Covid Varient EDA using Python

```
Importing required libraries.
For Analysis we are using libreries to visualize inforamtion.
```

In [3]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sb
import datetime as datetime
import plotly.express as px
import plotly.graph_objs as go
import plotly.figure_factory as ff
from plotly import tools
from plotly.offline import download_plotlyjs, init_notebook_mode, plot, iplot
init_notebook_mode(connected=True)
import warnings
warnings.filterwarnings("ignore")
```

Reading the file using read.csv using pandas

In [4]:

```
dt=pd.read_csv("C:\\Users\\Admin\\Downloads\\covid-variants.csv")
```

1. Finding Basic information about data

In [8]:

```
dt.columns
```

Out[8]:

```
Index(['location', 'date', 'variant', 'num_sequences', 'perc_sequences',
       'num_sequences_total'],
      dtype='object')
```

In [9]:

```
dt.head(10)
```

Out[9]:

	location	date	variant	num_sequences	perc_sequences	num_sequences_total
0	Angola	2020-07-06	Alpha	0	0.0	3
1	Angola	2020-07-06	B.1.1.277	0	0.0	3
2	Angola	2020-07-06	B.1.1.302	0	0.0	3
3	Angola	2020-07-06	B.1.1.519	0	0.0	3
4	Angola	2020-07-06	B.1.160	0	0.0	3
5	Angola	2020-07-06	B.1.177	0	0.0	3
6	Angola	2020-07-06	B.1.221	0	0.0	3
7	Angola	2020-07-06	B.1.258	0	0.0	3
8	Angola	2020-07-06	B.1.367	0	0.0	3
9	Angola	2020-07-06	B.1.620	0	0.0	3

In [7]:

```
dt.tail()
```

Out[7]:

	location	date	variant	num_sequences	perc_sequences	num_sequences_total
100411	Zimbabwe	2021-11-01	Omicron	0	0.0	6
100412	Zimbabwe	2021-11-01	S:677H.Robin1	0	0.0	6
100413	Zimbabwe	2021-11-01	S:677P.Pelican	0	0.0	6
100414	Zimbabwe	2021-11-01	others	0	0.0	6
100415	Zimbabwe	2021-11-01	non_who	0	0.0	6

In [9]:

```
dt.shape
```

Out[9]:

```
(100416, 6)
```

from the above details of file we found, The data (COVID-19 Variants) contains the following information:

location- this is the country for which the variants information is provided.

date - date for the data entry.

variant - this is the variant corresponding to this data entry.

num_sequences - the number of sequences processed (for the country, variant and date).

perc_sequences - percentage of sequences from the total number of sequences (for the country, variant and date).

num_sequences_total - total number of sequences (for the country, variant and date).

In [10]:

```
dt.describe()
```

Out[10]:

	num_sequences	perc_sequences	num_sequences_total
count	100416.000000	100416.000000	100416.000000
mean	72.171676	6.154355	1509.582457
std	1669.262169	21.898989	8445.291772
min	0.000000	-0.010000	1.000000
25%	0.000000	0.000000	12.000000
50%	0.000000	0.000000	59.000000
75%	0.000000	0.000000	394.000000
max	142280.000000	100.000000	146170.000000

2.showing data types of columns if required then we can change the data type.

In [10]:

```
dt.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 100416 entries, 0 to 100415
Data columns (total 6 columns):
 #   Column               Non-Null Count   Dtype 
---  ------               --------------   ----- 
 0   location             100416 non-null  object
 1   date                 100416 non-null  object
 2   variant              100416 non-null  object
 3   num_sequences        100416 non-null  int64 
 4   perc_sequences       100416 non-null  float64
 5   num_sequences_total  100416 non-null  int64 
dtypes: float64(1), int64(2), object(3)
memory usage: 4.6+ MB
```

In [ ]:

```
#converting date Dtype oject to Dtype date
dt["date"]=dt["date"].apply(pd.to_datetime, dayfirst=True)
dt=dt.fillna(0)
```

In [103]:

```
dt.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 100416 entries, 0 to 100415
Data columns (total 6 columns):
 #   Column               Non-Null Count   Dtype         
---  ------               --------------   -----         
 0   location             100416 non-null  object        
 1   date                 100416 non-null  datetime64[ns]
 2   variant              100416 non-null  object        
 3   num_sequences        100416 non-null  int64         
 4   perc_sequences       100416 non-null  float64       
 5   num_sequences_total  100416 non-null  int64         
dtypes: datetime64[ns](1), float64(1), int64(2), object(2)
memory usage: 4.6+ MB
```

3.Finding the Null values

In [104]:

```
#count or check any missing values
dt.isnull().sum()
```

Out[104]:

```
location               0
date                   0
variant                0
num_sequences          0
perc_sequences         0
num_sequences_total    0
dtype: int64
```

4.Finding Duplicate values

In [105]:

```
# find any duplicate
dt.duplicated().sum()
```

Out[105]:

```
0
```

3.Unique values in the data

```
In [106]: # countries
          countries=dt['location'].unique()
          countrie=pd.Series(countries)
          countrie
```

```
Out[106]: 0             Angola
          1          Argentina
          2              Aruba
          3          Australia
          4            Austria
                        ...
          116    United States
          117          Uruguay
          118          Vietnam
          119           Zambia
          120         Zimbabwe
          Length: 121, dtype: object
```

```
In [107]: # types of varients
          var=dt['variant'].unique()
          varients=pd.Series(var)
          varients
```

```
Out[107]: 0              Alpha
          1          B.1.1.277
          2          B.1.1.302
          3          B.1.1.519
          4            B.1.160
          5            B.1.177
          6            B.1.221
          7            B.1.258
          8            B.1.367
          9            B.1.620
          10              Beta
          11             Delta
          12           Epsilon
          13               Eta
          14             Gamma
          15              Iota
          16             Kappa
          17            Lambda
          18                Mu
          19           Omicron
          20     S:677H.Robin1
          21    S:677P.Pelican
          22            others
          23           non_who
          dtype: object
```

5.varient wise number of sequence occured

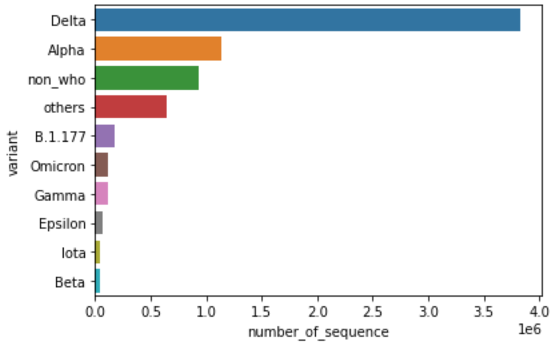
In [14]:
```
variants=dt.variant.unique()
variant_num_seq=[]
for i in variants:
    x=dt[dt.variant.values==i]
    num_seq=sum(x.num_sequences)
    variant_num_seq.append(num_seq)


variant_set=pd.DataFrame({"variant":variants,"number_of_sequence":variant_num_seq})
var_index=variant_set.number_of_sequence.sort_values(ascending=False).index.values
variant_set=variant_set.reindex(var_index)
variant_set
```

Out[14]:

	variant	number_of_sequence
11	Delta	3834100
0	Alpha	1132595
23	non_who	931098
22	others	642603
5	B.1.177	170457
19	Omicron	115538
14	Gamma	115156
12	Epsilon	66127
15	Iota	42905
10	Beta	40514
4	B.1.160	34019
7	B.1.258	30787
3	B.1.1.519	22825
6	B.1.221	15377
18	Mu	14248
17	Lambda	9411
16	Kappa	7477
13	Eta	6924
20	S:677H.Robin1	6547
21	S:677P.Pelican	4837
1	B.1.1.277	1183
9	B.1.620	1016
8	B.1.367	961
2	B.1.1.302	486

In [15]:
```
sb.barplot(variant_set.number_of_sequence.head(10),variant_set.variant.head(10))
plt.show()
```



