Analyze Covid Vaccination Progress Using Python

BEGINNER DATA VISUALIZATION PYTHON

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Introduction

Hello Readers!!
Covid-19 has affected our lives very much in very accepts it could be economical, mentally, etc. In this blog, we are going to explore how the vaccination drive is going around the world. For the past 1 year, we have been hoping for vaccines so that we can enjoy our life as we were doing before.
Hope this vaccination drive will help millions of people and save them. We are going to first read the dataset, then clean and draw some beautiful visuals.

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Dataset

Image Source

IMPORT LIBRARIES

For analyzing data, we need some libraries. In this section, we are importing all the required libraries like pandas, NumPy, matplotlib, plotly, seaborn, and word cloud that are required for data analysis. Check the below code to import all the required libraries.

```
import pandas as pd import numpy as np import matplotlib.pyplot as plt import plotly.express as px import
plotly.graph_objects as go import matplotlib.patches as mpatches from plotly.subplots import make_subplots
```

```
from wordcloud import WordCloud import seaborn as sns sns.set(color_codes = True) sns.set(style="whitegrid")
import plotly.figure_factory as ff from plotly.colors import n_colors
```

READ DATA AND BASIC INFORMATION

Read the CSV file using pandas read_csv() function and show the output using head() function.

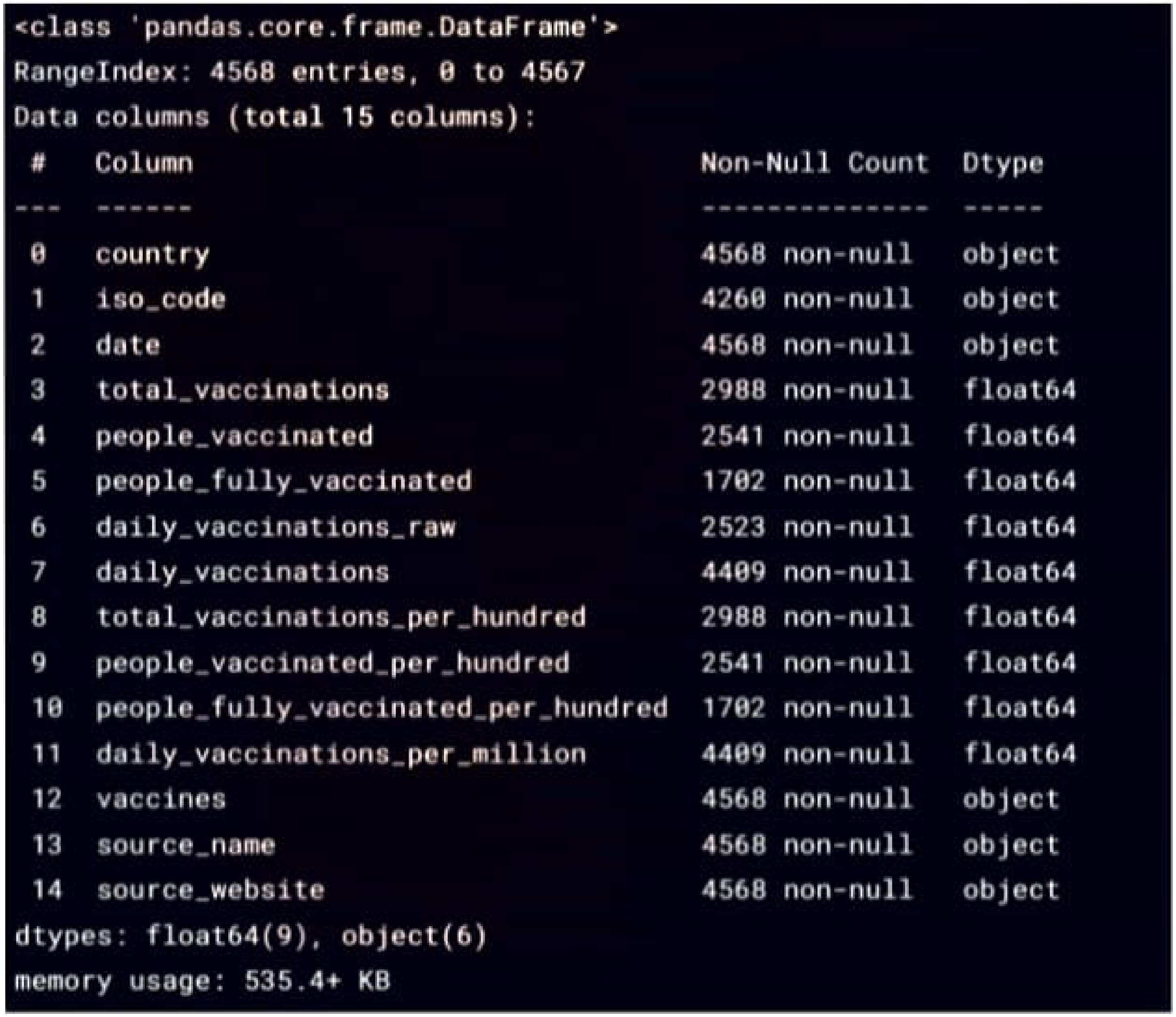
```
df = pd.read_csv('covid-world-vaccination-progress/country_vaccinations.csv') df.head()
```

