Inference_2and3

May 16, 2022

[50]:
```
from google.colab import drive
drive.mount('/content/drive')
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call
drive.mount("/content/drive", force_remount=True).
```

[51]:
```
%cd /content/drive/Shareddrives/CSE544_Project/
```

```
/content/drive/Shareddrives/CSE544_Project
```

[52]:
```
ls Exploratory/flight_dataset/Flights_2021
```

```
april.csv  dec.csv  jan.csv   june.csv   may.csv  oct.csv
aug.csv    feb.csv  july.csv  march.csv  nov.csv  sep.csv
```

[53]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import os
import glob
```

0.0.1 2021 Flights Data preprocessing

[54]:
```
path = 'Exploratory/flight_dataset/Flights_2021'
csv_files = glob.glob(os.path.join(path, "*.csv"))
df = pd.concat(map(pd.read_csv, csv_files), ignore_index = True)
```

Sorting the Flights data by Date

[55]:
```
df['Date'] = pd.to_datetime(df['FL_DATE'])
df = df.sort_values(by='Date')
```

0.0.2 CASES dataset preprocessing

1. read COVID19 cases data

2. Select 2021 data
3. Sort Values by Date
4. Calculate total cases of every month by using groupby feature

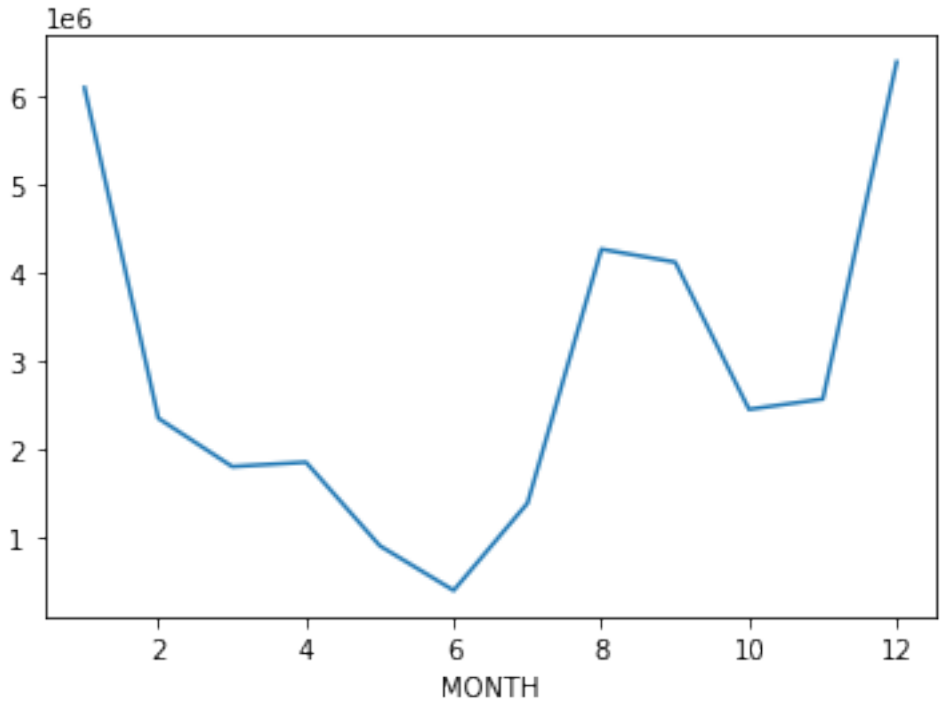
[56]:
```
df_cases = pd.read_csv('covid_dataset/
↪United_States_COVID-19_Cases_and_Deaths_by_State_over_Time.csv')
```

[57]:
```
df_cases['Date'] = pd.to_datetime(df_cases['submission_date'])
```

[58]:
```
df_cases = df_cases[(df_cases['Date'] >= '2021-01-01') & (df_cases['Date'] <␣
↪'2022-01-01')]
df_cases = df_cases.sort_values(by='Date')
df_cases = df_cases.groupby('Date').sum().reset_index()
df_cases['MONTH'] = df_cases['Date'].dt.month
```

[59]:
```
df_cases.groupby('MONTH').sum()['new_case'].plot()
```

[59]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fd04cef5c10>
```