```
From above barplot we can conclude the most number of sequences occure varient is delta.
also we can see the top 10 varient in geven data set.
```

6.Last date analysis of covid variant data

In [19]:
```
last_date_data_df = sample.groupby(["variant", "Location"])["date"].max().reset_index()
print(last_date_data_df.shape)
last_date_data_df
```

```
(2904, 3)
```

Out[19]:

	variant	Location	date
0	Alpha	Angola	2021-10-04
1	Alpha	Argentina	2021-12-27
2	Alpha	Aruba	2021-12-13
3	Alpha	Australia	2021-12-27
4	Alpha	Austria	2021-12-13
...	...	...	...
2899	others	United States	2022-01-05
2900	others	Uruguay	2021-05-03
2901	others	Vietnam	2021-12-27
2902	others	Zambia	2021-12-27
2903	others	Zimbabwe	2021-11-01

2904 rows × 3 columns

In [20]:
```
last_date_data_df = last_date_data_df.merge(sample, how="left")#merging data using left join
print(last_date_data_df.shape)
last_date_data_df.head()
```

```
(2904, 6)
```

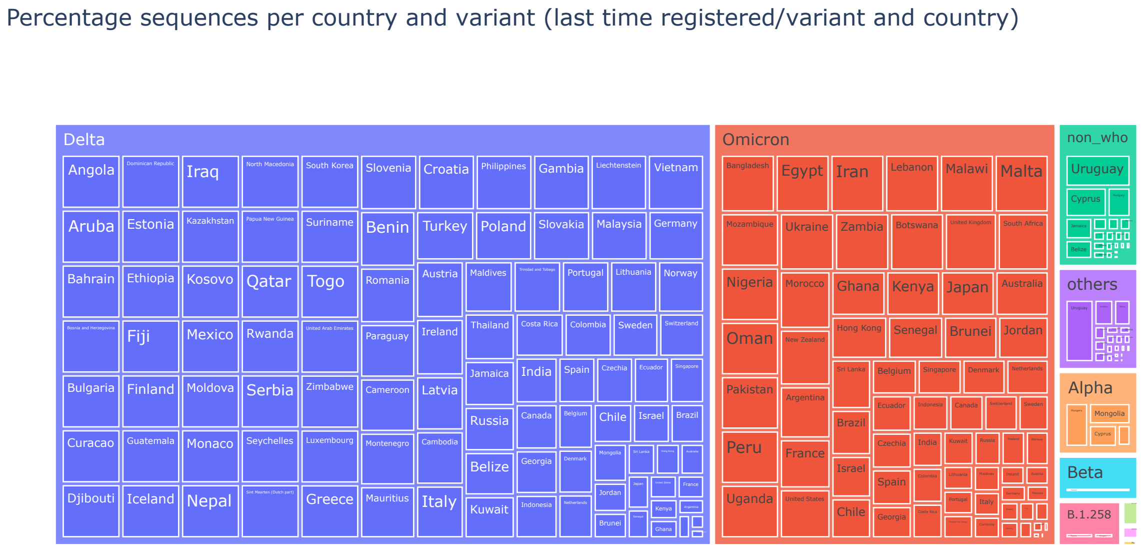
Out[20]:

	variant	Location	date	num_sequences	perc_sequences	Number of Case
0	Alpha	Angola	2021-10-04	0	0.0	33
1	Alpha	Argentina	2021-12-27	0	0.0	94
2	Alpha	Aruba	2021-12-13	0	0.0	61
3	Alpha	Australia	2021-12-27	0	0.0	1726
4	Alpha	Austria	2021-12-13	0	0.0	183

In [21]:
```
print(f"Countries number: {last_date_data_df.Location.nunique()}")
print(f"Date number: {last_date_data_df.date.nunique()}")
print(f"Variants number: {last_date_data_df.variant.nunique()}")
print(f"Variants names: {last_date_data_df.variant.unique()}")
```