	country	iso_code	date	total_vaccinations	people_vaccinated	people_fully_vaccinated	daily_v
0	Albania	ALB	2021-01-10	0.0	0.0	NaN	NaN
1	Albania	ALB	2021-01-11	NaN	NaN	NaN	NaN
2	Albania	ALB	2021-01-12	128.0	128.0	NaN	NaN
3	Albania	ALB	2021-01-13	188.0	188.0	NaN	60.0
4	Albania	ALB	2021-01-14	266.0	266.0	NaN	78.0

Observation:
Dataset has columns like country, iso_code, date, total_vaccinations, people_vaccinated, people_fully vaccinated, etc. An initial look at the above table shows that data has null values too. We will deal with null values later.

info() function is used to get the overview of data like data type of feature, a number of null values in each column, and many more.

```
df.info()
```



```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4568 entries, 0 to 4567
Data columns (total 15 columns):
 #   Column                               Non-Null Count  Dtype
---  ------                               --------------  -----
 0   country                              4568 non-null   object
 1   iso_code                             4260 non-null   object
 2   date                                 4568 non-null   object
 3   total_vaccinations                   2988 non-null   float64
 4   people_vaccinated                    2541 non-null   float64
 5   people_fully_vaccinated              1702 non-null   float64
 6   daily_vaccinations_raw               2523 non-null   float64
 7   daily_vaccinations                   4409 non-null   float64
 8   total_vaccinations_per_hundred       2988 non-null   float64
 9   people_vaccinated_per_hundred        2541 non-null   float64
 10  people_fully_vaccinated_per_hundred  1702 non-null   float64
 11  daily_vaccinations_per_million       4409 non-null   float64
 12  vaccines                             4568 non-null   object
 13  source_name                          4568 non-null   object
 14  source_website                       4568 non-null   object
dtypes: float64(9), object(6)
memory usage: 535.4+ KB
```

Observation:

The above picture shows that there are many null values in our dataset. We will deal with these null values later in this blog. There are two data types as seen from the table object means string and float.

The below function is used to get the total count of null values in each feature.

```
df.isnull().sum()
```

Observation:
The below picture shows tables like country, date, vaccines, source_name has 0 null values. Features like people_fully_vaccinated have a maximum of 2866 null values.

DATA CLEANING

Dataset has many null values as we have seen before. To get rid of it we need to clean the data first, After cleaning we will perform our further analysis. For cleaning the dataset we will perform many steps. Some of these steps are shown below

- Handling and Filling null values
- Change the data type of features
- Handling strings like splitting.

Check the below code for all the data cleaning that we are performing here:

```
df.fillna(value = 0, inplace = True) df.total_vaccinations = df.total_vaccinations.astype(int)
df.people_vaccinated = df.people_vaccinated.astype(int) df.people_fully_vaccinated =
df.people_fully_vaccinated.astype(int) df.daily_vaccinations_raw = df.daily_vaccinations_raw.astype(int)
df.daily_vaccinations = df.daily_vaccinations.astype(int) df.total_vaccinations_per_hundred =
df.total_vaccinations_per_hundred.astype(int) df.people_fully_vaccinated_per_hundred =
df.people_fully_vaccinated_per_hundred.astype(int) df.daily_vaccinations_per_million =
df.daily_vaccinations_per_million.astype(int) df.people_vaccinated_per_hundred =
df.people_vaccinated_per_hundred.astype(int) date = df.date.str.split('-', expand =True) date
```

```
df['year'] = date[0] df['month'] = date[1] df['day'] = date[2] df.year = pd.to_numeric(df.year) df.month =
pd.to_numeric(df.month) df.day = pd.to_numeric(df.day) df.date = pd.to_datetime(df.date) df.head()
```

SOME FEATURES

Let's get some details about our features using the below code

```
print('Data  point  starts  from  ',df.date.min(),'n')  print('Data  point  ends  at  ',df.date.max(),'n')
print('Total  no  of  countries  in  the  data  set  ',len(df.country.unique()),'n')  print('Total  no  of  unique
vaccines in the data set ',len(df.vaccines.unique()),'n')
```

