COVID-19 Data Understanding

Data Dictionary

Field	Description
Date	Date of incident
Province/State	If there is a breakdown in states
Lat	Latitude
Lon	Longitude
Confirmed	Confirmed cases
Recovered	Recovered cases
Deaths	Death cases
Active	Active cases

Summary

Import Libraries

In [1]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import statsmodels.api as sm
import datetime
import scipy.stats

%matplotlib inline
#sets the default autosave frequency in seconds
%autosave 60
sns.set_style('dark')
sns.set(font_scale=1.2)

import warnings
warnings.filterwarnings('ignore')

#import feature_engine.missing_data_imputers as mdi
#from feature_engine.outlier_removers import Winsorizer
#from feature_engine import categorical_encoders as ce

pd.set_option('display.max_columns',None)
#pd.set_option('display.max_rows',None)
pd.set_option('display.width', 1000)

np.random.seed(0)
np.set_printoptions(suppress=True)
```

```
Autosaving every 60 seconds
```

Country Level Analysis

In [2]:

```
df = pd.read_csv("countrywise.csv")
```

In [3]:

```
df
```

Out[3]:

	Country	Confirmed	Deaths	Recovered	Active	New Cases	Deaths / 100 Cases	Recovered / 100 Cases	Deaths / 100 Recovered	Population	Cases / Million People	Confirmed last week	1 week change
0	Afghanistan	38544	1420	31048	6076	24	3.68	80.55	4.57	38928341	990.0	43851	1639
1	Albania	10704	322	6284	4098	151	3.01	58.71	5.12	2877800	3720.0	29837	5107
2	Algeria	47216	1581	33379	12256	278	3.35	70.69	4.74	43851043	1077.0	70629	7396
3	Andorra	1301	53	938	310	40	4.07	72.10	5.65	77265	16838.0	6018	410
4	Angola	3092	126	1245	1721	59	4.08	40.27	10.12	32866268	94.0	13922	899
...	...	...	...	...	...	...	...	...	...	...	...	...	...
186	West Bank and Gaza	27919	192	18466	9261	556	0.69	66.14	1.04	4543126	6145.0	66186	10541

187	Western Sahara	10	1	8	1	0	10.00	80.00	12.50	597330	17.0	10	0
188	Yemen	1999	576	1209	214	5	28.81	60.48	47.64	29825968	67.0	2083	41
189	Zambia	13112	300	11839	973	160	2.29	90.29	2.53	18383956	713.0	17280	255
190	Zimbabwe	7429	222	5542	1665	41	2.99	74.60	4.01	14862927	500.0	8981	527

191 rows × 14 columns

Exploratory Data Analysis

In [4]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 191 entries, 0 to 190
Data columns (total 14 columns):
 #   Column                  Non-Null Count  Dtype  
---  ------                  --------------  -----  
 0   Country                 191 non-null    object 
 1   Confirmed               191 non-null    int64  
 2   Deaths                  191 non-null    int64  
 3   Recovered               191 non-null    int64  
 4   Active                  191 non-null    int64  
 5   New Cases               191 non-null    int64  
 6   Deaths / 100 Cases      191 non-null    float64
 7   Recovered / 100 Cases   191 non-null    float64
 8   Deaths / 100 Recovered  191 non-null    float64
 9   Population              191 non-null    int64  
 10  Cases / Million People  191 non-null    float64
 11  Confirmed last week     191 non-null    int64  
 12  1 week change           191 non-null    int64  
 13  1 week % increase       191 non-null    float64
dtypes: float64(5), int64(8), object(1)
memory usage: 21.0+ KB
```

In [5]:

```
df.describe()
```

Out[5]:

