** ** **COVID-19 Prediction**

```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
from plotly import *
import plotly as ppy
import plotly.express as px
from sklearn.model_selection import train_test_split
from sklearn.tree import DecisionTreeClassifier
from sklearn.metrics import accuracy_score
```

Load Data

```
url ="/content/drive/MyDrive/DATA_sets/corona_tested_006.csv"
```

```
original_df=pd.read_csv(url)
```

```
<ipython-input-7-a34b0b9a1f3b>:1: DtypeWarning:

Columns (2,3,4,5,6) have mixed types. Specify dtype option on import or set low_memory=False.
```

```
df=original_df.copy()
```

Data Cleaning

```
df.head()
```

	Ind_ID	Test_date	Cough_symptoms	Fever	Sore_throat	Shortness_of_breath	Headache	Corona	Age_60_above	S
0	1	11-03-2020	TRUE	FALSE	TRUE	FALSE	FALSE	negative	None	Nc
1	2	11-03-2020	FALSE	TRUE	FALSE	FALSE	FALSE	positive	None	Nc
2	3	11-03-2020	FALSE	TRUE	FALSE	FALSE	FALSE	positive	None	Nc
3	4	11-03-2020	TRUE	FALSE	FALSE	FALSE	FALSE	negative	None	Nc
4	5	11-03-2020	TRUE	FALSE	FALSE	FALSE	FALSE	negative	None	Nc

```
df.columns
```

```
Index(['Ind_ID', 'Test_date', 'Cough_symptoms', 'Fever', 'Sore_throat',
       'Shortness_of_breath', 'Headache', 'Corona', 'Age_60_above', 'Sex',
       'Known_contact'],
      dtype='object')
```

```
df.dtypes
```

```
Ind_ID                  int64
Test_date              object
Cough_symptoms         object
Fever                  object
```

```
     Sore_throat            object
     Shortness_of_breath    object
     Headache               object
     Corona                 object
     Age_60_above           object
     Sex                    object
     Known_contact          object
     dtype: object
```

```
df.shape
```

```
     (278848, 11)
```

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

```
     Ind_ID                 0
     Test_date              0
     Cough_symptoms         0
     Fever                  0
     Sore_throat            0
     Shortness_of_breath    0
     Headache               0
     Corona                 0
     Age_60_above           0
     Sex                    0
     Known_contact          0
     dtype: int64
```

```
for i in df:
  print(i, ":", df[i].unique())
```

```
     Ind_ID : [     1      2      3 ... 278846 278847 278848]
     Test_date : ['11-03-2020' '12-03-2020' '13-03-2020' '14-03-2020' '15-03-2020'
      '16-03-2020' '17-03-2020' '18-03-2020' '19-03-2020' '20-03-2020'
      '21-03-2020' '22-03-2020' '23-03-2020' '24-03-2020' '25-03-2020'
      '26-03-2020' '27-03-2020' '28-03-2020' '29-03-2020' '30-03-2020'
      '31-03-2020' '01-04-2020' '02-04-2020' '03-04-2020' '04-04-2020'
      '05-04-2020' '06-04-2020' '07-04-2020' '08-04-2020' '09-04-2020'
      '10-04-2020' '11-04-2020' '12-04-2020' '13-04-2020' '14-04-2020'
      '15-04-2020' '16-04-2020' '17-04-2020' '18-04-2020' '19-04-2020'
      '20-04-2020' '21-04-2020' '22-04-2020' '23-04-2020' '24-04-2020'
      '25-04-2020' '26-04-2020' '27-04-2020' '28-04-2020' '29-04-2020'
      '30-04-2020']
     Cough_symptoms : ['TRUE' 'FALSE' 'None' False True]
     Fever : ['FALSE' 'TRUE' 'None' False True]
     Sore_throat : ['TRUE' 'FALSE' 'None' False True]
     Shortness_of_breath : ['FALSE' 'TRUE' 'None' False True]
     Headache : ['FALSE' 'TRUE' 'None' False True]
     Corona : ['negative' 'positive' 'other']
     Age_60_above : ['None' 'No' 'Yes']
     Sex : ['None' 'male' 'female']
     Known_contact : ['Abroad' 'Contact with confirmed' 'Other']
```

```
df['Cough_symptoms'].unique()
```

```
     array(['TRUE', 'FALSE', 'None', False, True], dtype=object)
```

```
df['Cough_symptoms']=df['Cough_symptoms'].apply(lambda x: x.lower() if isinstance(x,str) else x)
```

```
df['Cough_symptoms'].unique()
```

```
     array(['TRUE', 'FALSE', 'None', False, True], dtype=object)
```

```
df['Cough_symptoms'].mode()[0]
```

```
     False
```

```
df['Cough_symptoms']=df['Cough_symptoms'].apply(lambda x: 'false' if x==False else x)
df['Cough_symptoms']=df['Cough_symptoms'].apply(lambda x: 'true' if x==True else x)
```

```
df['Cough_symptoms'].replace('none', df['Cough_symptoms'].mode()[0],inplace=True)# inplace=True
```

```
df['Cough_symptoms'].value_counts()
```

```
false    236620
true      42228
Name: Cough_symptoms, dtype: int64
```

```
df["Corona"].value_counts()
```

```
negative    260227
positive     14729
other         3892
Name: Corona, dtype: int64
```

```
df["Sex"].value_counts()
```

```
female    130158
male      129127
None       19563
Name: Sex, dtype: int64
```

```
df["Fever"].value_counts()
```

```
False    137774
FALSE    119070
TRUE      11750
True      10002
None        252
Name: Fever, dtype: int64
```

```
df["Age_60_above"].value_counts()
```

```
None    127320
No      125703
Yes      25825
Name: Age_60_above, dtype: int64
```

```
df['Fever']=df['Fever'].apply(lambda x: x.lower() if isinstance(x,str) else x)
```

```
df['Fever']=df['Fever'].apply(lambda x: 'false' if x==False else x)
df['Fever']=df['Fever'].apply(lambda x: 'true' if x==True else x)
```

```
df['Fever'].replace('none', df['Fever'].mode()[0],inplace=True)
```

```
df['Fever'].value_counts()
```

```
false    257096
true      21752
Name: Fever, dtype: int64
```

```
df['Sore_throat']=df['Sore_throat'].apply(lambda x: x.lower() if isinstance(x,str) else x)
```

```
df['Sore_throat']=df['Sore_throat'].apply(lambda x: 'false' if x==False else x)
df['Sore_throat']=df['Sore_throat'].apply(lambda x: 'true' if x==True else x)
```

```
df['Sore_throat'].replace('none', df['Sore_throat'].mode()[0],inplace=True)
```

```
df['Sore_throat'].value_counts()
```

```
false    276922
true       1926
Name: Sore_throat, dtype: int64
```

```
df['Shortness_of_breath']=df['Shortness_of_breath'].apply(lambda x: x.lower() if isinstance(x,str) else x)
```

```
df['Shortness_of_breath']=df['Shortness_of_breath'].apply(lambda x: 'false' if x==False else x)
df['Shortness_of_breath']=df['Shortness_of_breath'].apply(lambda x: 'true' if x==True else x)
```

```
df['Shortness_of_breath'].replace('none', df['Shortness_of_breath'].mode()[0],inplace=True)
```

```
df['Shortness_of_breath'].value_counts()
```

```
false    277271
true       1577
Name: Shortness_of_breath, dtype: int64
```

```
df['Headache']=df['Headache'].apply(lambda x: x.lower() if isinstance(x,str) else x)
```

```
df['Headache']=df['Headache'].apply(lambda x: 'false' if x==False else x)
df['Headache']=df['Headache'].apply(lambda x: 'true' if x==True else x)
```

```
df['Headache'].replace('none', df['Headache'].mode()[0],inplace=True)
```

```
df['Headache'].value_counts()
```

```
false    276434
true       2414
Name: Headache, dtype: int64
```

```
sex_mode = df['Sex'].mode()[0]
df['Sex'] = df['Sex'].replace('None', sex_mode)
```

```
df['Sex'].value_counts()
```

```
female    149721
male      129127
Name: Sex, dtype: int64
```

```
df['Age_60_above'].value_counts()
```

```
None    127320
No      125703
Yes      25825
Name: Age_60_above, dtype: int64
```

```
age_mode = df['Age_60_above'].mode()[0]
print(age_mode)
```

```
None
```

```
df['Age_60_above'].value_counts()
```

```
None    127320
No      125703
Yes      25825
Name: Age_60_above, dtype: int64
```

```
print(df['Age_60_above'].unique())
```

```
['None' 'No' 'Yes']
```

```
for i in df:
  print(i, ":", df[i].unique())
```

```
Ind_ID : [     1      2      3 ... 278846 278847 278848]
Test_date : ['11-03-2020' '12-03-2020' '13-03-2020' '14-03-2020' '15-03-2020'
 '16-03-2020' '17-03-2020' '18-03-2020' '19-03-2020' '20-03-2020'
 '21-03-2020' '22-03-2020' '23-03-2020' '24-03-2020' '25-03-2020'
 '26-03-2020' '27-03-2020' '28-03-2020' '29-03-2020' '30-03-2020'
 '31-03-2020' '01-04-2020' '02-04-2020' '03-04-2020' '04-04-2020'
 '05-04-2020' '06-04-2020' '07-04-2020' '08-04-2020' '09-04-2020'
 '10-04-2020' '11-04-2020' '12-04-2020' '13-04-2020' '14-04-2020'
 '15-04-2020' '16-04-2020' '17-04-2020' '18-04-2020' '19-04-2020'
 '20-04-2020' '21-04-2020' '22-04-2020' '23-04-2020' '24-04-2020'
 '25-04-2020' '26-04-2020' '27-04-2020' '28-04-2020' '29-04-2020'
 '30-04-2020']
Cough_symptoms : ['true' 'false']
Fever : ['false' 'true']
Sore_throat : ['true' 'false']
Shortness_of_breath : ['false' 'true']
Headache : ['false' 'true']
Corona : ['negative' 'positive']
Age_60_above : ['None' 'No' 'Yes']
Sex : ['female' 'male']
Known_contact : ['Abroad' 'Contact with confirmed' 'Other']
```