Observation

Data points start from 2020-12-08

Data points end at 2021-02-28

Total Number of countries in the data set = 117

Total Number of Unique Vaccines in the data set = 22

```
df.info()
```

DATA VISUALIZATION

In this section, we are going to draw some visuals to get insights from our dataset. So let's started.

describe() function in pandas used to get the statistics of each feature present in our dataset. Some of the information we get include count, max, min, standard deviation, median, etc.

```
df.describe()
```

unique() function in pandas helps to get unique values present in the feature.

```
df.country.unique()
```

```
def size(m,n): fig = plt.gcf(); fig.set_size_inches(m,n);
```

Word Art of Countries

Word Cloud is a unique way to get information from our dataset. The words are shown in the form of art where the size proportional depends on how much the particular word repeated in the dataset. This is made by using the **WordCloud** library. Check the below code on how to draw word cloud

```
wordCloud = WordCloud( background_color='white', max_font_size = 50).generate(' '.join(df.country))
plt.figure(figsize=(15,7)) plt.axis('off') plt.imshow(wordCloud) plt.show()
```

Total Vaccinated Till Date

In this section, we are going to see how many total vaccines have been used in each country. Check the below code for more information. The data shows the United States has administrated most vaccines in the world followed by China, United Kingdom, England, India and at the last some countries includes Saint Helena, San Marino has 0 vaccination.

```
country_wise_total_vaccinated = {} for country in df.country.unique() : vaccinated = 0 for i in range(len(df)) : if df.country[i] == country : vaccinated += df.daily_vaccinations[i] country_wise_total_vaccinated[country] = vaccinated # made a seperate dict from the df country_wise_total_vaccinated_df = pd.DataFrame.from_dict(country_wise_total_vaccinated, orient='index', columns = ['total_vaccinted_till_date']) # converted dict to df country_wise_total_vaccinated_df.sort_values(by = 'total_vaccinted_till_date', ascending = False, inplace = True) country_wise_total_vaccinated_df
```

```
fig = px.bar(country_wise_total_vaccinated_df, y = 'total_vaccinted_till_date', x = country_wise_total_vaccinated_df.index, color = 'total_vaccinted_till_date', color_discrete_sequence= px.colors.sequential.Viridis_r ) fig.update_layout( title={ 'text' : "Vaccination till date in various countries", 'y':0.95, 'x':0.5 }, xaxis_title="Countries", yaxis_title="Total vaccinated", legend_title="Total vaccinated" ) fig.show()
```

Observation

- The United States has administrated most vaccines in the world followed by China, United Kingdom, England, India
- Countries include Saint Helena, San Marino has 0 vaccination.

Country Wise Daily Vaccination

To check what is the vaccination trend in each country, check the below code. We are drawing the line plot where the x-axis is the date and the y-axis is the count of daily vaccination, Colours is set to be the **country**.

```
fig = px.line(df, x = 'date', y ='daily_vaccinations', color = 'country') fig.update_layout( title={ 'text' :
"Daily vaccination trend", 'y':0.95, 'x':0.5 }, xaxis_title="Date", yaxis_title="Daily Vaccinations" )
fig.show()
```

Observation:

There is a mixed kind of trend among each country. Sometimes a particular country shows a positive trend and sometimes it shows a negative trend.

Plot Till Date Function

```
# helper function def plot_till_date(value1, value2, title, color1, color2) : so_far_dict = {} for dates in
df.date.unique() : so_far_dict[dates], value1_count, value2_count = [], 0, 0 for i in range(len(df)) : if
df.date[i] == dates : value1_count += df[value1][i] value2_count += df[value2][i] # if dates not in
so_far_dict.keys() : so_far_dict[dates].append(value1_count) so_far_dict[dates].append(value2_count)
so_far_df = pd.DataFrame.from_dict(so_far_dict, orient = 'index', columns=[value1, value2])
so_far_df.reset_index(inplace = True) # return so_far_df so_far_df.sort_values(by='index', inplace = True)
plot = go.Figure(data=[go.Scatter( x = so_far_df['index'], y = so_far_df[value1], stackgroup='one', name =
value1, marker_color= color1), go.Scatter( x = so_far_df['index'], y = so_far_df[value2], stackgroup='one',
name = value2, marker_color= color2) ]) plot.update_layout( title={ 'text' : title, 'y':0.95, 'x':0.5 },
xaxis_title="Date" ) return plot.show()
```

People vaccinated vs people fully vaccinated in the world :

In this section, let's analyze how many people vaccinated vs the people which are fully vaccinated in the world. We are drawing a kind of curve where the x-axis is Date and the y-axis is the count of people that are fully vaccinated in the world

```
plot_till_date('people_fully_vaccinated', 'people_vaccinated','People vaccinated vs Fully vaccinated till
date', '#c4eb28', '#35eb28')
```

Observation

- People fully vaccinated in the world is around 50 million
- People that are vaccinated in the world is around 50 million