	Confirmed	Deaths	Recovered	Active	New Cases	Deaths / 100 Cases	Recovered / 100 Cases	Deaths / 100 Recovered	Population	Cases / Million People
count	1.910000e+02	191.000000	1.910000e+02	1.910000e+02	191.000000	191.000000	191.000000	191.000	1.910000e+02	191.0
mean	1.458425e+05	4732.125654	9.834962e+04	4.276075e+04	1490.712042	2.788953	71.458534	inf	1.126747e+07	inf
std	6.443462e+05	18857.883062	4.103525e+05	2.844920e+05	7857.399265	3.302730	25.249672	NaN	2.337136e+08	NaN
min	0.000000e+00	0.000000	0.000000e+00	0.000000e+00	0.000000	0.000000	0.000000	0.000	-2.147484e+09	-2080.0
25%	1.895500e+03	35.000000	1.122500e+03	3.090000e+02	3.500000	0.990000	61.075000	1.415	2.023465e+06	325.5
50%	9.108000e+03	176.000000	5.991000e+03	1.847000e+03	80.000000	2.070000	79.580000	2.820	8.737370e+06	1547.0
75%	6.162050e+04	1065.500000	4.161750e+04	1.058750e+04	545.000000	3.255000	90.245000	5.065	3.044946e+07	5345.5
max	6.351756e+06	190923.000000	3.611632e+06	3.773354e+06	95735.000000	28.810000	100.000000	inf	4.287241e+08	inf

In [6]:

```
df.columns
```

Out[6]:

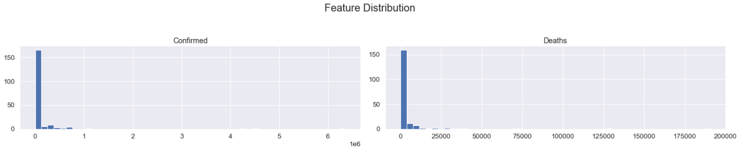
```
Index(['Country', 'Confirmed', 'Deaths', 'Recovered', 'Active', 'New Cases', 'Deaths / 100 Cases', 'Recovere
d / 100 Cases', 'Deaths / 100 Recovered', 'Population', 'Cases / Million People', 'Confirmed last week', '1
week change', '1 week % increase'], dtype='object')
```

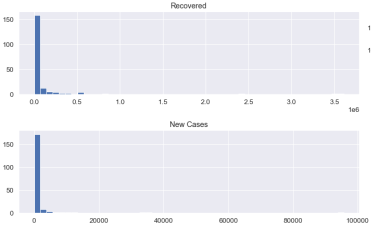
Data Visualization

Univariate Data Exploration

In [7]:

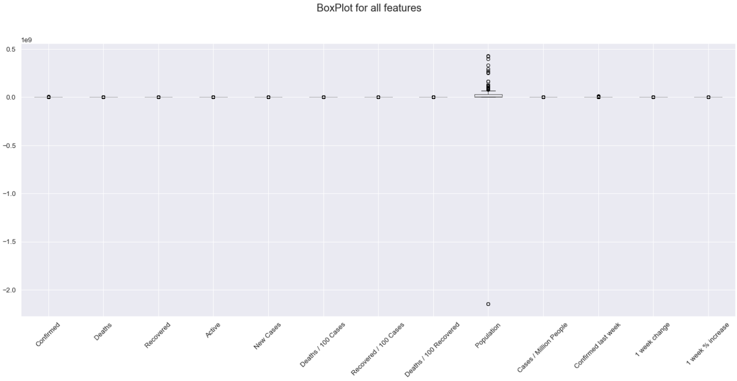
```
df[['Confirmed', 'Deaths', 'Recovered', 'Active', 'New Cases']].hist(bins=50, figsize=(20,10))
plt.suptitle('Feature Distribution', x=0.5, y=1.02, ha='center', fontsize=20)
plt.tight_layout()
plt.show()
```





In [8]:

```
df.boxplot(figsize=(20,10))
plt.suptitle('BoxPlot for all features', x=0.5, y=1.02, ha='center', fontsize=20)
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()
```