Duckcb sql Analysis

```
import duckdb
```

```
conn=duckdb.connect()
conn.register("df",df)
```

```
<duckdb.duckdb.DuckDBPyConnection at 0x7c3094d99cf0>
```

1.Find the number of corona patients who faced shortness of breath.

2.Find the number of negative corona patients who have fever and sore_throat.

3.Group the data by month and rank the number of positive cases.

4.Find the female negative corona patients who faced cough and headache.

5.How many elderly corona patients have faced breathing problems?

6.Which three symptoms were more common among COVID positive patients?

7.Which symptom was less common among COVID negative people?

8.What are the most common symptoms among COVID positive males whose known contact was abroad?

```
conn.execute("select * from df limit 5").fetchdf()
```

	Ind_ID	Test_date	Cough_symptoms	Fever	Sore_throat	Shortness_of_breath	Headache	Corona	Age_60_above	S
0	1	11-03-2020	true	false	true	false	false	negative	None	fem
1	2	11-03-2020	false	true	false	false	false	positive	None	fem
2	3	11-03-2020	false	true	false	false	false	positive	None	fem
3	4	11-03-2020	true	false	false	false	false	negative	None	fem
4	5	11-03-2020	true	false	false	false	false	negative	None	fem

```
#1.Find the number of corona patients who faced shortness of breath.
conn.execute("select count(*) from df where Shortness_of_breath ='true' and Corona='positive'").fetchdf()
```

```
#2.Find the number of negative corona patients who have fever and sore_throat.
conn.execute("select count(*) from df where sore_throat ='true' and Corona='negative' and fever='true'").fetchdf()
```

	count_star()
0	121

```


df['Test_month'] = pd.to_datetime(df['Test_date'], format='%d-%m-%Y').dt.month

# Display the DataFrame with the new 'Test_month' column
print(df[['Test_date', 'Test_month']])
```

```
         Test_date  Test_month
0       11-03-2020           3
1       11-03-2020           3
2       11-03-2020           3
3       11-03-2020           3
4       11-03-2020           3
...            ...         ...
278843  30-04-2020           4
278844  30-04-2020           4
278845  30-04-2020           4
278846  30-04-2020           4
278847  30-04-2020           4

[278848 rows x 2 columns]
```

```
#3.Group the data by month and rank the number of positive cases.
conn.execute("""
    SELECT
        Test_month,
        RANK() OVER (PARTITION BY Test_month ORDER BY COUNT(*) DESC) AS positive_rank,
        COUNT(*) AS positive_cases
    FROM df
    WHERE Corona = 'positive'
    GROUP BY Test_month
    ORDER BY Test_month
""").fetchdf()
```

	Test_month	positive_rank	positive_cases
0	3	1	5848
1	4	1	8881

```
#4.Find the female negative corona patients who faced cough and headache.
conn.execute("select * from df where Corona='negative'  and Sex ='female'  and Cough_symptoms='true' and headache='tru
```

	Ind_ID	Test_date	Cough_symptoms	Fever	Sore_throat	Shortness_of_breath	Headache	Corona	Age_60_above	
0	340	12-03-2020	true	true	false	false	true	negative	None	fe
1	493	12-03-2020	true	true	false	false	true	negative	None	fe
2	511	12-03-2020	true	false	false	false	true	negative	None	fe
3	936	13-03-2020	true	true	true	false	true	negative	None	fe
4	1113	13-03-2020	true	false	false	false	true	negative	None	fe
5	1481	13-03-2020	true	true	false	false	true	negative	None	fe
6	1523	13-03-2020	true	false	true	false	true	negative	None	fe
7	1526	13-03-2020	true	false	false	false	true	negative	None	fe
8	1528	13-03-2020	true	false	true	false	true	negative	None	fe
9	1532	13-03-2020	true	false	false	false	true	negative	None	fe
10	1665	14-03-2020	true	true	false	false	true	negative	None	fe
11	1813	14-03-2020	true	false	true	false	true	negative	None	fe
12	1822	14-03-2020	true	true	false	false	true	negative	None	fe
13	1941	14-03-2020	true	false	false	false	true	negative	None	fe
14	2422	15-03-2020	true	true	true	false	true	negative	None	fe
15	3228	16-03-2020	true	true	true	false	true	negative	None	fe
16	3765	16-03-2020	true	true	true	false	true	negative	None	fe
17	4431	16-03-2020	true	true	false	false	true	negative	None	fe
18	4502	16-03-2020	true	false	false	false	true	negative	None	fe
19	4832	17-03-2020	true	true	false	true	true	negative	No	fe
20	5245	17-03-2020	true	true	false	true	true	negative	No	fe
21	6106	18-03-2020	true	false	true	false	true	negative	No	fe
22	6394	18-03-2020	true	true	false	false	true	negative	No	fe
23	7963	18-03-2020	true	false	true	false	true	negative	No	fe
24	10341	20-03-2020	true	false	true	false	true	negative	No	fe
25	10523	20-03-2020	true	true	true	false	true	negative	No	fe
26	12599	21-03-2020	true	false	true	false	true	negative	No	fe
27	13016	21-03-	true	true	true	false	true	negative	No	fe