```
Countries number: 121
Date number: 17
Variants number: 24
Variants names: ['Alpha' 'B.1.1.277' 'B.1.1.302' 'B.1.1.519' 'B.1.160' 'B.1.177' 'B.1.221'
 'B.1.258' 'B.1.367' 'B.1.620' 'Beta' 'Delta' 'Epsilon' 'Eta' 'Gamma'
 'Iota' 'Kappa' 'Lambda' 'Mu' 'Omicron' 'S:677H.Robin1' 'S:677P.Pelican'
 'non_who' 'others']
```

```
In [23]: fig = px.treemap(last_date_data_df, path = ['variant', 'Location'], values = 'perc_sequences',
                         title="Percentage sequences per country and variant (last time registered/variant and country)")
         fig.show()
```



```
The tree map of last day data shows the delta and omicron varients are more active in lots of countries as compair to
other varients.
```

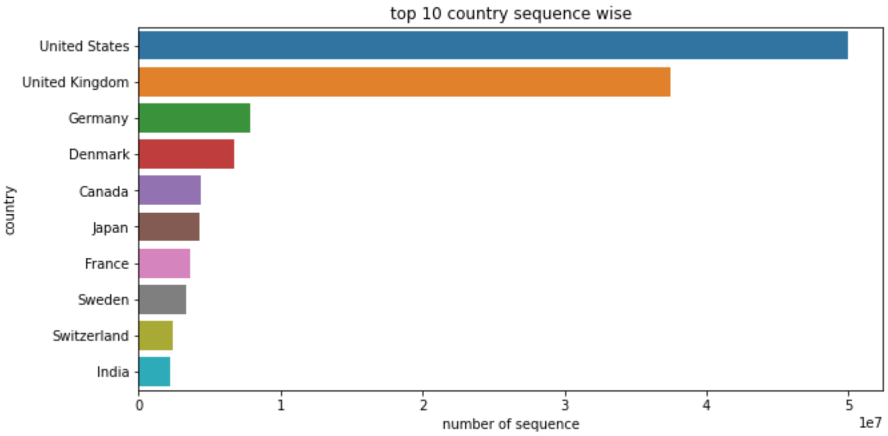
7.country wise sequence

```
In [25]: # Using groupby() and sum() to  check country wise sequence in desc
         data3 = dt.groupby(['location'])['num_sequences_total'].sum().sort_values(ascending=False)
         data3
```

```
Out[25]: location
         United States     49960248
         United Kingdom    37427568
         Germany            7851432
         Denmark            6728880
         Canada             4365240
                             ...
         Belize                7536
         Iraq                  4008
         Moldova               3648
         Mongolia              3600
         Monaco                2016
         Name: num_sequences_total, Length: 121, dtype: int64
```

In [26]:

```
country=data3.head(10)
plt.figure(figsize=(10,5))
sb.barplot(data3.head(10).values,data3.head(10).index)
plt.title("top 10 country sequence wise")
plt.ylabel("country",fontsize=10)
plt.xlabel("number of sequence",fontsize=10)
plt.show()
```



In given data set number of sequence occures is higher in US follwed by UK.so we can conclude that US and UK are most affected areas in covid.

In [18]:

```
sample  = dt.rename(columns={"location":"Location","num_sequences_total":"Number of Case"})
sample
```

Out[18]:

	Location	date	variant	num_sequences	perc_sequences	Number of Case
0	Angola	2020-07-06	Alpha	0	0.0	3
1	Angola	2020-07-06	B.1.1.277	0	0.0	3
2	Angola	2020-07-06	B.1.1.302	0	0.0	3
3	Angola	2020-07-06	B.1.1.519	0	0.0	3
4	Angola	2020-07-06	B.1.160	0	0.0	3
...	...	...	...	...	...	...
100411	Zimbabwe	2021-11-01	Omicron	0	0.0	6
100412	Zimbabwe	2021-11-01	S:677H.Robin1	0	0.0	6
100413	Zimbabwe	2021-11-01	S:677P.Pelican	0	0.0	6
100414	Zimbabwe	2021-11-01	others	0	0.0	6
100415	Zimbabwe	2021-11-01	non_who	0	0.0	6

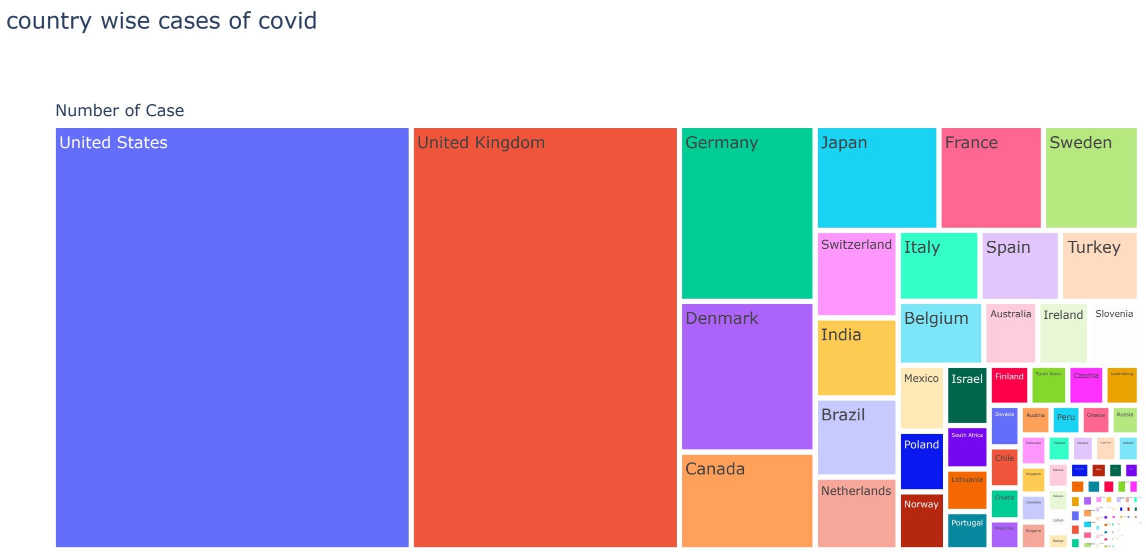
100416 rows × 6 columns

8.Tree map of a all data set to visualize the affection of covid varients country wise.

In [27]:

```
fig = px.treemap(sample, path=[px.Constant('Number of Case'),'Location'],values='Number of Case',hover_data=['Location'],
                title='country wise cases of covid')
```

In [28]:
```
fig.show()
```



Yearwise total cases of cove from given data set

In [49]:
```
#get year from corresponding date column
dt['year']=pd.DatetimeIndex(dt['date']).year
```

In [50]:
```
#yearwise sequences occured..
data2 = dt.groupby(['year'])['num_sequences_total'].sum()
data2
```

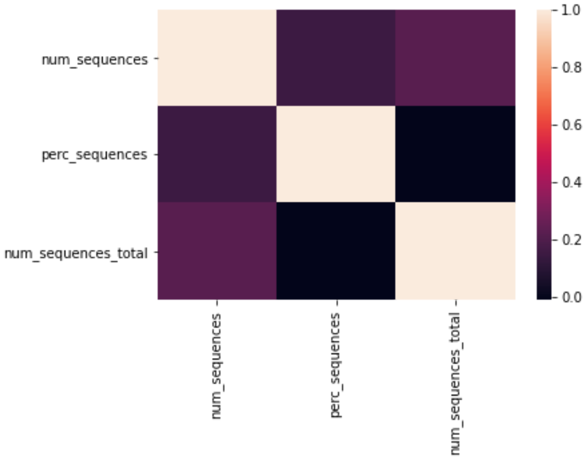
Out[50]:
```
year
2020     10942512
2021    140620224
2022        23496
Name: num_sequences_total, dtype: int64
```

In [34]:
```
#correlation between data
dt.corr()
```

Out[34]:

	num_sequences	perc_sequences	num_sequences_total
num_sequences	1.000000	0.147368	0.219677
perc_sequences	0.147368	1.000000	-0.011211
num_sequences_total	0.219677	-0.011211	1.000000

```
In [253]: #Correlation Plot
          Correlation_Plot=sb.heatmap(dt.corr())
```



```
In [ ]:
```