In [9]:

```
df.columns
```

Out[9]:

```
Index(['Country', 'Confirmed', 'Deaths', 'Recovered', 'Active', 'New Cases', 'Deaths / 100 Cases', 'Recovere
d / 100 Cases', 'Deaths / 100 Recovered', 'Population', 'Cases / Million People', 'Confirmed last week', '1
week change', '1 week % increase'], dtype='object')
```

In [10]:

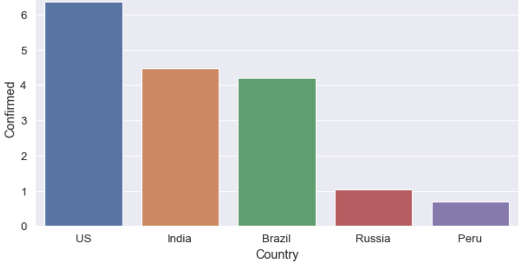
```
top5confirm = df.nlargest(5,'Confirmed')
top5confirm
```

Out[10]:

	Country	Confirmed	Deaths	Recovered	Active	New Cases	Deaths / 100 Cases	Recovered / 100 Cases	Deaths / 100 Recovered	Population	Cases / Million People	Confirmed last week	1 week change
176	US	6351756	190923	2387479	3773354	33895	3.01	37.59	8.00	330541757	19216.0	11541986	1230667
79	India	4465863	75062	3471783	919018	95735	1.68	77.74	2.16	-2147483648	-2080.0	8958483	308222
23	Brazil	4197889	128539	3611632	457718	35816	3.06	86.03	3.56	422706534	9931.0	5945849	220757
141	Russia	1037526	18080	854069	165377	5172	1.74	82.32	2.12	292579178	3546.0	1975629	168600
135	Peru	696190	30123	536959	129108	4615	4.33	77.13	5.61	65597846	10613.0	939931	12508

In [11]:

```
plt.figure(figsize=(10,5))
sns.barplot(x=top5confirm.Country, y=top5confirm.Confirmed, data=top5confirm, ci=None)
plt.title("Top 5 Confirmed COVID-19 Cases by Country", fontsize=15)
plt.show()
```



In [12]:

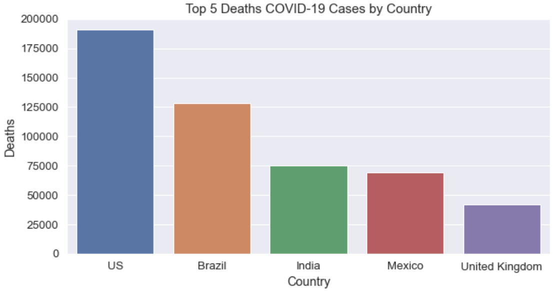
```
top5deaths = df.nlargest(5,'Deaths')
top5deaths
```

Out[12]:

	Country	Confirmed	Deaths	Recovered	Active	New Cases	Deaths / 100 Cases	Recovered / 100 Cases	Deaths / 100 Recovered	Population	Cases / Million People	Confirmed last week	1 week change
176	US	6351756	190923	2387479	3773354	33895	3.01	37.59	8.00	330541757	19216.0	11541986	1230667
23	Brazil	4197889	128539	3611632	457718	35816	3.06	86.03	3.56	422706534	9931.0	5945849	220757
79	India	4465863	75062	3471783	919018	95735	1.68	77.74	2.16	-2147483648	-2080.0	8958483	308222
114	Mexico	647321	69049	538514	39758	4461	10.67	83.19	12.82	255584572	2533.0	1015071	55416
180	United Kingdom	357613	41683	1831	314099	2681	11.66	0.51	2276.52	134856358	2652.0	1434004	126868

In [13]:

```
plt.figure(figsize=(10,5))
sns.barplot(x=top5deaths.Country, y=top5deaths.Deaths, data=top5deaths, ci=None)
plt.title("Top 5 Deaths COVID-19 Cases by Country", fontsize=15)
plt.show()
```