27		2020	true	true	true	false	true	negative	No	fe
28	13756	22-03-2020	true	true	true	false	true	negative	No	fe
29	17289	22-03-2020	true	true	true	false	true	negative	No	fe
30	17657	23-03-2020	true	false	true	false	true	negative	No	fe
31	19554	23-03-2020	true	true	false	false	true	negative	No	fe
32	19615	23-03-2020	true	false	true	true	true	negative	No	fe
33	20248	23-03-2020	true	true	false	false	true	negative	Yes	fe
34	20253	23-03-2020	true	true	false	false	true	negative	No	fe
35	37904	27-03-2020	true	true	true	true	true	negative	No	fe
36	40616	27-03-2020	true	false	false	true	true	negative	No	fe
37	40752	27-03-2020	true	true	false	false	true	negative	No	fe
38	43650	28-03-2020	true	false	true	true	true	negative	No	fe
39	49678	29-03-2020	true	true	false	false	true	negative	No	fe
40	51034	29-03-2020	true	false	false	false	true	negative	Yes	fe
41	52740	29-03-2020	true	true	true	false	true	negative	No	fe
42	57155	30-03-2020	true	false	true	false	true	negative	No	fe
43	58101	30-03-2020	true	false	true	false	true	negative	No	fe
44	70026	01-04-2020	true	true	false	false	true	negative	No	fe
45	76125	01-04-2020	true	true	true	true	true	negative	No	fe
46	84586	03-04-2020	true	false	true	false	true	negative	No	fe
47	86104	03-04-2020	true	false	true	true	true	negative	No	fe
48	86109	03-04-2020	true	false	false	true	true	negative	No	fe
49	86145	03-04-2020	true	false	true	true	true	negative	No	fe
50	100555	05-04-2020	true	false	false	false	true	negative	No	fe
51	122243	09-04-2020	true	true	false	true	true	negative	No	fe
52	133573	11-04-2020	true	false	true	true	true	negative	No	fe
53	135059	11-04-	true	true	true	false	true	negative	Yes	fe

```
#How many elderly corona patients have faced breathing problems?
conn.execute("select count(*) from df where Corona='positive'  and Age_60_above ='Yes'  and Shortness_of_breath='true'
```

count_star()

56 149178 2020 true false false false true negative No fe

```
#6.Which three symptoms were more common among COVID positive patients?
conn.execute("""
   select
    count(*) AS symptom_count,
    cough_symptoms,
    fever,
    sore_throat,
    shortness_of_breath,
    headache
from df
where corona = 'positive'
group by cough_symptoms, fever, sore_throat, shortness_of_breath, headache
order by symptom_count DESC
LIMIT 3;
""").fetchdf()
```

	symptom_count	Cough_symptoms	Fever	Sore_throat	Shortness_of_breath	Headache
0	5312	false	false	false	false	false
1	2166	true	true	false	false	false
2	2133	true	false	false	false	false

```
#7.Which symptom was less common among COVID negative people?

conn.execute("""
   select
    count(*) AS symptom_count,
    cough_symptoms,
    fever,
    sore_throat,
    shortness_of_breath,
    headache
from df
where corona = 'negative'
group by cough_symptoms, fever, sore_throat, shortness_of_breath, headache
order by symptom_count asc
LIMIT 1;
""").fetchdf()
```

	symptom_count	Cough_symptoms	Fever	Sore_throat	Shortness_of_breath	Headache
0	1	false	true	false	true	true

```
#8.What are the most common symptoms among COVID positive males whose known contact was abroad?

conn.execute("""SELECT
    COUNT(*) AS symptom_count,
    Cough_symptoms,
    Fever,
    Sore_throat,
    Shortness_of_breath,
    Headache
FROM df
WHERE Corona = 'positive'
    AND Sex = 'male'
    AND Known_contact = 'Abroad'
GROUP BY Cough_symptoms, Fever, Sore_throat, Shortness_of_breath, Headache
ORDER BY symptom_count DESC
LIMIT 1""").fetchdf()
```

	symptom_count	Cough_symptoms	Fever	Sore_throat	Shortness_of_breath	Headache
0	189	true	false	false	false	false

**EDA

```
# This is formatted as code
```

**

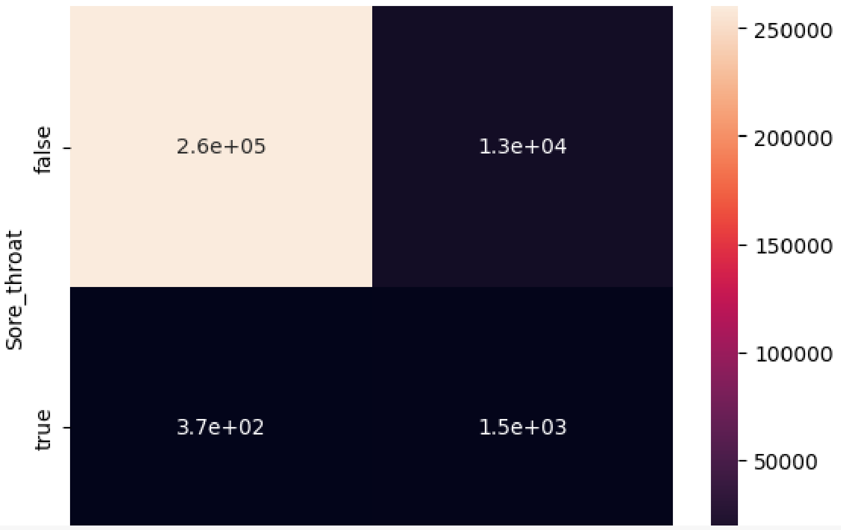
```
# Display the first few rows of the DataFrame
print(df.head())

# Display basic statistics of numerical columns
print(df.describe())

# Display information about the DataFrame (data types, non-null counts)
print(df.info())
print(df.shape)
```

```
   Ind_ID   Test_date Cough_symptoms  Fever Sore_throat Shortness_of_breath  \
0       1  11-03-2020           true  false        true               false
1       2  11-03-2020          false   true       false               false
2       3  11-03-2020          false   true       false               false
3       4  11-03-2020           true  false       false               false
4       5  11-03-2020           true  false       false               false

  Headache    Corona Age_60_above     Sex           Known_contact
0    false  negative         None  female                  Abroad
1    false  positive         None  female                  Abroad
2    false  positive         None  female                  Abroad
3    false  negative         None  female                  Abroad
4    false  negative         None  female  Contact with confirmed
              Ind_ID
count  274956.000000
mean   139523.837338
std     80520.445132
min         1.000000
25%     69841.750000
50%    139230.500000
75%    209257.250000
max    278848.000000
<class 'pandas.core.frame.DataFrame'>
Int64Index: 274956 entries, 0 to 278847
Data columns (total 11 columns):
 #   Column               Non-Null Count   Dtype
---  ------               --------------   -----
 0   Ind_ID               274956 non-null  int64
 1   Test_date            274956 non-null  object
 2   Cough_symptoms       274956 non-null  object
 3   Fever                274956 non-null  object
 4   Sore_throat          274956 non-null  object
 5   Shortness_of_breath  274956 non-null  object
 6   Headache             274956 non-null  object
 7   Corona               274956 non-null  object
 8   Age_60_above         274956 non-null  object
 9   Sex                  274956 non-null  object
 10  Known_contact        274956 non-null  object
dtypes: int64(1), object(10)
memory usage: 25.2+ MB
None
(274956, 11)
```

