 5   acq_date    36011 non-null  object
 6   acq_time    36011 non-null  int64
 7   satellite   36011 non-null  object
 8   instrument  36011 non-null  object
 9   confidence  36011 non-null  int64
 10  version     36011 non-null  float64
 11  bright_t31  36011 non-null  float64
 12  frp         36011 non-null  float64
 13  daynight    36011 non-null  object
 14  type        36011 non-null  int64
dtypes: float64(8), int64(3), object(4)
memory usage: 4.1+ MB
```

[24]:
```python
min(df['acq_date'])
```

[24]: '2019-08-01'

[26]:
```
max(df['acq_date'])
```

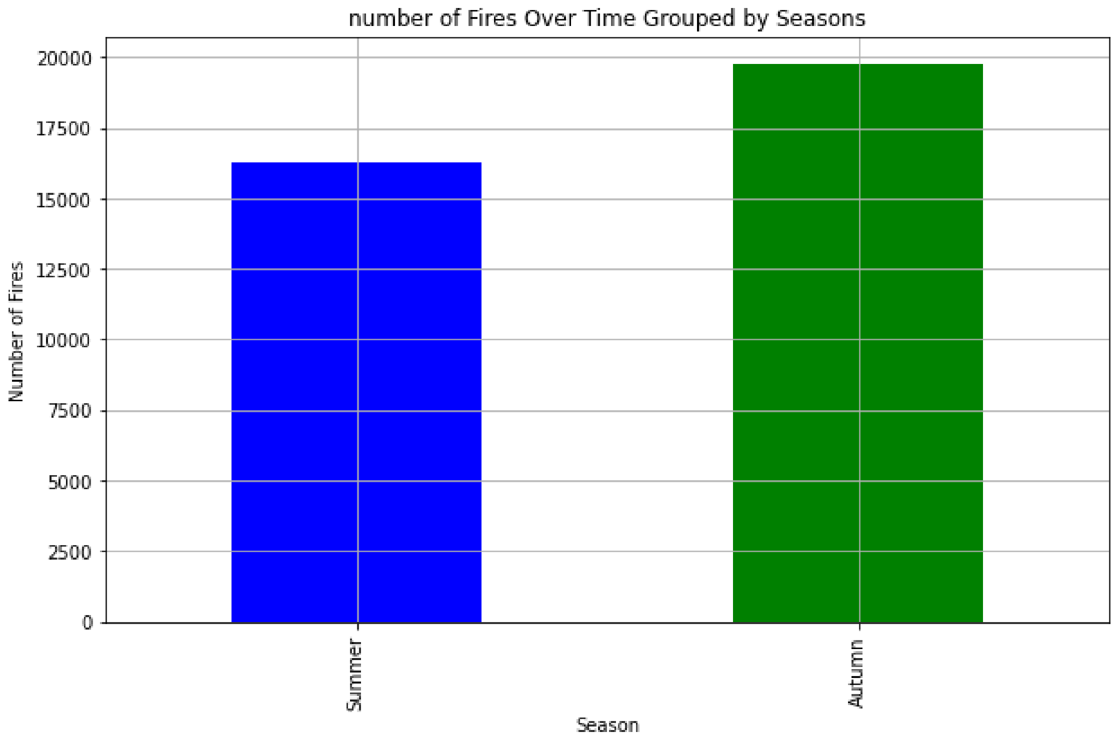
[26]: '2019-09-30'

2 Seasonal Variation:

Plot: Line plot showing the number of fires over time, grouped by seasons. Seasonal variation could be an indicator of natural factors like dry seasons. Geographical Distribution:

[29]:
```
# assuming 'acq_date' is in datetime format in your DataFrame
# If not, convert it using df['acq_date'] = pd.to_datetime(df['acq_date'])
df['acq_date'] = pd.to_datetime(df['acq_date'])

# create a new column for the season based on the month
df['season'] = df['acq_date'].dt.month.apply(lambda x: (x % 12 + 3) // 3)

# group by season and count the number of fires
seasonal_fires = df.groupby('season').size()

# map season numbers to names
season_names = {1: 'Winter', 2: 'Spring', 3: 'Summer', 4: 'Autumn'}
seasonal_fires.index = seasonal_fires.index.map(season_names)
```

[31]:
```
# Plotting
plt.figure(figsize=(10, 6))
#plt.plot(seasonal_fires#.index, seasonal_fires, marker='o', kind='bar' ,␣
↪linestyle='-', color='b', markerfacecolor='r')
seasonal_fires.plot(kind='bar', stacked=True, color=['blue', 'green'])
plt.title('number of Fires Over Time Grouped by Seasons')
plt.xlabel('Season')
plt.ylabel('Number of Fires')
plt.grid(True)
plt.show()
```



3 Result

Winter and autumn are the fire seasons in many parts of the world because these seasons are typically associated with drier conditions and increased winds, which can make it easier for fires to start and spread.

Factors that contribute to wildfires in winter and autumn include:

- Drier conditions
- Increased winds
- Leaves on the ground
- Low humidity
- Human activity
- Lightning

4 Reference

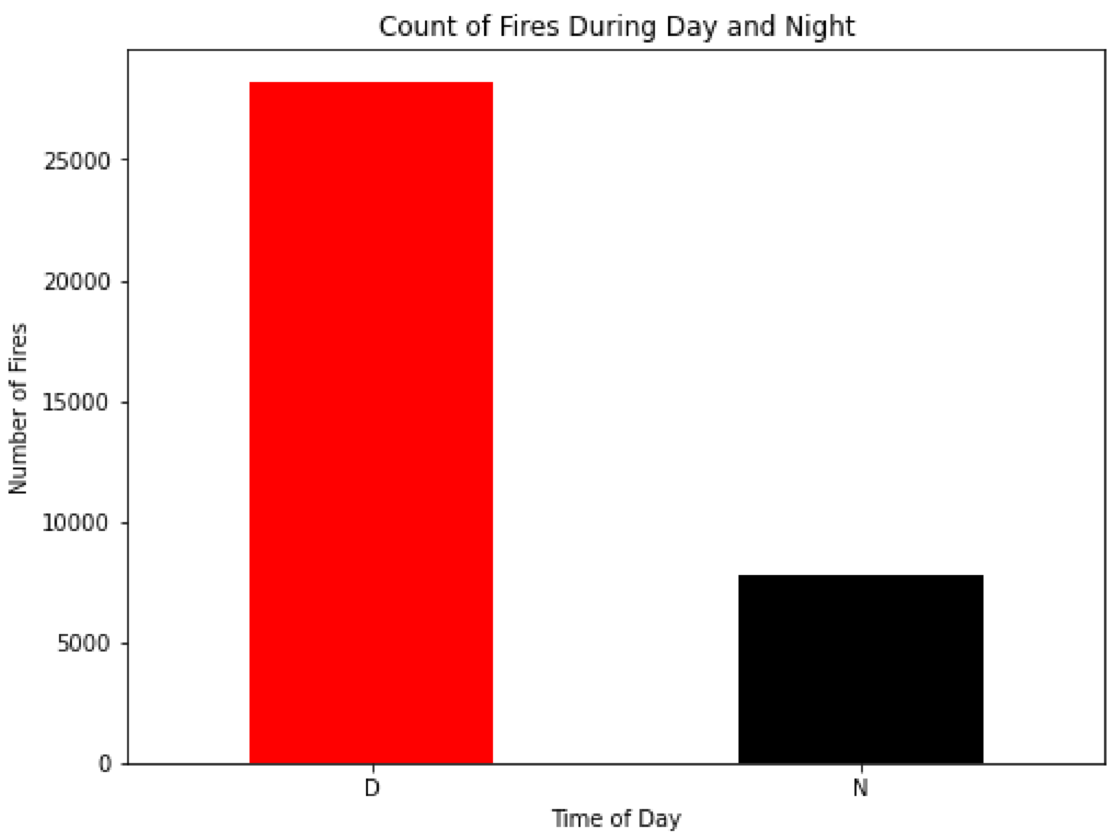
https://en.wikipedia.org/wiki/Wildfire

5 Time of Day:

Plot: Bar plot showing the count of fires during the day and night. This might indicate if human activities play a role in fire occurrences.

[35]:
```
day_night = df['daynight'].value_counts().sort_index()
```

[37]:
```
plt.figure(figsize=(8, 6))
day_night.plot(kind='bar', color=['red', 'black'])
plt.title('Count of Fires During Day and Night')
plt.xlabel('Time of Day')
plt.ylabel('Number of Fires')
plt.xticks(rotation=0)
plt.show()
```



6 Result

- The data shows that a higher percentage of fires occur during the day (61.80%) than at night (38.19%). This suggests that human activities may play a role in fire occurrences, as people are more likely to be using tools and equipment that could spark fires during the day.

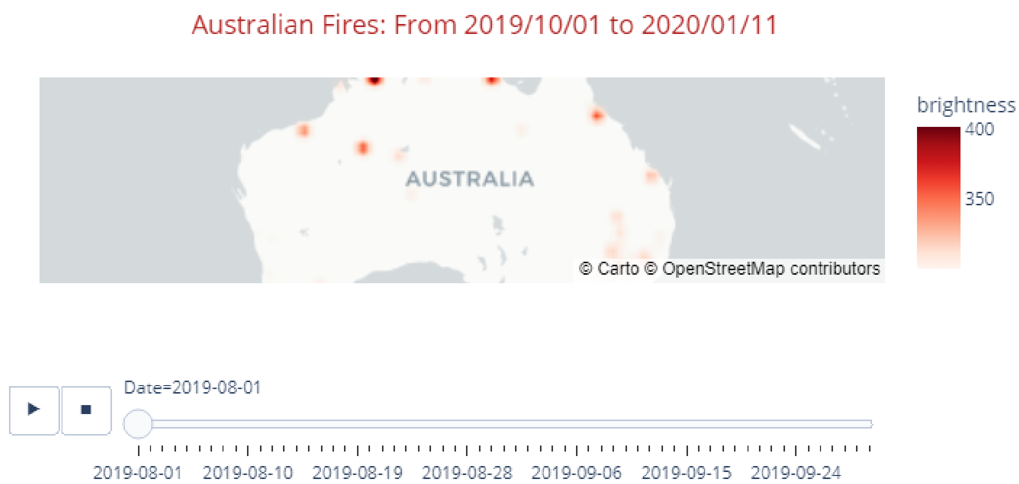
7 Refrence

- Human-caused wildfires in Australia: https://www.environment.gov.au/resource/wildfires/human-cause

8 Geographical Distribution:

Plot: Scatter plot of latitude vs longitude, color-coded by the number of fires in each region. This could help identify regions with a higher frequency of fires.

[41]:
```python
import pandas as pd
import plotly.express as px

# Assuming 'brightness', 'longitude', 'latitude', and 'acq_date' are columns in␣
↪your DataFrame
# If not, replace them with the correct column names

# Convert 'acq_date' to string
df['acq_date_str'] = df['acq_date'].astype(str)

# Sorting DataFrame by 'acq_date'
df1 = df.sort_values(by='acq_date', ascending=True)

# Creating the animated density map
fig = px.density_mapbox(
    df1,
    lon='longitude',
    lat='latitude',
    z='brightness',
    radius=8,
    center=dict(lon=134, lat=-25),
    zoom=2.4,
    mapbox_style='carto-positron',
    color_continuous_scale='reds',
    animation_frame='acq_date_str',  # Use the string version
    labels={"acq_date_str": "Date"}
)

# Updating layout
fig.update_layout(
    title='Australian Fires: From 2019/10/01 to 2020/01/11',
    title_font=dict(size=18, color='FireBrick'),
    title_x=0.5
)

# Show the figure
fig.show()
```



9 Result and analysis

- Regions with a higher frequency of wildfires in Australia: Southeast Australia, Northeast Australia, and Southwest Australia.
- Regions with a lower frequency of wildfires in Australia: Northern Territory and Central Australia.
- Factors that drive the geographical distribution of wildfires in Australia: Climate, vegetation, land use, and topography.
- Types of vegetation or land use patterns that increase wildfire risk: Eucalypt forests, dry grasslands and savannas, cleared or fragmented forests, and areas with a history of fire.

The data shows the locations(lat long) and density(number of cases) of the australia bushfires as seen from satellite images