In [14]:

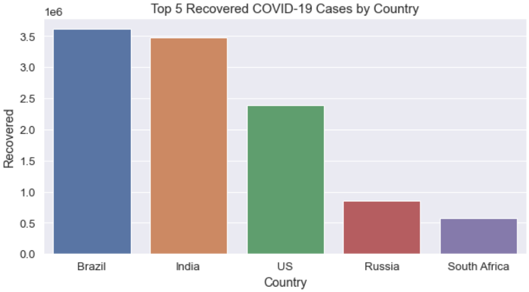
```
top5recover = df.nlargest(5,'Recovered')
top5recover
```

Out[14]:

	Country	Confirmed	Deaths	Recovered	Active	New Cases	Deaths / 100 Cases	Recovered / 100 Cases	Deaths / 100 Recovered	Population	Cases / Million People	Confirmed last week	1 week change
23	Brazil	4197889	128539	3611632	457718	35816	3.06	86.03	3.56	422706534	9931.0	5945849	220757
79	India	4465863	75062	3471783	919018	95735	1.68	77.74	2.16	-2147483648	-2080.0	8958483	308222
176	US	6351756	190923	2387479	3773354	33895	3.01	37.59	8.00	330541757	19216.0	11541986	1230667
141	Russia	1037526	18080	854069	165377	5172	1.74	82.32	2.12	292579178	3546.0	1975629	168600
158	South Africa	642431	15168	569935	57328	1990	2.36	88.72	2.66	59308690	10832.0	757144	18358

In [15]:

```
plt.figure(figsize=(10,5))
sns.barplot(x=top5recover.Country, y=top5recover.Recovered, data=top5recover, ci=None)
plt.title("Top 5 Recovered COVID-19 Cases by Country", fontsize=15)
plt.show()
```



In [16]:

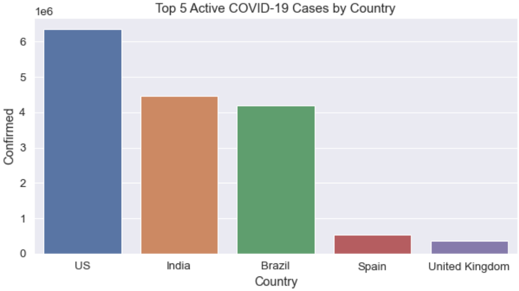
```
top5active = df.nlargest(5,'Active')
top5active
```

Out[16]:

	Country	Confirmed	Deaths	Recovered	Active	New Cases	Deaths / 100 Cases	Recovered / 100 Cases	Deaths / 100 Recovered	Population	Cases / Million People	Confirmed last week	1 week change
176	US	6351756	190923	2387479	3773354	33895	3.01	37.59	8.00	330541757	19216.0	11541986	1230667
79	India	4465863	75062	3471783	919018	95735	1.68	77.74	2.16	-2147483648	-2080.0	8958483	308222
23	Brazil	4197889	128539	3611632	457718	35816	3.06	86.03	3.56	422706534	9931.0	5945849	220757
160	Spain	543379	29628	150376	363375	8866	5.45	27.67	19.70	93691843	5800.0	1525341	79725
180	United Kingdom	357613	41683	1831	314099	2681	11.66	0.51	2276.52	134856358	2652.0	1434004	126868

In [17]:

```
plt.figure(figsize=(10,5))
sns.barplot(x=top5active.Country, y=top5active.Confirmed, data=top5active, ci=None)
plt.title("Top 5 Active COVID-19 Cases by Country", fontsize=15)
plt.show()
```