The People vaccinated vs people fully vaccinated per hundred in the world

In this section, let's analyze how many people vaccinated vs the people which are fully vaccinated in the world per hundred. We are drawing a kind of curve where the x-axis is Date and the y-axis is the count of people that are fully vaccinated in the world per hundred

```
plot_till_date('people_fully_vaccinated_per_hundred', 'people_vaccinated_per_hundred', 'People vaccinated vs
Fully vaccinated per hundred till date', '#0938e3','#7127cc')
```

Observation

- People fully vaccinated in the world per hundred is around 2
- People that are vaccinated in the world is around 7

Pie-Plot

In this section, we are going to draw pip-plots. For more details check the below code:

```
def plot_pie(value, title, color) : new_dict = {} for v in df[value].unique() : value_count = 0 for i in
range(len(df)) : if df[value][i] == v : value_count += 1 new_dict[v] = value_count # print(new_dict) new_df =
pd.DataFrame.from_dict(new_dict, orient = 'index', columns = ['Total']) if color == 'plasma' : fig =
px.pie(new_df, values= 'Total', names = new_df.index, title = title,
color_discrete_sequence=px.colors.sequential.Plasma) elif color == 'rainbow' : fig = px.pie(new_df, values=
'Total', names = new_df.index, title = title, color_discrete_sequence=px.colors.sequential.Rainbow) else :
fig = px.pie(new_df, values= 'Total', names = new_df.index, title = title) fig.update_layout( title={
'y':0.95, 'x':0.5 }, legend_title = value ) return fig.show() plot_pie('vaccines', 'Various vaccines and
their uses', 'plasma')
```

Most Used Vaccine

Let's see what all vaccines are used in the different part of the world:

```
df.vaccines.unique()
```

Word art of Vaccines

Word Cloud is a unique way to get information from our dataset. The words are shown in the form of art where the size proportional depends on how much the particular word repeated in the dataset. This is made by using the **WordCloud** library. Check the below code on how to draw word cloud

```
wordCloud = WordCloud( background_color='white', max_font_size = 50).generate(' '.join(df.vaccines))
plt.figure(figsize=(12,5)) plt.axis('off') plt.imshow(wordCloud) plt.show()
```

Daily vaccination trend per million

In this section, we will what is the trend of vaccination per million. We are going to draw a line plot where the x-axis is Date and the y-axis is daily vaccination per million. Check the below code for more information:

```
fig = px.line(df, x = 'date', y ='daily_vaccinations_per_million', color = 'country') fig.update_layout( title= 'text' : "Daily vaccination trend per million", 'y':0.95, 'x':0.5 }, xaxis_title="Date", yaxis_title="Daily Vaccinations per million" ) fig.show()
```

Observation

- Seychelles and Israel has the highest number of vaccinations per million
- On 10th Jan Gibraltar has the highest vaccination per million

Total vaccinated – India vs the USA

In this section, we will see what is the trend of vaccination among two great countries India and the USA. We are going to draw a line plot where the x-axis is Date and the y-axis is daily vaccination. Check the below code for more information:

```
india_usa = [df[df.country == 'United States'], df[df.country == 'India']] result = pd.concat(india_usa) fig
= px.line(result, x = 'date', y ='total_vaccinations', color = 'country') fig.update_layout( title={ 'text' :
"Total vaccinated - India vs USA", 'y':0.95, 'x':0.5 }, xaxis_title="Date", yaxis_title="Total Vaccinations"
) fig.show()
```

Observation

- The USA has started vaccination drive very early
- India is moving quite steadily despite it has started vaccination late.

MAPS

In this section, we are going to see how vaccinations are going in different countries using maps. The colour signifies how many people have been vaccinated. Check the below maps for more details.

Most vaccinated country

```
plot_map('total_vaccinations','Most vaccinated country', None)
```

Vaccines Used in Different countries

```
plot_map('vaccines','Vaccines Used in Different countries', None)
```

People fully vaccinated in Different countries

```
plot_map('people_fully_vaccinated','People fully vaccinated in Different countries', 'haline')
```

Key Observations:

1. **Sputnik V** is mostly used in **Asia, Africa, and South America**
2. Most of the countries are not fully vaccinated
3. **Modena and Pfizer** are mostly used in **North America and Europe**
4. **Pfizer/BioNTech** are mostly used in the world, its around **47.6%**
5. **Covishield and Covaxin** are in the 10th position
6. China has started **Mass Vaccination** first
7. Daily vaccination is **highest in the USA** thought the USA has started vaccination late as compared to China

End Notes

So in this article, we had a detailed discussion on **Covid Vaccination Progress.** Hope you learn something from this blog and it will help you in the future. Thanks for reading and your patience. Good luck!

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