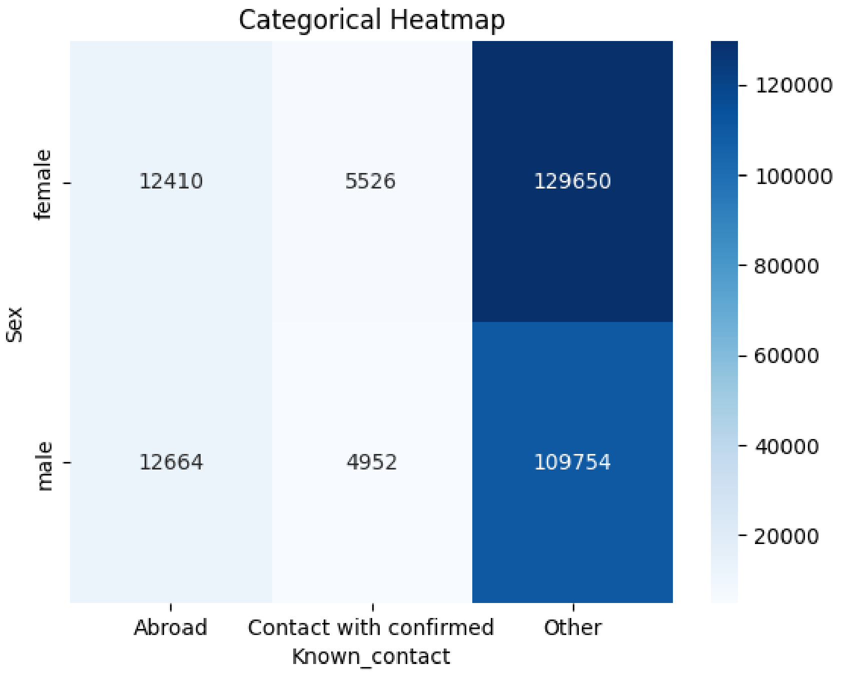
```
# Use loc to drop rows where 'Corona' is 'other'
df = df.loc[df['Corona'] != 'other']
```

```
# relationshio vetween two categorical variable # sex, and smoker
sns.heatmap(pd.crosstab(df['Sore_throat'],df['Corona']),annot=True)
```

```
<Axes: xlabel='Corona', ylabel='Sore_throat'>
```

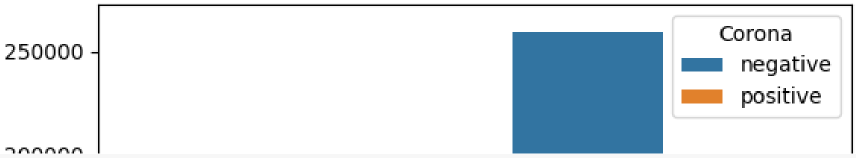


```
# Example: Categorical heatmap for 'Sex' and 'Known_contact'
cross_tab = pd.crosstab(df['Sex'], df['Known_contact'])
sns.heatmap(cross_tab, annot=True, cmap='Blues', fmt='d')
plt.title('Categorical Heatmap')
plt.show()
```

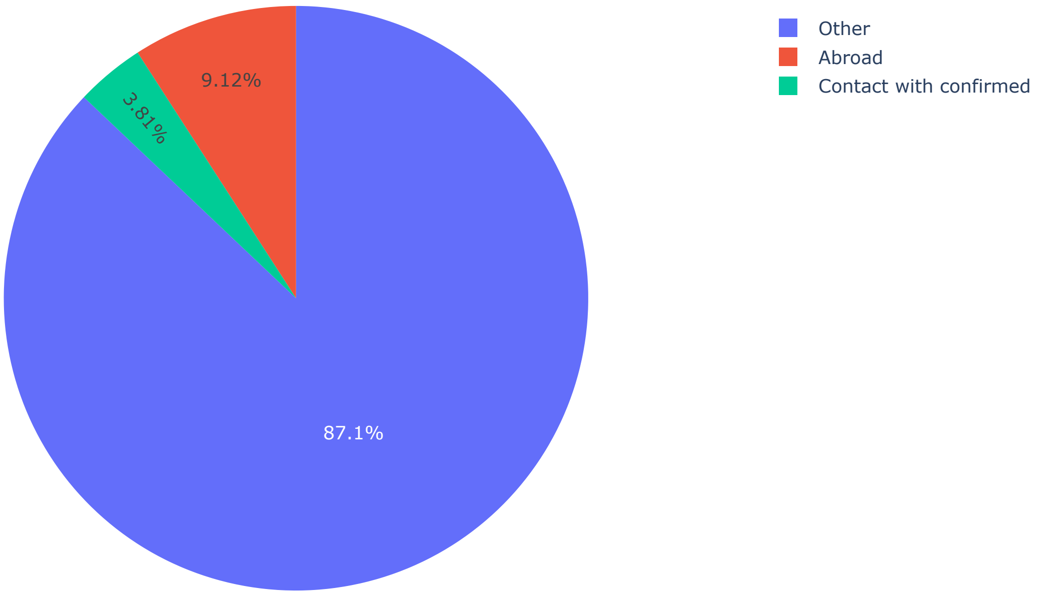


```
sns.countplot(x='Sore_throat', hue='Corona', data=df)
```

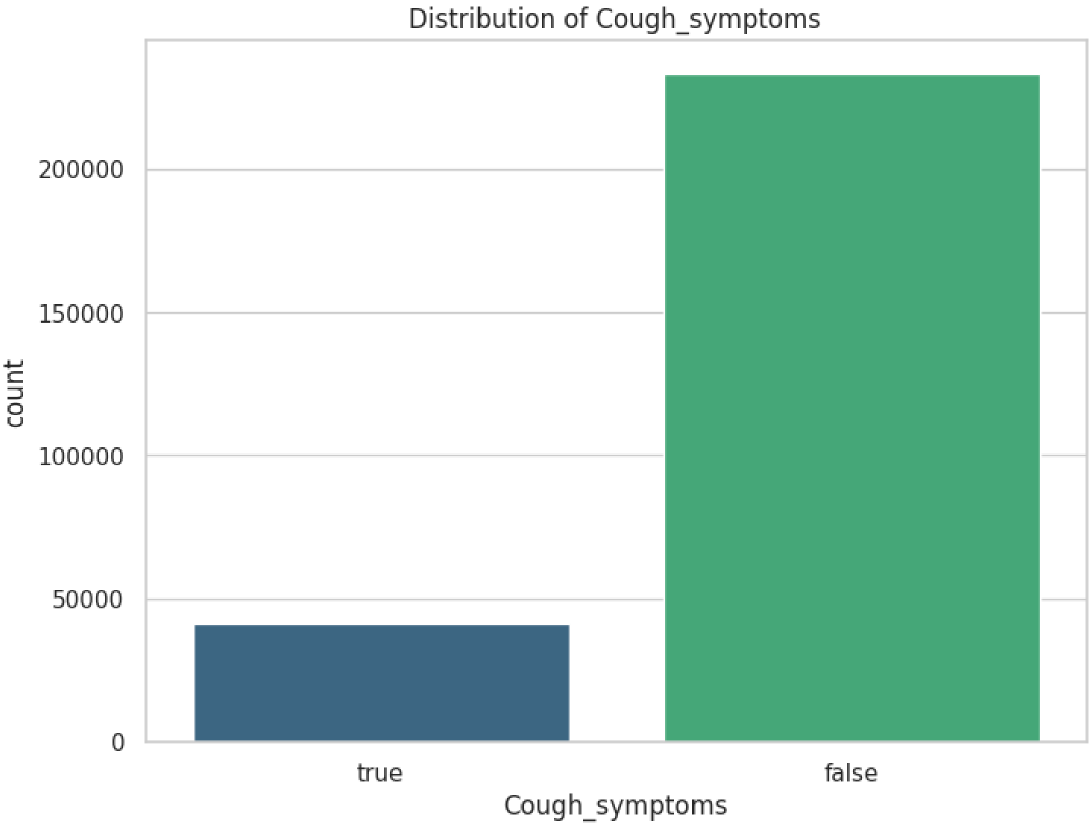
```
<Axes: xlabel='Sore_throat', ylabel='count'>
```