In [18]:

```
top5new = df.nlargest(5,'New Cases')
top5new
```

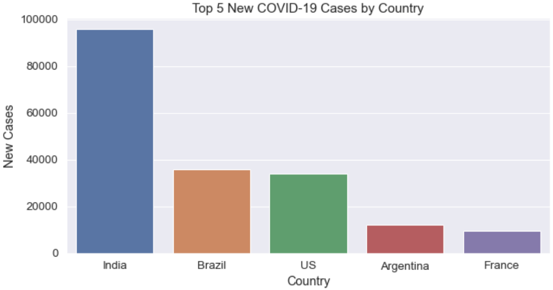
Out[18]:

	Country	Confirmed	Deaths	Recovered	Active	New Cases	Deaths / 100 Cases	Recovered / 100 Cases	Deaths / 100 Recovered	Population	Cases / Million People	Confirmed last week	1 week change
79	India	4465863	75062	3471783	919018	95735	1.68	77.74	2.16	-2147483648	-2080.0	8958483	308222
23	Brazil	4197889	128539	3611632	457718	35816	3.06	86.03	3.56	422706534	9931.0	5945849	220757
176	US	6351756	190923	2387479	3773354	33895	3.01	37.59	8.00	330541757	19216.0	11541986	1230667

6	Argentina	512293	10658	382490	119145	12259	2.08	74.66	2.79	45195777	11335.0	1339337	51051
62	France	383292	30805	89242	263245	9574	8.04	23.28	34.52	68151730	5624.0	2115717	106157

In [19]:

```python
plt.figure(figsize=(10,5))
sns.barplot(x=top5new.Country, y=top5new["New Cases"], data=top5new, ci=None)
plt.title("Top 5 New COVID-19 Cases by Country", fontsize=15)
plt.show()
```



Correlation

In [20]:

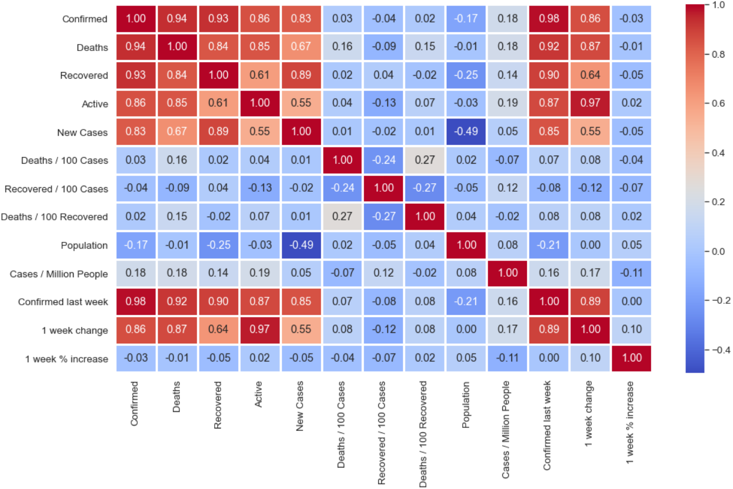
```python
df.corr()
```

Out[20]:

	Confirmed	Deaths	Recovered	Active	New Cases	Deaths / 100 Cases	Recovered / 100 Cases	Deaths / 100 Recovered	Population	Cases / Million People	Confirmed last week	1 cl
Confirmed	1.000000	0.936001	0.932637	0.857617	0.825854	0.031429	-0.036253	0.024084	-0.170678	0.180906	0.982705	0.8
Deaths	0.936001	1.000000	0.836808	0.846648	0.666371	0.159575	-0.088433	0.147513	-0.006591	0.184430	0.922572	0.8
Recovered	0.932637	0.836808	1.000000	0.614458	0.886462	0.016286	0.040626	-0.019543	-0.248159	0.142873	0.896067	0.6
Active	0.857617	0.846648	0.614458	1.000000	0.547669	0.037116	-0.134847	0.072943	-0.028186	0.191407	0.872085	0.9
New Cases	0.825854	0.666371	0.886462	0.547669	1.000000	0.009933	-0.023594	0.011782	-0.494192	0.054945	0.851942	0.5
Deaths / 100 Cases	0.031429	0.159575	0.016286	0.037116	0.009933	1.000000	-0.238857	0.266920	0.016635	-0.069147	0.066196	0.0
Recovered / 100 Cases	-0.036253	-0.088433	0.040626	-0.134847	-0.023594	-0.238857	1.000000	-0.267296	-0.051298	0.119342	-0.082926	-0.1
Deaths / 100 Recovered	0.024084	0.147513	-0.019543	0.072943	0.011782	0.266920	-0.267296	1.000000	0.040337	-0.019276	0.075681	0.0
Population	-0.170678	-0.006591	-0.248159	-0.028186	-0.494192	0.016635	-0.051298	0.040337	1.000000	0.076065	-0.211527	0.0
Cases / Million People	0.180906	0.184430	0.142873	0.191407	0.054945	-0.069147	0.119342	-0.019276	0.076065	1.000000	0.160043	0.1
Confirmed last week	0.982705	0.922572	0.896067	0.872085	0.851942	0.066196	-0.082926	0.075681	-0.211527	0.160043	1.000000	0.8
1 week change	0.862295	0.872050	0.643835	0.966537	0.549495	0.081358	-0.120870	0.084290	0.002100	0.171400	0.889413	1.0
1 week % increase	-0.027654	-0.010358	-0.054114	0.016109	-0.045721	-0.038357	-0.071958	0.017911	0.054895	-0.112614	0.001686	0.1

In [21]:

```python
plt.figure(figsize=(16,9))
sns.heatmap(df.corr(),cmap="coolwarm",annot=True,fmt='.2f',linewidths=2)
plt.show()
```



	Confirmed	Deaths	Recovered	Active	New Cases	Deaths / 100 Cases	Recovered / 100 Cases	Deaths / 100 Recovered	Population	Cases / Million People	Confirmed last week	1 week change	1 week % increase
Confirmed	1.00	0.94	0.93	0.86	0.83	0.03	-0.04	0.02	-0.17	0.18	0.98	0.86	-0.03
Deaths	0.94	1.00	0.84	0.85	0.67	0.16	-0.09	0.15	-0.01	0.18	0.92	0.87	-0.01
Recovered	0.93	0.84	1.00	0.61	0.89	0.02	0.04	-0.02	-0.25	0.14	0.90	0.64	-0.05
Active	0.86	0.85	0.61	1.00	0.55	0.04	-0.13	0.07	-0.03	0.19	0.87	0.97	0.02
New Cases	0.83	0.67	0.89	0.55	1.00	0.01	-0.02	0.01	-0.49	0.05	0.85	0.55	-0.05
Deaths / 100 Cases	0.03	0.16	0.02	0.04	0.01	1.00	-0.24	0.27	0.02	-0.07	0.07	0.08	-0.04
Recovered / 100 Cases	-0.04	-0.09	0.04	-0.13	-0.02	-0.24	1.00	-0.27	-0.05	0.12	-0.08	-0.12	-0.07
Deaths / 100 Recovered	0.02	0.15	-0.02	0.07	0.01	0.27	-0.27	1.00	0.04	-0.02	0.08	0.08	0.02
Population	-0.17	-0.01	-0.25	-0.03	-0.49	0.02	-0.05	0.04	1.00	0.08	-0.21	0.00	0.05
Cases / Million People	0.18	0.18	0.14	0.19	0.05	-0.07	0.12	-0.02	0.08	1.00	0.16	0.17	-0.11
Confirmed last week	0.98	0.92	0.90	0.87	0.85	0.07	-0.08	0.08	-0.21	0.16	1.00	0.89	0.00
1 week change	0.86	0.87	0.64	0.97	0.55	0.08	-0.12	0.08	0.00	0.17	0.89	1.00	0.10
1 week % increase	-0.03	-0.01	-0.05	0.02	-0.05	-0.04	-0.07	0.02	0.05	-0.11	0.00	0.10	1.00

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