0.0.3 Vaccination data preprocessing

1. read Vaccination data

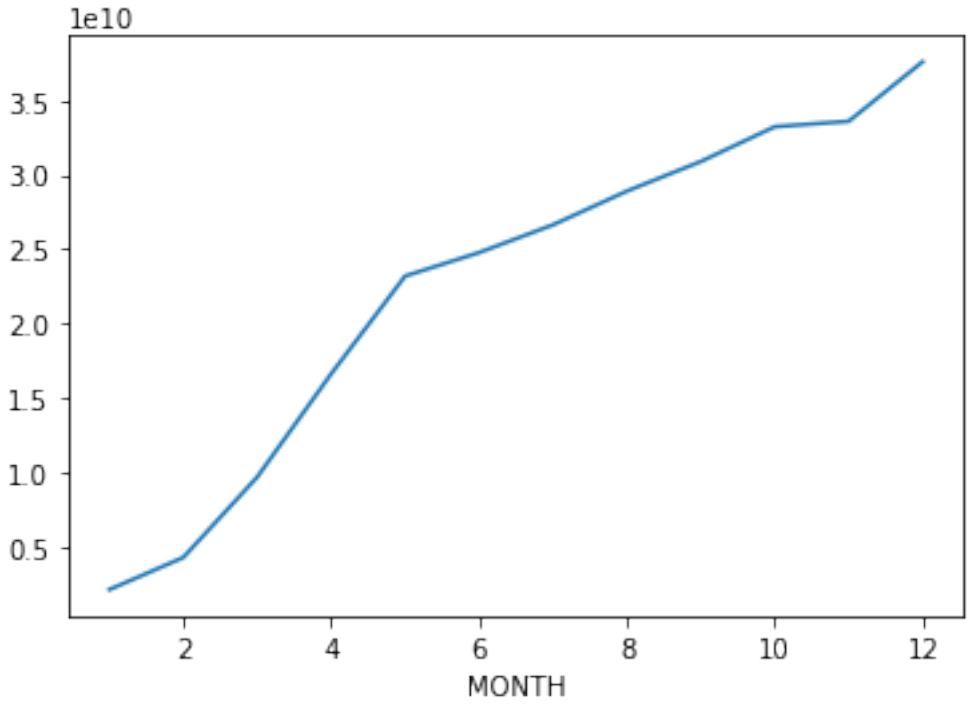
2. Select 2021 data
3. Sort Values by Date
4. Calculate cumulative total distribution upto each month by using groupby feature

[60]:
```
df_vac = pd.read_csv('covid_dataset/
↪COVID-19_Vaccinations_in_the_United_States_Jurisdiction.csv')
```

[61]:
```
df_vac["Date"] = pd.to_datetime(df_vac['Date'])
df_vac = df_vac[(df_vac['Date'] >= '2021-01-01') & (df_vac['Date'] <␣
↪'2022-01-01')]
df_vac = df_vac.sort_values(by='Date')
```

[62]:
```
df_vac = df_vac.groupby('Date').sum().reset_index()
df_vac['MONTH'] = df_vac['Date'].dt.month
df_vac.groupby('MONTH').sum()['Distributed'].plot()
```

[62]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fd04cfe3090>
```



0.0.4 Combining the 3 Datasets

[63]:
```
df_monthly= df[['MONTH', 'CANCELLED']]
df_monthly = df_monthly.groupby('MONTH').sum()
```

[64]:
```
df_monthly['total'] = df.groupby(['MONTH']).count()['CANCELLED']
```

[65]:
```
df_monthly['Distributed'] = df_vac.groupby('MONTH').sum()['Distributed']
df_monthly['Cases'] = df_cases.groupby('MONTH').sum()['new_case']
df_monthly = df_monthly[['total', 'Distributed', 'Cases']]
df_monthly
```

[65]:

MONTH	total	Distributed	Cases
1	361428	2137667200	6085925
2	332468	4294578070	2342664
3	444476	9697993400	1796134
4	450637	16628575010	1845334
5	495544	23196304765	898846
6	546124	24773496500	393323
7	583258	26636602530	1381778
8	579179	28904105495	4257357
9	538051	30893162470	4111442
10	564788	33229710535	2443704
11	547559	33593821530	2560788
12	551885	37593382080	6379179

Calulate Correlation between the Vaccine distributed, Total Flights Scheduled and Covid Cases

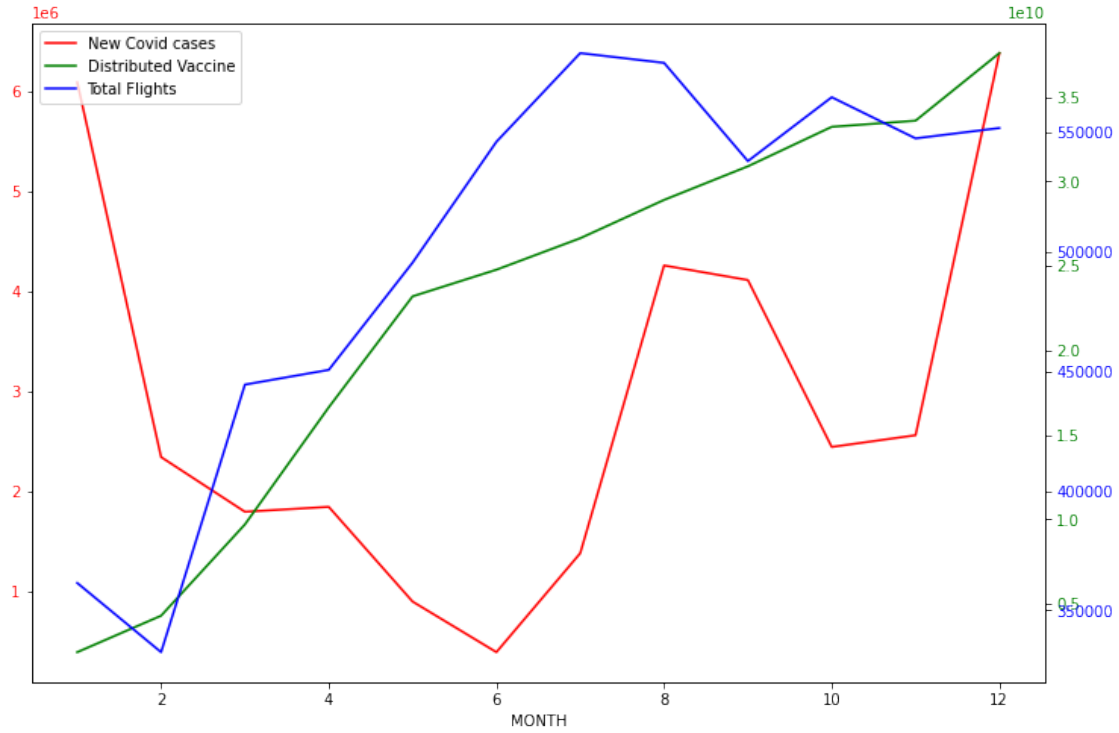
[66]:
```
df_monthly[['Distributed', 'total', 'Cases']].corr()
```

[66]:

	Distributed	total	Cases
Distributed	1.000000	0.920566	0.059443
total	0.920566	1.000000	-0.099813
Cases	0.059443	-0.099813	1.000000

[67]:
```
fig, ax = plt.subplots(figsize=(12,8))