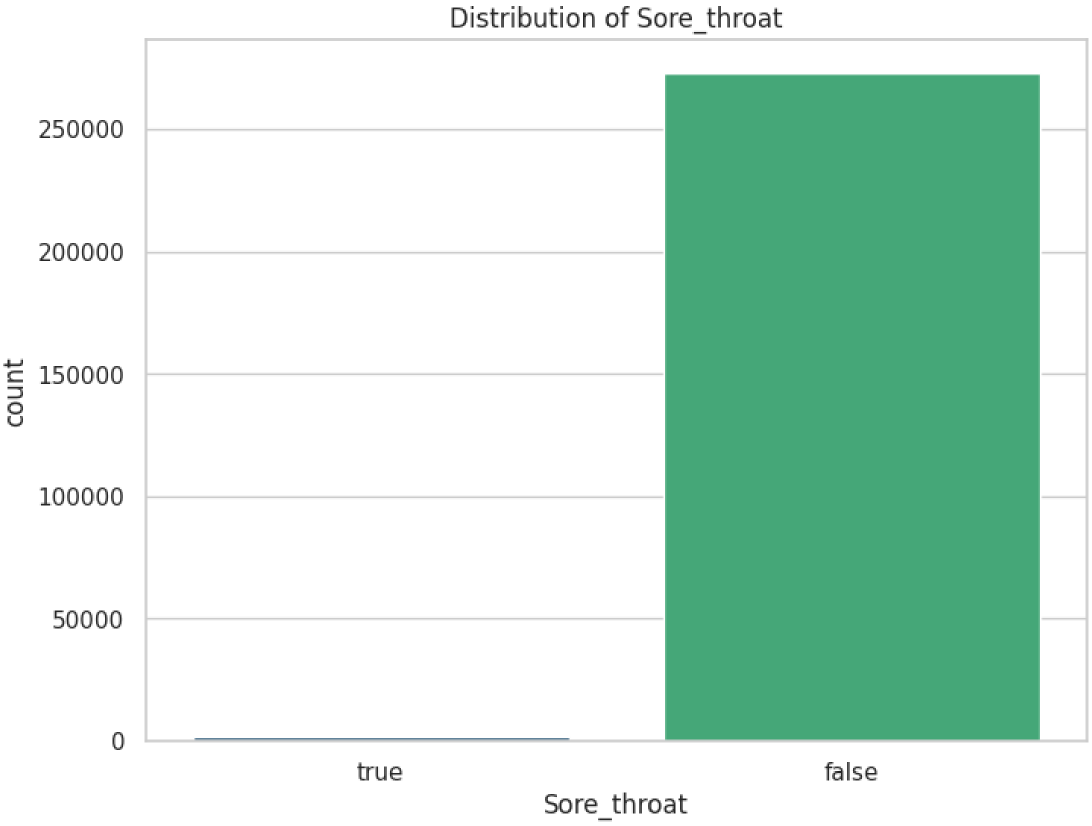


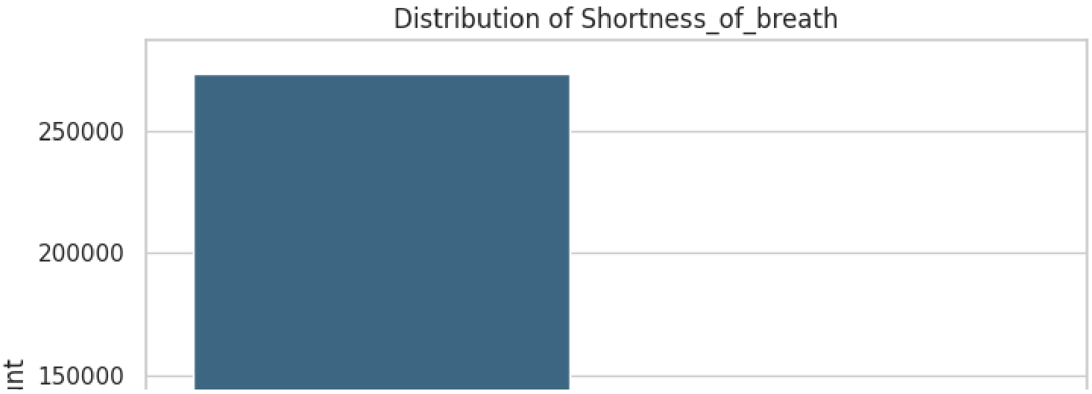
```
fig=px.pie(data_frame=df,names="Known_contact")
fig
```

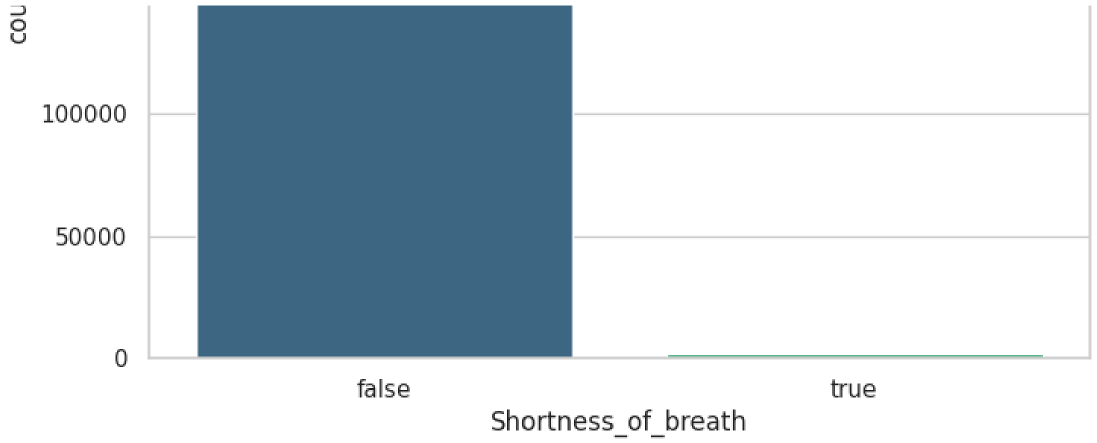


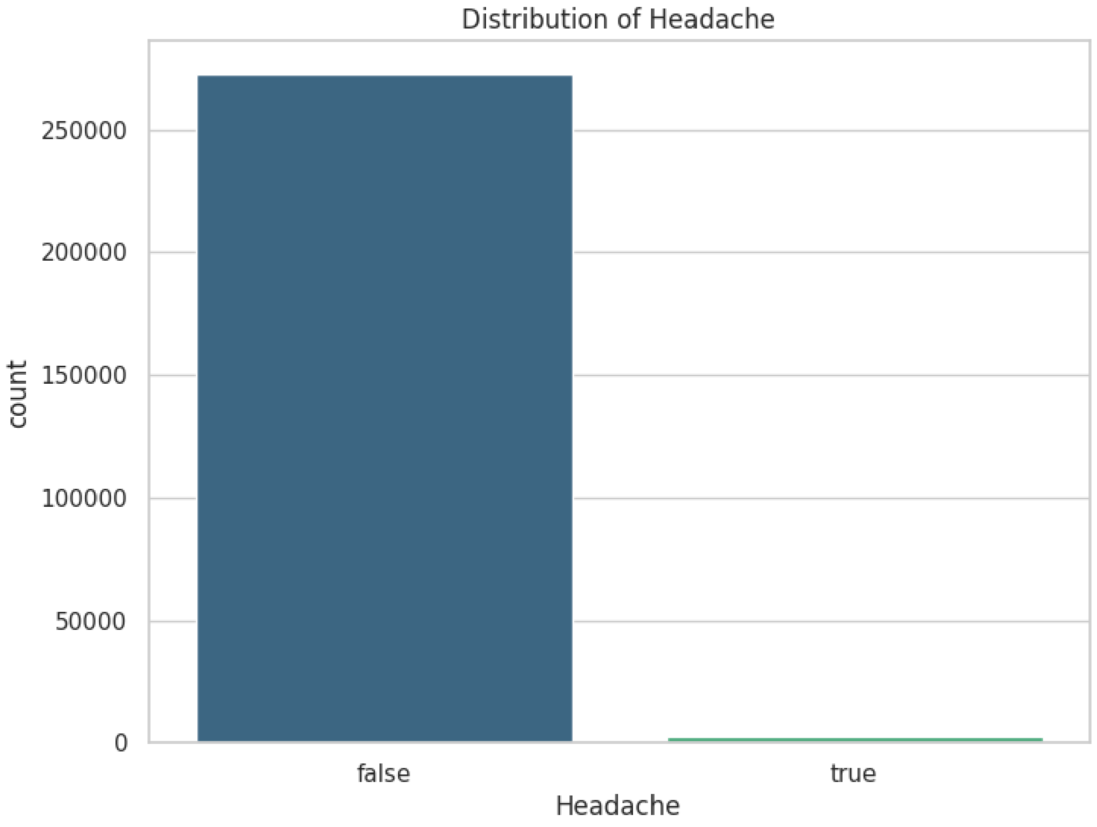
```
import matplotlib.pyplot as plt
import seaborn as sns

# Set the style for the plots
sns.set(style="whitegrid")

# Select the features of interest
features_of_interest = ['Cough_symptoms', 'Sore_throat', 'Shortness_of_breath', 'Headache', 'Known_contact']

# Plot histograms for each feature
for feature in features_of_interest:
    plt.figure(figsize=(8, 6))
    sns.countplot(x=feature, data=df, palette="viridis")
    plt.title(f'Distribution of {feature}')
    plt.show()
```

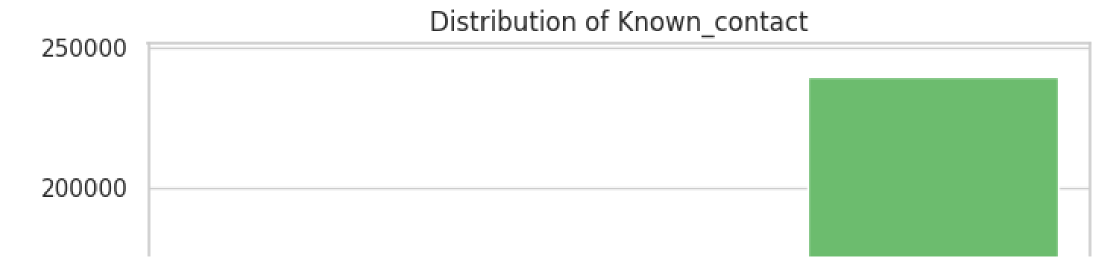

Distribution of Cough_symptoms
count
0
50000
100000
150000
200000
true
false
Cough_symptoms


Distribution of Sore_throat
count
0
50000
100000
150000
200000
250000
true
false
Sore_throat


Distribution of Shortness_of_breath
150000
200000
250000
int







Chi square testing to check the hypothesis

Hypothesis 1: Symptom Significance in COVID-19 Prediction

Statement: Symptoms like cough, fever, and shortness of breath will be significant predictors of COVID-19 infection.

Test: Chi-square Test

Procedure:

Null Hypothesis (H0): There is no association between symptoms (cough, fever, sore throat, shortness of breath, headache) and COVID-19 infection. Alternative Hypothesis (H1): There is a significant association between symptoms and COVID-19 infection.

Results:

Chi-square value: 21290.64 P-value: 0.0 (Significant at a 5% significance level) Conclusion:

We reject the null hypothesis, indicating a significant association between symptoms and COVID-19 infection.

```
from scipy.stats import chi2_contingency

# Example: Chi-square test for 'Sore_throat' and 'Corona'
contingency_table = pd.crosstab(df['Sore_throat'], df['Corona'])

# Perform chi-square test
chi2, p, _, _ = chi2_contingency(contingency_table)

# Print the result
print(f"Chi-square value: {chi2}")
print(f"P-value: {p}")
```

```
Chi-square value: 21290.644868638272
P-value: 0.0
```

```
# Example: Chi-square test for 'Cough_symptoms' and 'Corona'
contingency_table = pd.crosstab(df['Cough_symptoms'], df['Corona'])

# Perform chi-square test
chi2, p, _, _ = chi2_contingency(contingency_table)

# Print the result
print(f"Chi-square value: {chi2}")
print(f"P-value: {p}")
```

```
Chi-square value: 10609.529767154772
P-value: 0.0
```

```
# Example: Chi-square test for 'Fever' and 'Corona'
contingency_table = pd.crosstab(df['Fever'], df['Corona'])

# Perform chi-square test
chi2, p, _, _ = chi2_contingency(contingency_table)

# Print the result
print(f"Chi-square value: {chi2}")
print(f"P-value: {p}")
```

```
Chi-square value: 19489.55233920404
P-value: 0.0
```

```
# Example: Chi-square test for 'Shortness_of_breath' and 'Corona'
contingency_table = pd.crosstab(df['Shortness_of_breath'], df['Corona'])

# Perform chi-square test
chi2, p, _, _ = chi2_contingency(contingency_table)

# Print the result
print(f"Chi-square value: {chi2}")
print(f"P-value: {p}")
```

```
Chi-square value: 14951.005265593401
P-value: 0.0
```

```
# Example: Chi-square test for 'Headache' and 'Corona'
contingency_table = pd.crosstab(df['Headache'], df['Corona'])

# Perform chi-square test
chi2, p, _, _ = chi2_contingency(contingency_table)

# Print the result
print(f"Chi-square value: {chi2}")
print(f"P-value: {p}")
```

```
Chi-square value: 37061.47784842176
P-value: 0.0
```

```
# Example: Chi-square test for 'Sex' and 'Corona'
contingency_table = pd.crosstab(df['Sex'], df['Corona'])

# Perform chi-square test
chi2, p, _, _ = chi2_contingency(contingency_table)

# Print the result
print(f"Chi-square value: {chi2}")
print(f"P-value: {p}")
```

```
Chi-square value: 139.54358298541194
P-value: 3.349829634729112e-32
```

```
# Example: Chi-square test for 'Known_contact' and 'Corona'
contingency_table = pd.crosstab(df['Known_contact'], df['Corona'])

# Perform chi-square test
chi2, p, _, _ = chi2_contingency(contingency_table)

# Print the result
print(f"Chi-square value: {chi2}")
print(f"P-value: {p}")
```

```
Chi-square value: 90526.50708263667
P-value: 0.0
```

```
df.columns
```

```
Index(['Ind_ID', 'Test_date', 'Cough_symptoms', 'Fever', 'Sore_throat',
       'Shortness_of_breath', 'Headache', 'Corona', 'Age_60_above', 'Sex',
       'Known_contact'],
      dtype='object')
```

Preprocessing and Label Encoding

```
da=df.copy()
```

```
da.head()
```

Ind_ID Test_date Cough_symptoms Fever Sore_throat Shortness_of_breath Headache Corona Age_60_above S

```
# Drop unnecessary columns
da.drop(['Ind_ID', 'Test_date'], axis=1, inplace=True)
```

1 2 2020 false true false false false positive None fem

```
# Initialize LabelEncoder
label_encoder = LabelEncoder()

# Apply Label Encoding to categorical columns
for column in ['Cough_symptoms', 'Fever', 'Sore_throat', 'Shortness_of_breath', 'Headache', 'Corona', 'Age_60_above',
    da[column] = label_encoder.fit_transform(da[column])
```

4 5 2020 true false false false false negative None fem

```
da.head()
```

	Cough_symptoms	Fever	Sore_throat	Shortness_of_breath	Headache	Corona	Age_60_above	Sex	Known_contact
0	1	0	1	0	0	0	1	0	0
1	0	1	0	0	0	1	1	0	0
2	0	1	0	0	0	1	1	0	0
3	1	0	0	0	0	0	1	0	0
4	1	0	0	0	0	0	1	0	1

FEATURE SELECTION USING >>Recursive Feature Elimination<<

```
from sklearn.feature_selection import RFE
from sklearn.svm import SVR
from sklearn.preprocessing import LabelEncoder
import pandas as pd

# Assuming 'df' contains your data and 'Corona' is the target variable
# Select relevant categorical columns (excluding 'Corona' which is the target)
categorical_columns = ['Cough_symptoms', 'Fever', 'Sore_throat', 'Shortness_of_breath', 'Headache', 'Known_contact', '

# Create a subset DataFrame with only the selected columns
X_categorical = da[categorical_columns]

# Label encode categorical variables
label_encoder = LabelEncoder()
X_categorical_encoded = X_categorical.apply(label_encoder.fit_transform)

# Target variable ('Corona')
y = label_encoder.fit_transform(da['Corona'])

# Specify the estimator (SVR)
estimator = SVR(kernel="linear")

# Initialize RFE with the estimator and the number of features to select
selector = RFE(estimator, n_features_to_select=5, step=1)

# Fit RFE on the encoded categorical features and target variable
selector = selector.fit(X_categorical_encoded, y)

# Print the support (selected features)
print("Selected Features:")
print(selector.support_)

# Print the ranking of features
print("Feature Ranking:")
print(selector.ranking_)
```

```
Selected Features:
[ True False  True  True  True  True False]
```

```
Feature Ranking:
[1 3 1 1 1 1 2]
```

The features 'Cough_symptoms', 'Sore_throat', 'Shortness_of_breath', 'Headache', and 'Known_contact' are selected, and they have the lowest ranking of 1, indicating higher importance

Train_Test _split

```
from sklearn.model_selection import train_test_split
```

```
# Select features and target variable
X = da[['Cough_symptoms', 'Sore_throat', 'Shortness_of_breath', 'Headache', 'Known_contact']]
y = da['Corona']
```

```
# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
```

Logistic Regression:

```
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score, classification_report
```

```
# Train Logistic Regression model
logistic_model = LogisticRegression(random_state=42)
logistic_model.fit(X_train, y_train)
```

```
▾         LogisticRegression
LogisticRegression(random_state=42)
```

```
# Make predictions on the test set
y_pred_logistic = logistic_model.predict(X_test)
```

```
# Evaluate the model
accuracy_logistic = accuracy_score(y_test, y_pred_logistic)
print(f"Logistic Regression Accuracy: {accuracy_logistic}")
print(classification_report(y_test, y_pred_logistic))
```

```
Logistic Regression Accuracy: 0.9561936281640966
              precision    recall  f1-score   support

           0       0.96      1.00      0.98     52041
           1       0.82      0.23      0.36      2951

    accuracy                           0.96     54992
   macro avg       0.89      0.62      0.67     54992
weighted avg       0.95      0.96      0.94     54992
```

Hypothesis 2: Decision Tree Outperforms Random Forest

Statement: The Decision Tree model will have higher accuracy in predicting COVID-19 compared to the Random Forest model.

Test: Model Comparison

Procedure:

1.Train Decision Tree and Random Forest models on the dataset.

2.Evaluate and compare the accuracy of both models.

Results:

Decision Tree Accuracy: 96.59%

Random Forest Accuracy: 96.59%

Logistic Regression Accuracy: 95.62%

Conclusion:

Both Decision Tree and Random Forest models perform similarly, with high accuracies. No significant evidence to reject the hypothesis that Decision Tree outperforms Random Forest.

Decision Tree:

```
from sklearn.tree import DecisionTreeClassifier
```

```
# Train Decision Tree model
decision_tree_model = DecisionTreeClassifier(random_state=42)
decision_tree_model.fit(X_train, y_train)
```

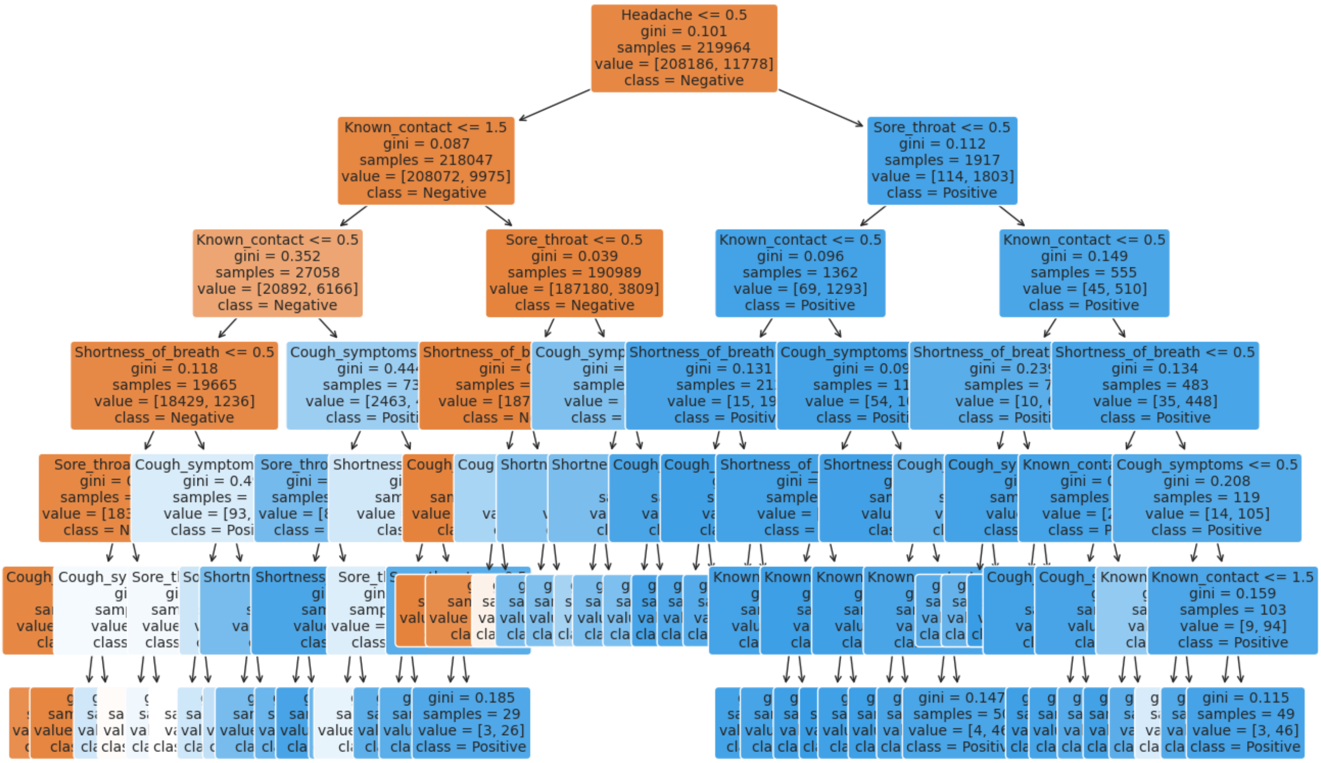
```
▾        DecisionTreeClassifier
DecisionTreeClassifier(random_state=42)
```

```
# Make predictions on the test set
y_pred_decision_tree = decision_tree_model.predict(X_test)
```

```
# Evaluate the model
accuracy_decision_tree = accuracy_score(y_test, y_pred_decision_tree)
print(f"Decision Tree Accuracy: {accuracy_decision_tree}")
print(classification_report(y_test, y_pred_decision_tree))
```

```
Decision Tree Accuracy: 0.9658677625836485
              precision    recall  f1-score   support

           0       0.98      0.99      0.98     52041
           1       0.71      0.61      0.66      2951

    accuracy                           0.97     54992
   macro avg       0.84      0.80      0.82     54992
weighted avg       0.96      0.97      0.96     54992
```

```
from sklearn.tree import DecisionTreeClassifier, plot_tree
import matplotlib.pyplot as plt



# Plotting the decision tree
plt.figure(figsize=(15, 10))
plot_tree(decision_tree_model, feature_names=X_train.columns, class_names=['Negative', 'Positive'],filled=True, rounde
plt.show()
```



Random Forest:

```
from sklearn.ensemble import RandomForestClassifier
```

```
# Train Random Forest model
random_forest_model = RandomForestClassifier(random_state=42)
random_forest_model.fit(X_train, y_train)
```

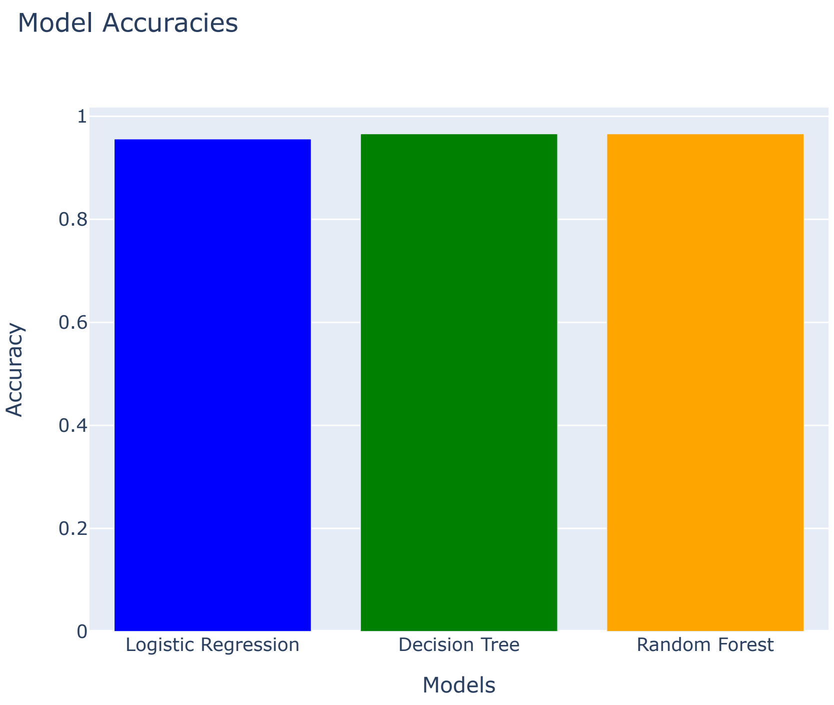
```
▾        RandomForestClassifier
RandomForestClassifier(random_state=42)
```

```
# Make predictions on the test set
y_pred_random_forest = random_forest_model.predict(X_test)
```

```
# Evaluate the model
accuracy_random_forest = accuracy_score(y_test, y_pred_random_forest)
print(f"Random Forest Accuracy: {accuracy_random_forest}")
print(classification_report(y_test, y_pred_random_forest))
```

```
Random Forest Accuracy: 0.9659223159732324
              precision    recall  f1-score   support

           0       0.98      0.99      0.98     52041
           1       0.71      0.61      0.66      2951

    accuracy                           0.97     54992
   macro avg       0.84      0.80      0.82     54992
weighted avg       0.96      0.97      0.96     54992
```

```
import plotly.graph_objects as go

# Replace these values with your actual accuracies and models
accuracies = [0.956, 0.966, 0.966]
models = ['Logistic Regression', 'Decision Tree', 'Random Forest']

# Create a bar chart
fig = go.Figure(data=[go.Bar(x=models, y=accuracies, marker_color=['blue', 'green', 'orange'])])

# Add title and labels
fig.update_layout(title_text='Model Accuracies',
                  xaxis_title='Models',
                  yaxis_title='Accuracy')

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



Decision tree model fit check -overfit/under fit

```
# Train Decision Tree model
decision_tree_model = DecisionTreeClassifier(random_state=42)
decision_tree_model.fit(X_train, y_train)
```

```
from sklearn.metrics import accuracy_score

# Predictions on the training set
y_train_pred = decision_tree_model.predict(X_train)

# Calculate training accuracy
train_accuracy = accuracy_score(y_train, y_train_pred)
print(f"Training Accuracy: {train_accuracy}")
```

```
Training Accuracy: 0.9666263570402429
```

```
# Predictions on the test set
y_test_pred = decision_tree_model.predict(X_test)

# Calculate test accuracy
test_accuracy = accuracy_score(y_test, y_test_pred)
print(f"Test Accuracy: {test_accuracy}")
```

```
Test Accuracy: 0.9658677625836485
```

Compare the training accuracy with the test accuracy.

Our Decision Tree model seems to have similar performance on both the training and test sets, with a training accuracy of approximately 96.66% and a test accuracy of approximately 96.59%. This indicates that your model is not showing signs of overfitting or underfitting, as the accuracies on the training and test sets are close.

Documentation

Project Documentation: Impact on Disease Prediction in Medical Field

Importance in Today's World:

In today's world, where healthcare resources are precious, accurate disease prediction is paramount. The proposed project focuses on predicting COVID-19 infection based on symptoms and other factors. This is particularly important in the current global scenario where infectious diseases can spread rapidly. The ability to identify potential cases early helps in implementing timely preventive measures, reducing the spread, and allocating resources efficiently.

Impact on Medical Field:

Effective Screening:

Accurate prediction models aid in early identification of potential COVID-19 cases.

Early screening allows for prompt isolation and treatment, preventing further transmission.

Resource Optimization:

Healthcare resources, including testing kits and medical personnel, can be utilized more efficiently.
Hospitals can better manage patient influx and allocate resources based on predicted cases.

Reducing Healthcare Burden:

By predicting and isolating potential cases early, the burden on healthcare systems is reduced.
This can prevent overwhelming hospital capacities, ensuring better care for those in need.

Future Implications and Knowledge Gap:

Applicability to Other Diseases:
The methodology developed in this project can serve as a blueprint for predicting other infectious diseases. By adapting the model features and training data, similar approaches can be employed for different health threats. Potential Knowledge Gap:

While the project focuses on COVID-19, there may be a knowledge gap in predicting and managing other emerging diseases. Future research can extend the proposed method to address various infectious diseases, contributing to a comprehensive disease prediction framework. Technological Integration:

As technology advances, integrating more data sources (e.g., wearable devices, environmental factors) can enhance prediction accuracy. The project lays the foundation for incorporating new technologies into disease prediction models.

Conclusion: In conclusion, the proposed project holds significant importance in today's world by offering a practical and effective way to predict and manage infectious diseases. It contributes to the optimization of healthcare resources, efficient screening, and, importantly, serves as a potential model for addressing emerging health challenges in the future.

Double-click (or enter) to edit

Double-click (or enter) to edit