p1, = ax.plot(df_monthly['Cases'], color='red', label='new cases')
ax.tick_params(axis='y', labelcolor='red')
ax.set_xlabel('MONTH')

ax2 = ax.twinx()
p2, = ax2.plot(df_monthly['Distributed'], color='green', label='Distributed')
ax2.tick_params(axis='y', labelcolor='green')

ax3 = ax.twinx()
```

```
p3, = ax3.plot(df_monthly['total'], color='blue')
ax3.tick_params(axis='y', labelcolor='blue')

plt.legend(handles=[p1,p2,p3], labels=['New Covid cases','Distributed␣
 ↪Vaccine','Total Flights'],fontsize = 10)
plt.show()
```



0.0.5 Inference

- Huge amount of data involving Vaccine data, Flight data and covid cases of entire country of United States of the year 2021 was considered.
- The Total Flights scheduled has an excellent positive correlation with vaccination distributed.
- Over the year as more people were vaccinated, more flights were being scheduled which is justified by the Correlation of 0.92
- To make sure that the effect is not just because of decreasing Cases, we also consider the covid cases data. We observe that, covid cases does not have any significant correlation with Total flights scheduled. (-0.09)
- This confirms that total flights is not being influenced by the rise and fall of covid cases but its correlated to the vaccine.

0.0.6 Chi-square Test:

(Please check the Inference 3 pdf document for the Chi square test analysis)

[68]:
```
df_la_flight_2020 = pd.read_csv('Exploratory/flight_dataset/LA_2020_flights.
↪csv')
df_la_flight_2021 = pd.read_csv('Exploratory/flight_dataset/LA_2021_flights.
↪csv')
```

[69]:
```
df_md_flight_2020 = pd.read_csv('Exploratory/flight_dataset/MD_2020_flights.
↪csv')
df_md_flight_2021 = pd.read_csv('Exploratory/flight_dataset/MD_2021_flights.
↪csv')
```

[70]:
```
print(df_md_flight_2021.shape)
print(df_la_flight_2021.shape)
```

```
(67818, 21)
(51303, 21)
```

[71]:
```
df_la_flight_2020['CANCELLED'].value_counts()
```

[71]:
```
0    26132
1     3495
Name: CANCELLED, dtype: int64
```

[72]:
```
df_la_flight_2021['CANCELLED'].value_counts()
```

[72]:
```
0.0    50236
1.0     1067
Name: CANCELLED, dtype: int64
```

[73]:
```
df_md_flight_2020['CANCELLED'].value_counts()
```

[73]:
```
0    34117
1     4406
Name: CANCELLED, dtype: int64
```

[74]:
```
df_md_flight_2021['CANCELLED'].value_counts()
```

[74]:
```
0.0    65999
1.0     1819
Name: CANCELLED, dtype: int64
```

[ ]:
```
!sudo apt-get install texlive-xetex texlive-fonts-recommended␣
↪texlive-plain-generic &> /dev/null
```

```
!jupyter nbconvert --to pdf /content/drive/Shareddrives/CSE544_Project/
↪Exploratory/Inference_2and3.ipynb  &> /dev/null
```

[ ]: