Estimation of COVID19 infection using Machine Learning Algorithms

Abstract

The COVID19 pandemic has affected the world very badly as the number of cases are not declining in any day. The growth and the mutation of virus in a different form has created a lot of concern among the researchers working on it. This project enables the prioritization of test by taking the symptoms from a person and feeding the input data to it which in turn gives an output of estimation of how much the person is infected with COVID19.

Introduction

COVID-19 is a viral infectious disease in which Wuhan was the initial epicenter and the maximum confirmed cases worldwide as of 8 November 2020 were 50,395,239 including 1,258,235 deaths with 35,629,514 recoveries. Coronavirus 2, also known as SARS-CoV-2 Extreme Acute Respiratory Syndrome, is the virus which caused the COVID-19 pandemic. This virus spreads rapidly when the infected person is in close contact. The lower concentrations respiratory droplets when an infected person coughs or sneezes, which may not be visible to the naked eye.

These droplets also may originate from saliva, which can be inhaled through the mouth or nose into a healthy person's lungs, thus spreading the disease from one person to another. If they touch their eyes, nose or mouth after they touch any contaminated objects, people may also get sick. The longevity of the virus is more on stainless-steel and plastic surfaces that are 72 hours, but the lifespan of this contagious virus is low on copper and cardboard. Tiredness, fever, and dry cough with moderate signs of runny nose, sore throat, pain and aches, and nasal congestion are the basic symptoms of the disease.

Old people with high blood pressure, heart attacks and diabetes have a serious risk of COVID-19 infection. The World Health Organization (WHO) suggests that everyone maintain a social distance of around 3 feet, as it will prevent droplets from being inhaled, wash their hands with soap and water for at least 20 seconds, as it will kill the virus, and also avoid touching their mouths. Aggregated data on the symptoms of other infected patients would play an enormous role in this study in order to speed up the early detection of COVID-19 infected individuals.

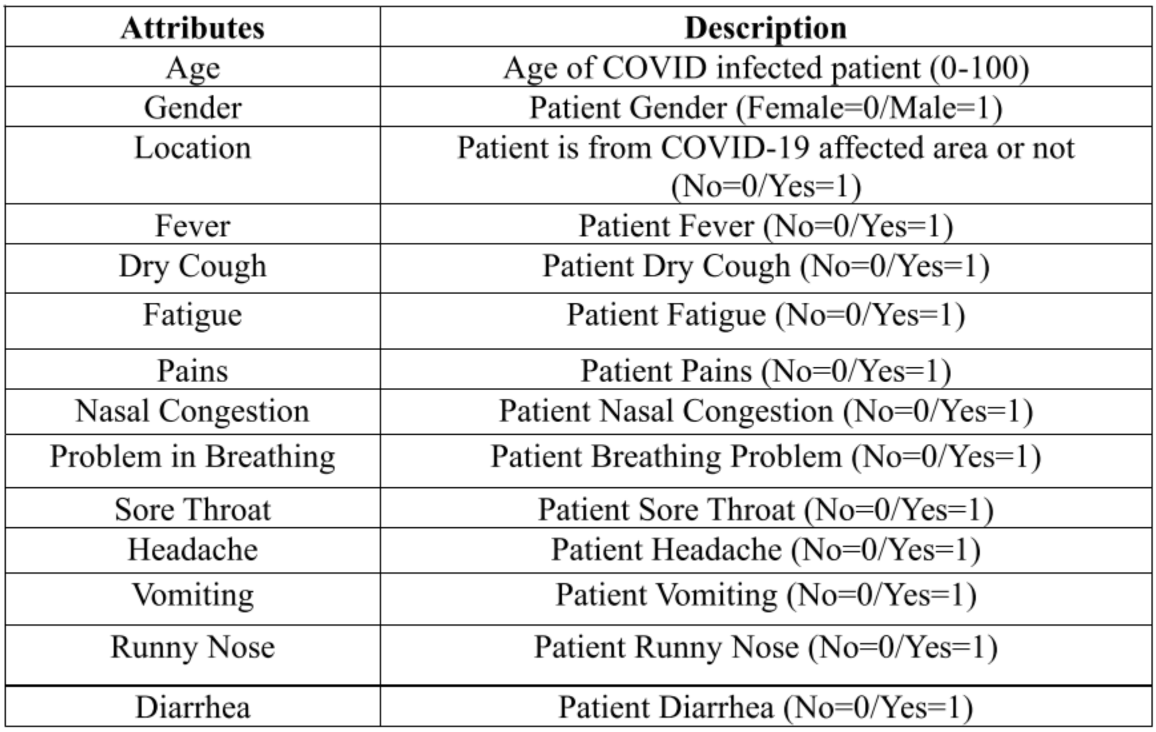
To identify a person with COVID-19, this paper focuses primarily on the symptoms as discussed above. After that, by applying various machine learning algorithms, we tried to estimate the likelihood of getting infected with the disease. We have developed a machine learning (ML) model for this analysis that uses Random Forest Classification to figure out the likelihood of a person getting COVID-19 infected based on his or her symptoms.

Motivation

In the early months of this year, COVID 19 was discovered. It's been months, but not a single vaccine or cure to this lethal virus has been available yet. If we can even identify the disease beforehand during these tough times, it might allow a person to contact medical officials in time and diagnose and obtain care in time.

Dataset

Table 1: Description about the attributes of COVID-19 Symptoms dataset.

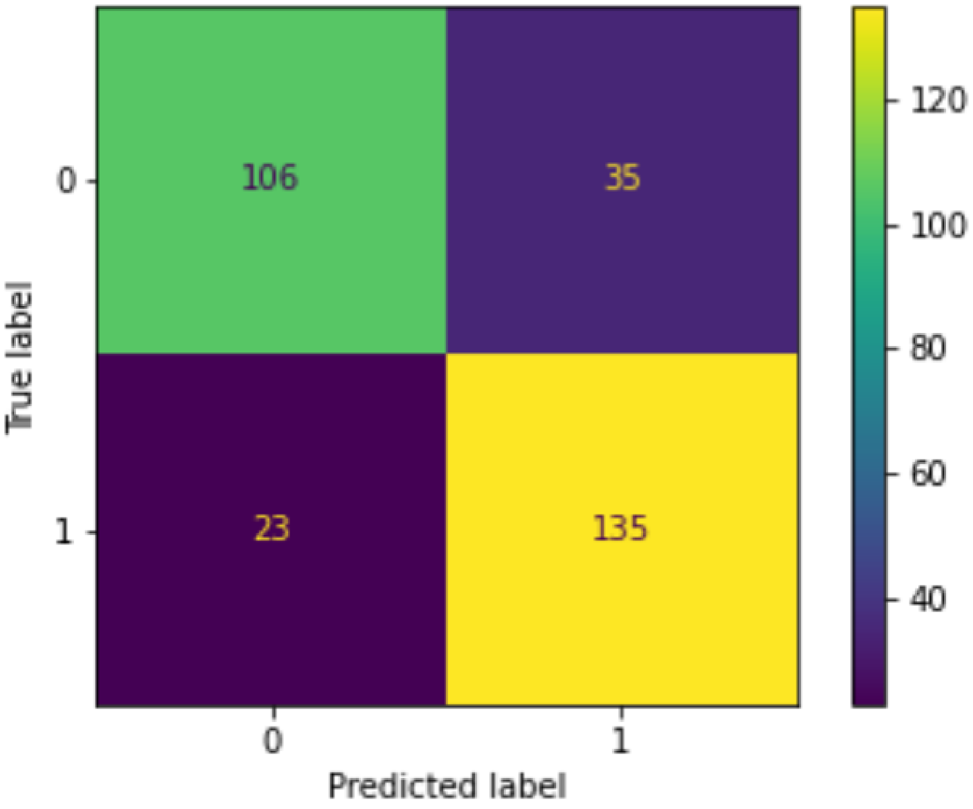


Attributes	Description
Age	Age of COVID infected patient (0-100)
Gender	Patient Gender (Female=0/Male=1)
Location	Patient is from COVID-19 affected area or not (No=0/Yes=1)
Fever	Patient Fever (No=0/Yes=1)
Dry Cough	Patient Dry Cough (No=0/Yes=1)
Fatigue	Patient Fatigue (No=0/Yes=1)
Pains	Patient Pains (No=0/Yes=1)
Nasal Congestion	Patient Nasal Congestion (No=0/Yes=1)
Problem in Breathing	Patient Breathing Problem (No=0/Yes=1)
Sore Throat	Patient Sore Throat (No=0/Yes=1)
Headache	Patient Headache (No=0/Yes=1)
Vomiting	Patient Vomiting (No=0/Yes=1)
Runny Nose	Patient Runny Nose (No=0/Yes=1)
Diarrhea	Patient Diarrhea (No=0/Yes=1)

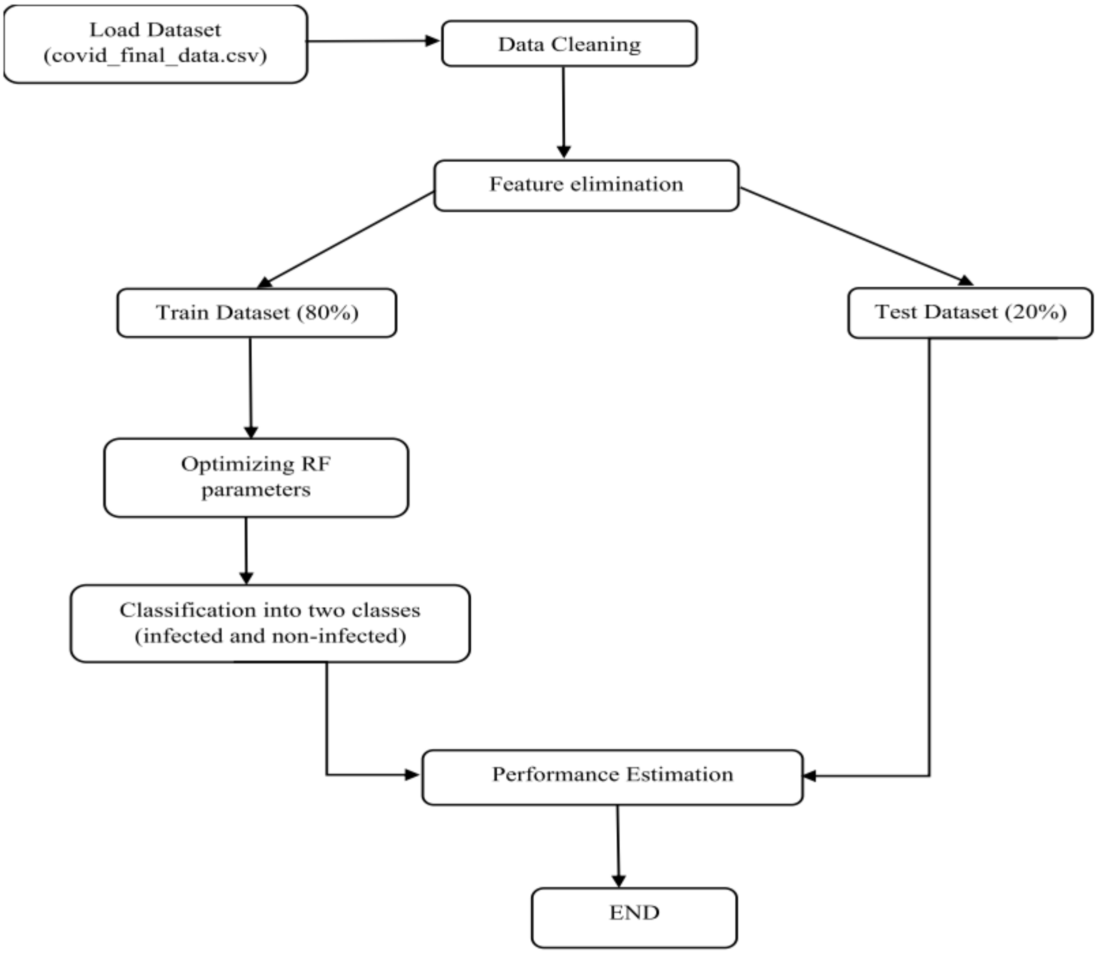
The dataset provides information about patient's symptoms and whether they are infected with COVID-19 or not. Considering all these details in both the dataset, another reliable dataset is created to maximize the data quality which consists of a total 14 columns with 13 independent variables and one dependent variable. It has 1495 rows. The dataset consists of 14 attributes out of which 11 are the patient's symptoms. As the output of this model will give whether the patient is infected or not with COVID-19, i.e. Yes or No. So, this problem is treated as Binary Classification.

Methodology

First of all, the COVID-19 Symptoms dataset is uploaded and the attributes are separated into independent and dependent variables, then the dataset is split into two parts - one being the train data and the other being the test data by which we can predict. The former being the larger part we process it through different machine learning algorithms to get the best possible output, and we observe that by using the Random Forest Classifier algorithm we get the best possible accuracy. The performance of Random Forest Classifier was the highest as compared to other algorithms. The output variable is the target variable and all the other attributes of the symptoms and individual's necessary details are fed into it and the desired result is shown. The confusion matrix for Random Forest Classifier is shown below in the below figure.



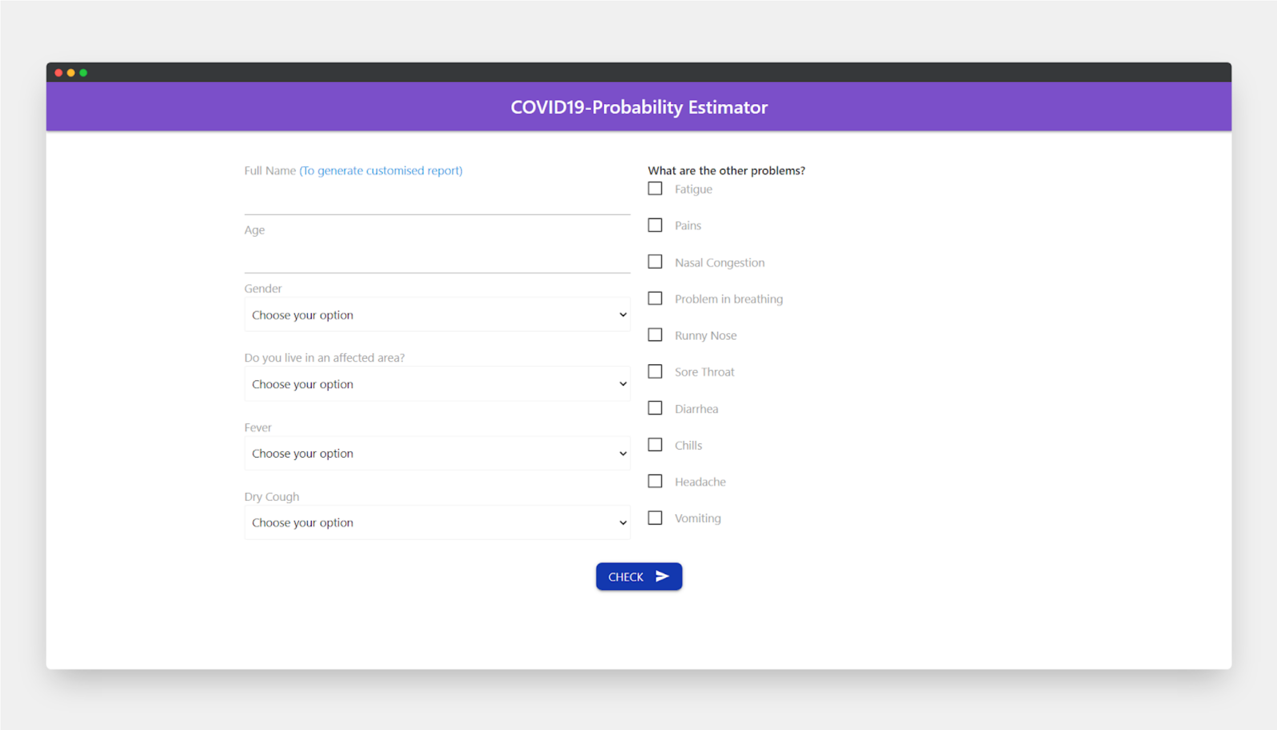
After the training of the model is complete, then the later dataset can be used for predicting the presence of COVID 19 in a particular individual. The Covid Output is the final result that we need to predict from our study. After the application of different machine learning algorithms, we construct a model that can be used to predict the patient's final Covid Output. For the last step, the test dataset is validated with the dataset that is trained and thereby calculating the rate of accuracy. The complete process is shown below.



Technological Stack

- Sklearn - Machine Learning Library
- Pandas - Data Manipulation Library
- Numpy - Numerical Computation Library
- Django - Python web framework
- HTML
- Material CSS

Demo



COVID19-Probability Estimator

Full Name (To generate customised report)

Age

Gender

Choose your option

Do you live in an affected area?

Choose your option

Fever

Choose your option

Dry Cough

Choose your option

What are the other problems?

□ Fatigue

□ Pains

□ Nasal Congestion

□ Problem in breathing

□ Runny Nose

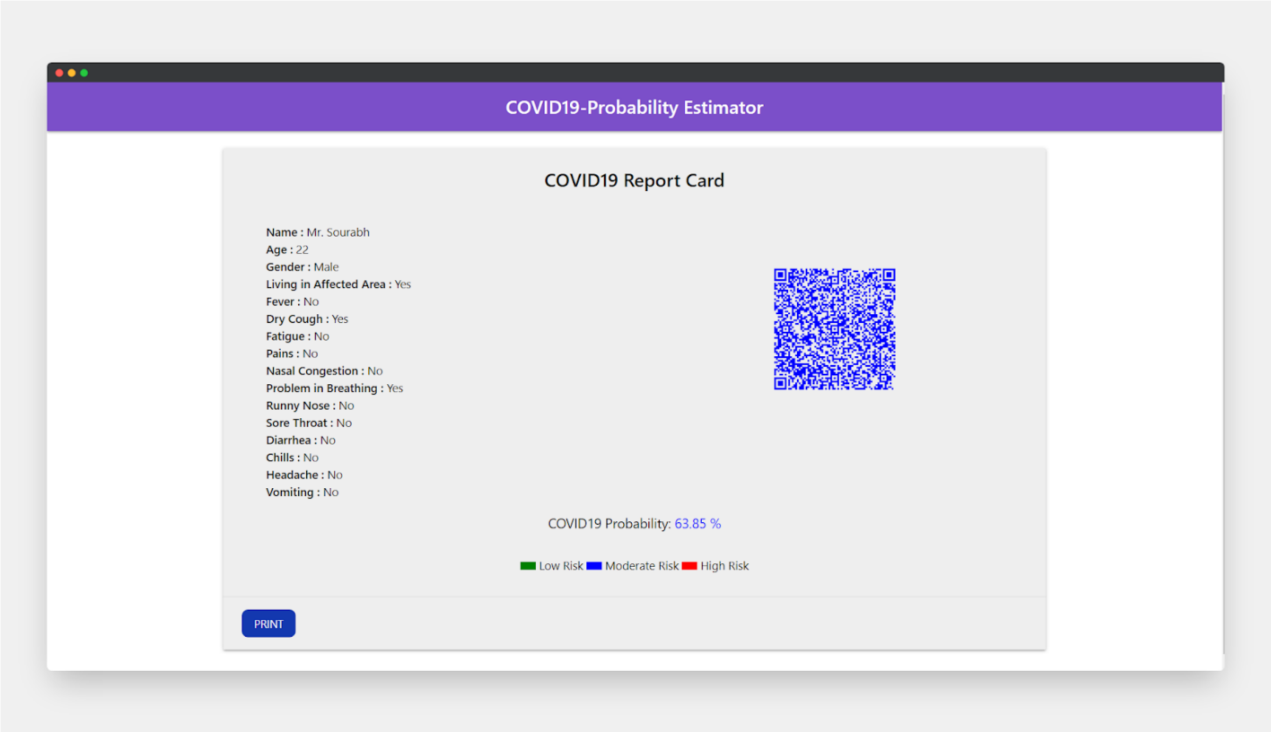
□ Sore Throat

□ Diarrhea

□ Chills

□ Headache

□ Vomiting



COVID19-Probability Estimator

COVID19 Report Card

Name : Mr. Sourabh
Age : 22
Gender : Male
Living in Affected Area : Yes
Fever : No
Dry Cough : Yes
Fatigue : No
Pains : No
Nasal Congestion : No
Problem in Breathing : Yes
Runny Nose : No
Sore Throat : No
Diarrhea : No
Chills : No
Headache : No
Vomiting : No

COVID19 Probability: 63.85 %

🟩 Low Risk 🟦 Moderate Risk 🟥 High Risk

Source Code

requirements.txt

```
alabaster==0.7.12
```

```
altgraph==0.16.1
appdirs==1.4.3
appmode==0.7.0
asgiref==3.2.7
astroid==2.3.3
atomicwrites==1.3.0
attrs==19.3.0
auto-py-to-exe==2.6.5
Automat==20.2.0
autopep8==1.5.1
Babel==2.8.0
backcall==0.1.0
bcrypt==3.1.7
beautifulsoup4==4.8.2
biopython==1.76
bleach==3.1.3
boto3==1.12.31
botocore==1.15.31
bottle==0.12.17
bottle-websocket==0.2.9
bs4==0.0.1
cachetools==4.0.0
certifi==2019.9.11
cffi==1.12.3
chardet==3.0.4
Click==7.0
cloudpickle==1.3.0
```

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colorama==0.4.3
constantly==15.1.0
cryptography==2.9
cssselect==1.1.0
cycler==0.10.0
decorator==4.4.2
defusedxml==0.6.0
detectlanguage==1.3.0
diff-match-patch==20181111
distlib==0.3.0
dj-database-url==0.5.0
Django==3.0.5
django-heroku==0.3.1
django-qr-code==1.1.0
docutils==0.15.2
Eel==0.10.4
entrypoints==0.3
et-xmlfile==1.0.1
filelock==3.0.12
flake8==3.7.9
Flask==1.1.1
future==0.17.1
gensim==3.8.1
gevent==1.4.0
gevent-websocket==0.10.1
google-api-core==1.16.0
google-auth==1.12.0
```

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google-cloud-core==1.3.0
google-cloud-storage==1.26.0
google-resumable-media==0.5.0
googleapis-common-protos==1.51.0
greenlet==0.4.15
helpdev==0.6.10
hyperlink==19.0.0
idna==2.8
imagesize==1.2.0
importlib-metadata==1.5.0
incremental==17.5.0
intervaltree==3.0.2
ipykernel==5.1.4
ipython==7.13.0
ipython-genutils==0.2.0
isort==4.3.21
itsdangerous==1.1.0
jdcal==1.4.1
jedi==0.15.2
Jinja2==2.11.1
jmespath==0.9.5
joblib==0.14.1
jsonschema==3.2.0
jupyter-client==6.1.0
jupyter-core==4.6.3
keyring==21.2.0
kiwisolver==1.1.0
```

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lxml==4.5.0
MarkupSafe==1.1.1
matplotlib==3.2.1
mccabe==0.6.1
mistune==0.8.4
nbconvert==5.6.1
nbformat==5.0.4
nltk==3.4.5
notebook==6.0.3
numpy==1.17.2
numpydoc==0.9.2
openpyxl==3.0.0
packaging==20.3
pandas==0.25.1
pandocfilters==1.4.2
paramiko==2.7.1
parsel==1.5.2
parso==0.5.2
pathtools==0.1.2
pefile==2019.4.18
pexpect==4.8.0
pickleshare==0.7.5
Pillow==7.1.1
pipenv==2018.11.26
pluggy==0.13.1
prometheus-client==0.7.1
```

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prompt-toolkit==3.0.4
Protego==0.1.16
protobuf==3.11.3
psutil==5.7.0
psycopg2==2.8.5
ptyprocess==0.6.0
pyasn1==0.4.8
pyasn1-modules==0.2.8
pycodestyle==2.5.0
pycparser==2.19
PyDispatcher==2.0.5
pydocstyle==5.0.2
pyflakes==2.2.0
Pygments==2.6.1
PyHamcrest==2.0.2
PyInstaller==3.5
pylint==2.4.4
PyNaCl==1.3.0
pyOpenSSL==19.1.0
pyparsing==2.4.6
PyPDF2==1.26.0
PyQt5==5.12.2
PyQt5-sip==4.19.19
pyqt5-tools==5.13.0.1.5
PyQtWebEngine==5.12.1
pyrsistent==0.15.7
python-dateutil==2.8.0
```

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python-dotenv==0.10.3
python-jsonrpc-server==0.3.4
python-language-server==0.31.9
pytz==2019.2
pywin32==225
pywin32-ctypes==0.2.0
pywinpty==0.5.7
pyzmq==19.0.0
QDarkStyle==2.8.1
qrcode==6.1
QtAwesome==0.7.0
qtconsole==4.7.2
QtPy==1.9.0
queuelib==1.5.0
requests==2.22.0
rope==0.16.0
rsa==4.0
s3transfer==0.3.3
scikit-learn==0.22.2.post1
scipy==1.4.1
Scrapy==2.0.1
selenium==3.141.0
Send2Trash==1.5.0
service-identity==18.1.0
six==1.12.0
sklearn==0.0
smart-open==1.10.0
```

```
snowballstemmer==2.0.0
sortedcontainers==2.1.0
soupsieve==2.0
Sphinx==3.0.1
sphinxcontrib-applehelp==1.0.2
sphinxcontrib-devhelp==1.0.2
sphinxcontrib-htmlhelp==1.0.3
sphinxcontrib-jsmath==1.0.1
sphinxcontrib-qthelp==1.0.3
sphinxcontrib-serializinghtml==1.1.4
spyder==4.1.2
spyder-kernels==1.9.0
sqlparse==0.3.1
terminado==0.8.3
testpath==0.4.4
tornado==6.0.4
traitlets==4.3.3
Twisted==20.3.0
typed-ast==1.4.1
urllib3==1.25.6
vaderSentiment==3.3.1
virtualenv==20.0.15
virtualenv-clone==0.5.4
w3lib==1.21.0
watchdog==0.10.2
wcwidth==0.1.8
webencodings==0.5.1
```

```
Werkzeug==1.0.0
whichcraft==0.6.1
whitenoise==5.0.1
wrapt==1.11.2
xgboost==1.0.2
xlrd==1.2.0
xlwt==1.3.0
yapf==0.29.0
zipp==3.1.0
zope.interface==5.0.2
```

manage.py

```
#!/usr/bin/env python
"""Django's command-line utility for administrative tasks."""
import os
import sys


def main():
    os.environ.setdefault('DJANGO_SETTINGS_MODULE',
'covidpred.settings')
    try:
        from django.core.management import execute_from_command_line
    except ImportError as exc:
        raise ImportError(
            "Couldn't import Django. Are you sure it's installed and "
            "available on your PYTHONPATH environment variable? Did you "
            "forget to activate a virtual environment?"
        ) from exc
    execute_from_command_line(sys.argv)



if __name__ == '__main__':
    main()
```

base.html

```
<!DOCTYPE html>
{% load static %}
<html>
<head>


  <title> COVID19-Probability</title>
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <link rel="shortcut icon" href="{% static 'img/icon.png' %}">
  <link href="https://fonts.googleapis.com/icon?family=Material+Icons"
rel="stylesheet">
  <link rel="stylesheet" href="{% static 'styles/materialize.min.css' %}">
</head>
<header>
                      <nav style="background-color:#7b4fc9;">
    <div class="nav-wrapper">
      <a class="brand-logo center"
      href="{% url 'index' %}"
      style="font-size:24px;font-weight: 599;">COVID19-Probability
Estimator</a>


    </div>
  </nav>
</header>
<style>
  label{
    font-size: 15px;
  }
</style>
<body>

          {% block content %}

  {% endblock %}

</body>
</html>
```

index.html

```
{% extends 'base.html' %}

{% block content %}

   <div class="container" style="padding:40px 15px 0px 15px">


      <div>
        <form class="row" method="POST" action="{% url 'index' %}">
          {% csrf_token %}
          <div class="col m6 s12">
      <div >
        <label for="full_name">Full Name<a class="tooltipped"
name="full_name" data-position="right" data-tooltip="I am a tooltip"> (To
generate
          customised report)</a>
          </label>
        <input
          type="text"
          id="full_name"
          name="full_name"

        />
      </div>
      <div>
        <label for="age">Age</label>
        <input
          type="number"
          step="1"
          class="form-control"
          id="age"
          min=1 max=150
          name="age" required
        />
      </div>
      <div class="form-control">
        <label for="gender">Gender</label>
        <select name="gender" class="browser-default" required>
          <option value="" disabled selected>Choose your option</option>
          <option value="0">Female</option>
          <option value="1">Male</option>
        </select>
      </div><br>
      <div>
        <label for="cough">Do you live in an affected area?</label>
        <select name="lives_in_affected_area" required class="browser-default">
          <option value="" disabled selected>Choose your option</option>
          <option value="1">Yes</option>
          <option value="0">No</option>
        </select>
      </div><br>
      <div>
        <label for="fever">Fever</label>
        <select name="fever" required class="browser-default">
          <option value="" disabled selected>Choose your option</option>
          <option value="1">Yes</option>
          <option value="0">No</option>
        </select>
      </div><br>
      <div>
        <label for="cough">Dry Cough</label>
        <select name="cough" required class="browser-default">
          <option value="" disabled selected>Choose your option</option>
          <option value="1">Yes</option>
          <option value="0">No</option>
        </select>
```

```
          </div>
        </div>


        <div class="col m6 s12" >
          <strong>What are the other problems?</strong><br>
          <div>
            <label>
              <input id="indeterminate-checkbox fatigue" name="fatigue"
type="checkbox" />
              <span>Fatigue</span>
            </label>
          </div>
           <br>
          <div>
            <label>
              <input id="indeterminate-checkbox pains" name="pains"
type="checkbox" />
              <span>Pains</span>
            </label>
          </div> <br>
          <div>
            <label>
              <input id="indeterminate-checkbox nasal_congestion"
name="nasal_congestion"  type="checkbox" />
              <span>Nasal Congestion</span>
            </label>
          </div> <br>
          <div>
            <label>
              <input id="indeterminate-checkbox shortness_of_breath" name="shortness_of_breath"  type="checkbox" />
              <span>Problem in breathing</span>
            </label>
          </div> <br>
          <div>
            <label>
              <input id="indeterminate-checkbox runny_nose" name="runny_nose" type="checkbox" />
              <span>Runny Nose</span>
            </label>
          </div> <br>
          <div>
            <label>
              <input id="indeterminate-checkbox sore_throat" name="sore_throat" type="checkbox" />
              <span>Sore Throat</span>
            </label>
          </div> <br>
          <div>
            <label>
              <input id="indeterminate-checkbox diarrhea" name="diarrhea" type="checkbox" />
              <span>Diarrhea</span>
            </label>
          </div> <br>
          <div>
            <label>
```

```
              <input id="indeterminate-checkbox chills" name="chills" type="checkbox" />
              <span>Chills</span>
            </label>
          </div> <br>
          <div>
            <label>
              <input id="indeterminate-checkbox headache" name="headache" type="checkbox" />
              <span>Headache</span>
            </label>
          </div> <br>
          <div>
            <label>
              <input id="indeterminate-checkbox vomiting" name="vomiting" type="checkbox" />
              <span>Vomiting</span>
            </label>
          </div><br>
                <br>
        </div>


        <center>


          <button type="submit" class="btn" style="background-color: #1338af;border-radius: 8px;">
            Check<i class="material-icons right">send</i>
          </button>
```

```
     </center>
    </form>
   </div>
  </div>

{% endblock %}
```

result.html

```
{% extends 'base.html' %}

{% block content %}

{% load qr_code %}
<style>
 .card_data{
  padding:10px 0px 0px 20px!important;
 }
</style>

 <!-- Result Block -->
 <div class="container" style="padding: 15px 0px 0px 0px;">
  <div class="row">
    <div class="card grey lighten-3">
     <div class="card-content black-text ">
      <center><span class="card-title" style="font-weight: 500;">COVID19 Report Card</span></center>
      <br>
      <div class="row card_data">
```

```
          <div class="col m6 l6 xl6" style="text-align: justify;">{% for key,value in user_details_API.items %}
           <span style="font-weight: 500;">{{key}} : </span>
           <span>{{value}}</span><br>
          {% endfor %}
        </div>
          <div class="col m6 l6 xl6 center-align" style="margin-top: 50px;">
            {% qr_from_text user_json_data size="T" %}
          </div>
        </div>
        <center>
          {% if result %}
          <h6 class="Probability">COVID19 Probability: <span class="probability-value">{{ result }} %</span></h6>
          {%else%}
          <h6 class="Probability">COVID19 Probability: <span class="probability-value">0%</span></h6>
          {% endif %}<br>


          <div style="padding:5px 0px 5px 0px">
            <svg width="20" height="10">
              <rect width="36" height="18" style="fill:green"/><span> Low Risk</span>
            </svg>
            <svg width="20" height="10">
              <rect width="36" height="18" style="fill:blue"/><span> Moderate Risk</span>
            </svg>
            <svg width="20" height="10">
```

```
                  <rect width="36" height="18" style="fill:red"/><span> High Risk</span>
                </svg>
              </div>
            </center>
          </div>
          <div class="card-action">
            <a href="#" class="btn-flat" style="color:white;background-color: #1338af;border-radius: 8px;" id="print-btn" onclick="printDiv()">Print</a>
          </div>
        </div>
    </div>
  </div>

  <script type="text/javascript">
    function printDiv() {
    var printContents = document.querySelector('.card-content').innerHTML;
    var originalContents = document.body.innerHTML;
     document.body.innerHTML = `
     <div style="padding:50px 10px 10px 20px;border: solid 5px #000">
     ${printContents}
     </div>
     `;
     window.print();
     window.close()
     document.body.innerHTML = originalContents;
    }
    let val = document.querySelector('.probability-value')
    // Low, Mild, Moderate, Severe
    if(parseFloat(val.textContent)<=40){
      val.style.color="green"
      document.querySelector('path').style.fill="green"
    }

    else if(parseFloat(val.textContent)>40 && parseFloat(val.textContent)
<=75){
      val.style.color="blue"
      document.querySelector('path').style.fill="blue"
    }
    else {
      val.style.color="red"
      document.querySelector('path').style.fill="red"
    }
</script>
{% endblock %}
```

settings.py (Config)

```
"""
Django settings for covidpred project.

Generated by 'django-admin startproject' using Django 3.0.5.

For more information on this file, see
https://docs.djangoproject.com/en/3.0/topics/settings/

For the full list of settings and their values, see
```

```
https://docs.djangoproject.com/en/3.0/ref/settings/
"""

import os

# Build paths inside the project like this: os.path.join(BASE_DIR, ...)
BASE_DIR = os.path.dirname(os.path.dirname(os.path.abspath(__file__)))



# Quick-start development settings - unsuitable for production
# See https://docs.djangoproject.com/en/3.0/howto/deployment/checklist/

# SECURITY WARNING: keep the secret key used in production secret!
SECRET_KEY = 'ff45r5bt$3e%ztoo$x%b=v*$-z#elm#)&b@%2(k2w3(tt=f4l7'

# SECURITY WARNING: don't run with debug turned on in production!
DEBUG = True

ALLOWED_HOSTS = ['192.168.43.132','127.0.0.1']

STATICFILES_DIRS=[
    os.path.join(BASE_DIR, 'static')

]

# Application definition
```

```
INSTALLED_APPS = [
    'django.contrib.admin',
    'django.contrib.auth',
    'django.contrib.contenttypes',
    'django.contrib.sessions',
    'django.contrib.messages',
    'django.contrib.staticfiles',
    'qr_code',
    'covid'
]

MIDDLEWARE = [
    'django.middleware.security.SecurityMiddleware',
    'django.contrib.sessions.middleware.SessionMiddleware',
    'django.middleware.common.CommonMiddleware',
    'django.middleware.csrf.CsrfViewMiddleware',
    'django.contrib.auth.middleware.AuthenticationMiddleware',
    'django.contrib.messages.middleware.MessageMiddleware',
    'django.middleware.clickjacking.XFrameOptionsMiddleware',
]

ROOT_URLCONF = 'covidpred.urls'

TEMPLATES = [
    {
        'BACKEND': 'django.template.backends.django.DjangoTemplates',
        'DIRS': [os.path.join(BASE_DIR,'templates')],
        'APP_DIRS': True,
        'OPTIONS': {
            'context_processors': [
                'django.template.context_processors.debug',
                'django.template.context_processors.request',
                'django.contrib.auth.context_processors.auth',
                'django.contrib.messages.context_processors.messages',
            ],
        },
    },
]

WSGI_APPLICATION = 'covidpred.wsgi.application'



# Password validation
# https://docs.djangoproject.com/en/3.0/ref/settings/#auth-password-validators

AUTH_PASSWORD_VALIDATORS = [
    {
        'NAME':
'django.contrib.auth.password_validation.UserAttributeSimilarityValidator',
    },
    {
        'NAME':
'django.contrib.auth.password_validation.MinimumLengthValidator',
    },
    {
        'NAME':
'django.contrib.auth.password_validation.CommonPasswordValidator',
    },
    {
        'NAME':
'django.contrib.auth.password_validation.NumericPasswordValidator',
    },
]


# Internationalization
# https://docs.djangoproject.com/en/3.0/topics/i18n/

LANGUAGE_CODE = 'en-us'

TIME_ZONE = 'UTC'

USE_I18N = True

USE_L10N = True

USE_TZ = True


# Static files (CSS, JavaScript, Images)
# https://docs.djangoproject.com/en/3.0/howto/static-files/

STATIC_URL = '/static/'
```

asgi.py

```
"""
ASGI config for covidpred project.

It exposes the ASGI callable as a module-level variable named ``application``.

For more information on this file, see
https://docs.djangoproject.com/en/3.0/howto/deployment/asgi/
"""

import os

from django.core.asgi import get_asgi_application

os.environ.setdefault('DJANGO_SETTINGS_MODULE', 'covidpred.settings')

application = get_asgi_application()
```

urls.py

```
"""covidpred URL Configuration

The `urlpatterns` list routes URLs to views. For more information please see:
    https://docs.djangoproject.com/en/3.0/topics/http/urls/
Examples:
Function views
    1. Add an import:  from my_app import views
    2. Add a URL to urlpatterns:  path('', views.home, name='home')
```

```
Class-based views
    1. Add an import:  from other_app.views import Home
    2. Add a URL to urlpatterns:  path('', Home.as_view(), name='home')
Including another URLconf
    1. Import the include() function: from django.urls import include, path
    2. Add a URL to urlpatterns:  path('blog/', include('blog.urls'))
"""
from django.contrib import admin
from django.urls import path
from django.urls import path, include
from django.conf.urls import url
from django.conf import settings

urlpatterns = [
          path('', include('covid.urls')),
          path('result', include('covid.urls')),
    path('admin/', admin.site.urls),
]
```

wsgi.py

```
"""
WSGI config for covidpred project.

It exposes the WSGI callable as a module-level variable named ``application``.

For more information on this file, see
https://docs.djangoproject.com/en/3.0/howto/deployment/wsgi/
"""
```

```
import os


from django.core.wsgi import get_wsgi_application


os.environ.setdefault('DJANGO_SETTINGS_MODULE', 'covidpred.settings')


application = get_wsgi_application()
```

apps.py

```
from django.apps import AppConfig



class CovidConfig(AppConfig):
    name = 'covid'
```

models.py

```
from django.db import models
from django.contrib.auth.models import User
from django.core.validators import MaxValueValidator,MinValueValidator
# Create your models here.
class Coviddata(models.Model):
    age= models.IntegerField(validators=[MinValueValidator(0),
MaxValueValidator(1)])
    gender= models.IntegerField(validators=[MinValueValidator(0),
MaxValueValidator(1)])
    fever= models.IntegerField(validators=[MinValueValidator(0),
MaxValueValidator(1)])
    cough= models.IntegerField(validators=[MinValueValidator(0),
MaxValueValidator(1)])
```

```
    fatigue= models.IntegerField(validators=[MinValueValidator(0),
MaxValueValidator(1)])

    pains= models.IntegerField(validators=[MinValueValidator(0),
MaxValueValidator(1)])

    nasal_congestion= models.IntegerField(validators=[MinValueValidator(0),
MaxValueValidator(1)])

    shortness_of_breath=
models.IntegerField(validators=[MinValueValidator(0),
MaxValueValidator(1)])

    runny_nose= models.IntegerField(validators=[MinValueValidator(0),
MaxValueValidator(1)])

    sore_throat= models.IntegerField(validators=[MinValueValidator(0),
MaxValueValidator(1)])

    diarrhea= models.IntegerField(validators=[MinValueValidator(0),
MaxValueValidator(1)])

    chills= models.IntegerField(validators=[MinValueValidator(0),
MaxValueValidator(1)])

    headache= models.IntegerField(validators=[MinValueValidator(0),
MaxValueValidator(1)])

    vomiting= models.IntegerField(validators=[MinValueValidator(0),
MaxValueValidator(1)])

    lives_in_affected_area=
models.IntegerField(validators=[MinValueValidator(0),
MaxValueValidator(1)])

    result= models.FloatField()

    created_at = models.DateTimeField(auto_now_add=True)
```

urls.py

```
from django.urls import path


from . import views
```

```
urlpatterns=[
        path('',views.index,name='index'),
        path('result',views.index,name='result'),

]
```

views.py

```
from django.shortcuts import render
from .models import Coviddata
import pickle
import numpy as np
import pandas as pd

import json
def index(request):

    if request.method == 'POST':
        full_name = request.POST['full_name']
        age = request.POST['age']
        gender = request.POST['gender']
        fever = request.POST['fever']
        cough = request.POST['cough']

        fatigue = request.POST.get('fatigue')
        fatigue = 1 if fatigue else 0
        pains = request.POST.get('pains')
        pains = 1 if pains else 0
```

```
nasal_congestion = request.POST.get('nasal_congestion')
nasal_congestion = 1 if nasal_congestion else 0
shortness_of_breath = request.POST.get('shortness_of_breath')
shortness_of_breath = 1 if shortness_of_breath else 0
runny_nose = request.POST.get('runny_nose')
runny_nose = 1 if runny_nose else 0
sore_throat = request.POST.get('sore_throat')
sore_throat = 1 if sore_throat else 0
diarrhea = request.POST.get('diarrhea')
diarrhea = 1 if diarrhea else 0
chills = request.POST.get('chills')
chills = 1 if chills else 0
headache =request.POST.get('headache')
headache = 1 if headache else 0
vomiting = request.POST.get('vomiting')
vomiting = 1 if vomiting else 0
lives_in_affected_area = request.POST['lives_in_affected_area']
file = open("model.pkl", "rb")
classifier = pickle.load(file)
file.close()
user_data = np.array(
    (age,
     gender,
     lives_in_affected_area,
     fever,
     cough,
     fatigue,
     pains,
     nasal_congestion,
     shortness_of_breath,
     runny_nose,
     sore_throat,
     diarrhea,
     chills,
     headache,
     vomiting
     )
).reshape(1, 15) # 1 row and 15 cols.

result = classifier.predict_proba(user_data)
result=round(result[0][1]*100,2)
print(f"Result: {result}")



age = int(user_data[0][0])
gender = 'Male' if int(user_data[0][1]) else 'Female'
lives_in_affected_area ='Yes' if int(user_data[0][2]) else 'No'
fever ='Yes' if int(user_data[0][3]) else 'No'
cough ='Yes' if int(user_data[0][4]) else 'No'
fatigue ='Yes' if int(user_data[0][5]) else 'No'
pains = 'Yes' if int(user_data[0][6]) else 'No'
nasal_congestion='Yes' if int(user_data[0][7]) else 'No'
shortness_of_breath = 'Yes' if int(user_data[0][8]) else 'No'
runny_nose = 'Yes' if int(user_data[0][9]) else 'No'
```

```
        sore_throat = 'Yes' if int(user_data[0][10]) else 'No'
        diarrhea = 'Yes' if int(user_data[0][11]) else 'No'
        chills = 'Yes' if int(user_data[0][12]) else 'No'
        headache = 'Yes' if int(user_data[0][13]) else 'No'
        vomiting = 'Yes' if int(user_data[0][14]) else 'No'

        user_details_API = {
            'Name':full_name,
            'Age':age,
            'Gender':gender,
            'Living in Affected Area':lives_in_affected_area,
            'Fever':fever,
            'Dry Cough':cough,
            'Fatigue':fatigue,
            'Pains':pains,
            'Nasal Congestion':nasal_congestion,
            'Problem in Breathing':shortness_of_breath,
            'Runny Nose':runny_nose,
            'Sore Throat':sore_throat,
            'Diarrhea':diarrhea,
            'Chills':chills,
            'Headache':headache,
            'Vomiting':vomiting
        }

        return
render(request,"result.html",{'result':result,'user_details_API':user_details_API,
                'user_json_data':json.dumps(user_details_API)})
```

```
    else:
        return render(request,"index.html")
```

Notebook.ipynb

```
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    "### Importing the packages"
   ]
  },
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   "metadata": {},
   "outputs": [],
   "source": [
    "import numpy as np\n",
    "import pandas as pd\n",
    "import matplotlib.pyplot as plt\n",
    "from sklearn.metrics import accuracy_score,plot_roc_curve\n",
    "%matplotlib inline\n",
    "import warnings\n",
    "warnings.simplefilter('ignore')\n",
    "from sklearn.linear_model import LogisticRegression\n",
    "from sklearn.ensemble import RandomForestClassifier\n",
    "from sklearn.tree import DecisionTreeClassifier\n",
    "from sklearn.naive_bayes import GaussianNB\n",
    "from sklearn.svm import LinearSVC\n"
   ]
  },
  {
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   ]
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   "source": [
    "#Reading the DataSet\n",
    "df = pd.read_csv('covid_final_data.csv')"
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   "cell_type": "markdown",
   "metadata": {},
   "source": [
    "### Dataset Attributes\n"
  ]
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      "       'NASAL_CONGESTION', 'SHORTNESS_OF_BREATH', 'RUNNY_NOSE', 'SORE THROAT',\n",
      "       'DIARRHEA', 'CHILLS', 'HEADACHE', 'VOMITING', 'LIVES_IN_AFFECTED_AREA',\n",
      "       'COVID_OUTPUT'],\n",
      "      dtype='object')"
     ]
    },
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   }
  ],
  "source": [
   "df.columns"
  ]
```

````
},
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  "**Patient's Attribute**\n",
  "\n",
  "```\n",
  "1. Age: Patient's Age\n",
  "2. Gender: Male(1) or Female (0)\n",
  "3. Fever: Yes(1) or No(0)\n",
  "4. Cough: Yes(1) or No(0)\n",
  "5. Fatigue: Yes(1) or No(0)\n",
  "6. Pains: Yes(1) or No(0)\n",
  "7. Nasal Congestion: Yes(1) or No(0)\n",
  "8. Shortness of Breath: Yes(1) or No(0)\n",
  "9. Runny Nose: Yes(1) or No(0)\n",
  "10. Sore Throat: Yes(1) or No(0)\n",
  "11. Diarrhea: Yes(1) or No(0)\n",
  "12. Chills: Yes(1) or No(0)\n",
  "13. Headache: Yes(1) or No(0)\n",
  "14. Vomiting: Yes(1) or No(0)\n",
  "15. Lives in affected area: Yes(1) or No(0)\n",
  "--------------------------------------------\n",
  "16. Covid Output: Yes(1) or No(0)\n",
  "```"
 ]
````

```
},
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     "    }\n",
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"      <th>PAINS</th>\n",
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"      <th>RUNNY_NOSE</th>\n",
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     "  </tbody>\n",
     "</table>\n",
     "</div>"
    ],
    "text/plain": [
     "   AGE  GENDER  FEVER  COUGH  FATIGUE  PAINS
NASAL_CONGESTION  \\\n",
     "0   19      0      1      1       0      0                 0  \n",
"1  28    1    1    0     0    0          0  \n",
"2  35    0    1    1     0    0          0  \n",
"3  33    0    1    0     0    0          0  \n",
"4  33    0    1    0     0    0          0  \n",
"5  87    0    1    0     1    0          0  \n",
"6  55    0    1    0     0    0          0  \n",
"7  60    0    1    0     0    0          0  \n",
"8  66    1    1    1     1    0          0  \n",
"9  57    1    1    0     0    0          0  \n",
"\n",
"   SHORTNESS_OF_BREATH  RUNNY_NOSE  SORE THROAT  DIARRHEA  CHILLS  HEADACHE  \\\n",
"0            0       0        1      0     0      1   \n",
"1            0       0        0      0     0      1   \n",
"2            0       0        0      0     0      1   \n",
"3            0       0        0      0     0      1   \n",
"4            0       0        0      0     0      1   \n",
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"6            0       1        0      0     0      1   \n",
"7            0       0        0      0     0      1   \n",
"8            0       0        0      0     0      1   \n",
"9            0       0        1      0     0      1   \n",
"\n",
"   VOMITING  LIVES_IN_AFFECTED_AREA  COVID_OUTPUT  \n",
"0      0              0        1  \n",
"1      0              1        1  \n",
"2      0              0        1  \n",
     "3        0                    0           1  \n",
     "4        0                    0           1  \n",
     "5        0                    0           1  \n",
     "6        0                    0           1  \n",
     "7        0                    0           1  \n",
     "8        0                    0           1  \n",
     "9        0                    0           1  "
    ]
   },
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   "metadata": {},
   "output_type": "execute_result"
  }
 ],
 "source": [
  "df.head(10)"
 ]
},
{
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 "metadata": {},
 "source": [
  "### Correlation Matrix"
 ]
},
{
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 "data": {
  "text/html": [
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   "    }\n",
   "\n",
   "    .dataframe tbody tr th {\n",
   "        vertical-align: top;\n",
   "    }\n",
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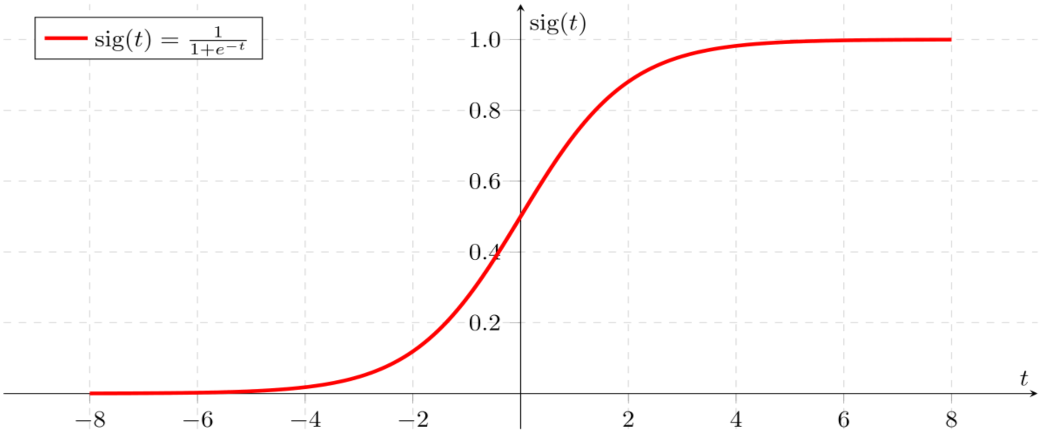
Algorithms Used

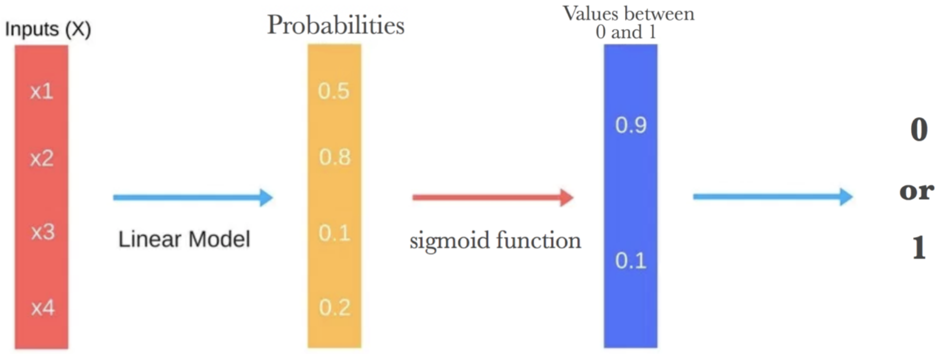
1. *Logistic Regression*

This method of regression is a famous method after Linear Regression. Though, both of them are regression algorithms the underlying difference is that the

Logistic Regression is used for classification tasks while the other is used for predicting or forecasting of data provided to the model. This algorithm also uses a linear equation to predict the value but the output range lies between negative and positive infinity. To have a classification output we will be having binary data for which 1 means Yes and 0 means No which sums it up to have the range 0 to 1. For squeezing the output data to be in this range, the sigmoid function is used.



Below is the graphical representation of Logistic Regression input and output scenario.



2. *Decision Tree Classifier*

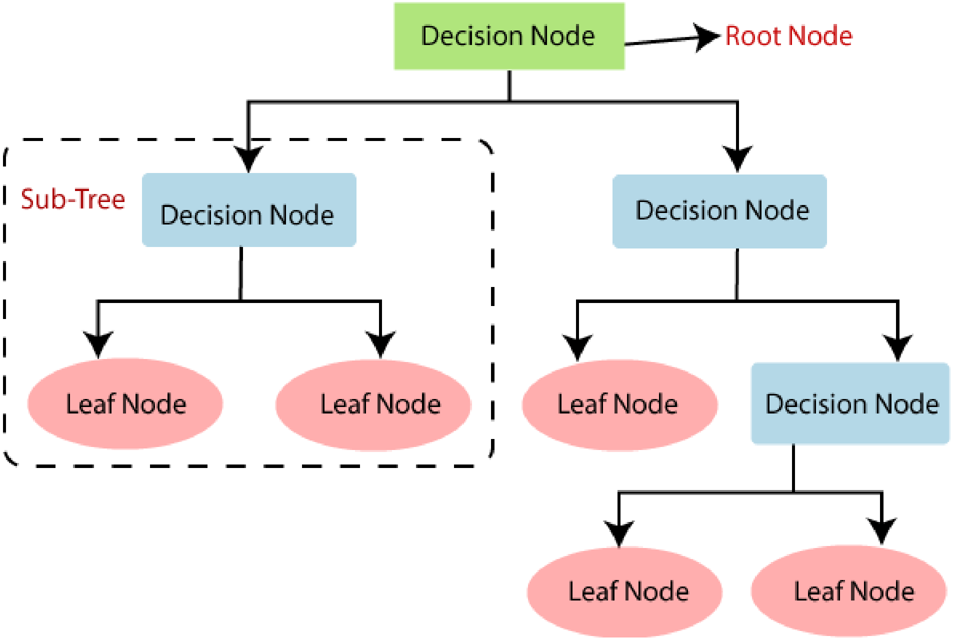
A Decision Tree is a simple representation for classifying examples. It is a Supervised Machine Learning where the data is continuously split according to a certain parameter.

Decision Tree consists of:

- Nodes: Test for the value of a certain attribute.

- Edges/ Branch: Correspond to the outcome of a test and connect to the next node or leaf.
- Leaf nodes: Terminal nodes that predict the outcome (represent class labels or class distribution).

Below is the graphical representation: -



There are two main types of Decision Trees:

- Classification Trees.
- Regression Trees.

2.1. Classification trees (Yes/No types):

What we've seen above is an example of classification tree, where the outcome was a variable like 'fit' or 'unfit'. Here the decision variable is Categorical/ discrete.

Such a tree is built through a process known as binary recursive partitioning. This is an iterative process of splitting the data into partitions, and then splitting it up further on each of the branches.

2.2. Regression trees (Continuous data types):

Decision trees where the target variable can take continuous values (typically real numbers) are called regression trees. (e.g., the price of a house, or a patient's length of stay in a hospital).

Creation of Decision Tree:

In this method a set of training examples is broken down into smaller and smaller subsets while at the same time an associated decision tree gets incrementally developed. At the end of the learning process, a decision tree covering the training set is returned.

The key idea is to use a decision tree to partition the data space into cluster (or dense) regions and empty (or sparse) regions.

In Decision Tree Classification a new example is classified by submitting it to a series of tests that determine the class label of the example. These tests are organized in a hierarchical structure called a decision tree. Decision Trees follow Divide-and-Conquer Algorithm.

Decision Tree Classifier

Using the decision algorithm, we start at the tree root and split the data on the feature that results in the largest information gain (IG) (reduction in uncertainty towards the final decision).

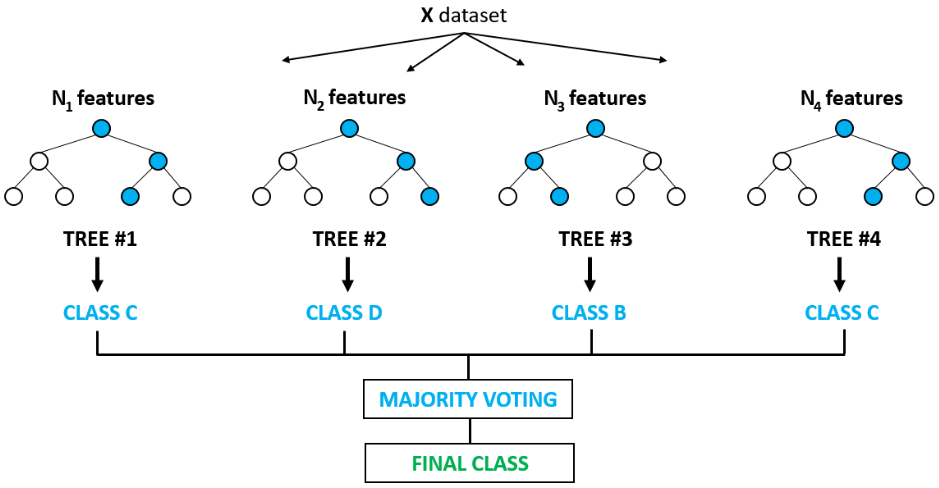
In an iterative process, we can then repeat this splitting procedure at each child node until the leaves are pure. This means that the samples at each leaf node all belong to the same class.

In practice, we may set a limit on the depth of the tree to prevent overfitting. We compromise on purity here somewhat as the final leaves may still have some impurity.

3. Random Forest Classifier

Random forests are a supervised learning algorithm. It can be used both for classification and regression. It is also the most flexible and easy to use algorithm. A forest is comprised of trees. It is said that the more trees it has, the more robust a forest is. Random forests create decision trees on randomly selected data samples, gets prediction from each tree and selects the best solution by means of voting. It also provides a pretty good indicator of the feature importance.

Random forests have a variety of applications, such as recommendation engines, image classification and feature selection. It can be used to classify loyal loan applicants, identify fraudulent activity and predict diseases. It lies at the base of the Boruta algorithm, which selects important features in a dataset.



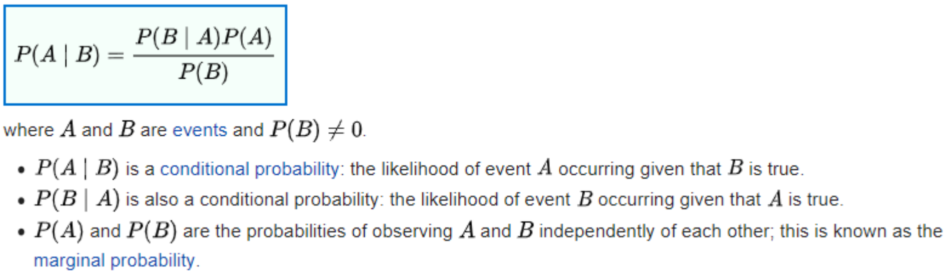
It works in four steps:

1. Select random samples from a given dataset.
2. Construct a decision tree for each sample and get a prediction result from each decision tree.
3. Perform a vote for each predicted result.
4. Select the prediction result with the most votes as the final prediction.

4. *Naive Bayes*

Naive Bayes is the simplest algorithm that you can apply to your data. As the name suggests, here this algorithm makes an assumption as all the variables in the dataset is "Naive" i.e not correlated to each other.

Naive Bayes is a very popular classification algorithm that is mostly used to get the base accuracy of the dataset.



$$\boxed{P(A \mid B) = \frac{P(B \mid A)P(A)}{P(B)}}$$

where A and B are events and $P(B) \neq 0$.

- $P(A \mid B)$ is a conditional probability: the likelihood of event A occurring given that B is true.
- $P(B \mid A)$ is also a conditional probability: the likelihood of event B occurring given that A is true.
- $P(A)$ and $P(B)$ are the probabilities of observing A and B independently of each other; this is known as the marginal probability.

Advantages

- It is easy and fast to predict the class of the test data set. It also performs well in multi-class prediction.

- When assumption of independence holds, a Naive Bayes classifier performs better compare to other models like logistic regression and you need less training data.
- It performs well in case of categorical input variables compared to numerical variable(s). For numerical variable, normal distribution is assumed (bell curve, which is a strong assumption).

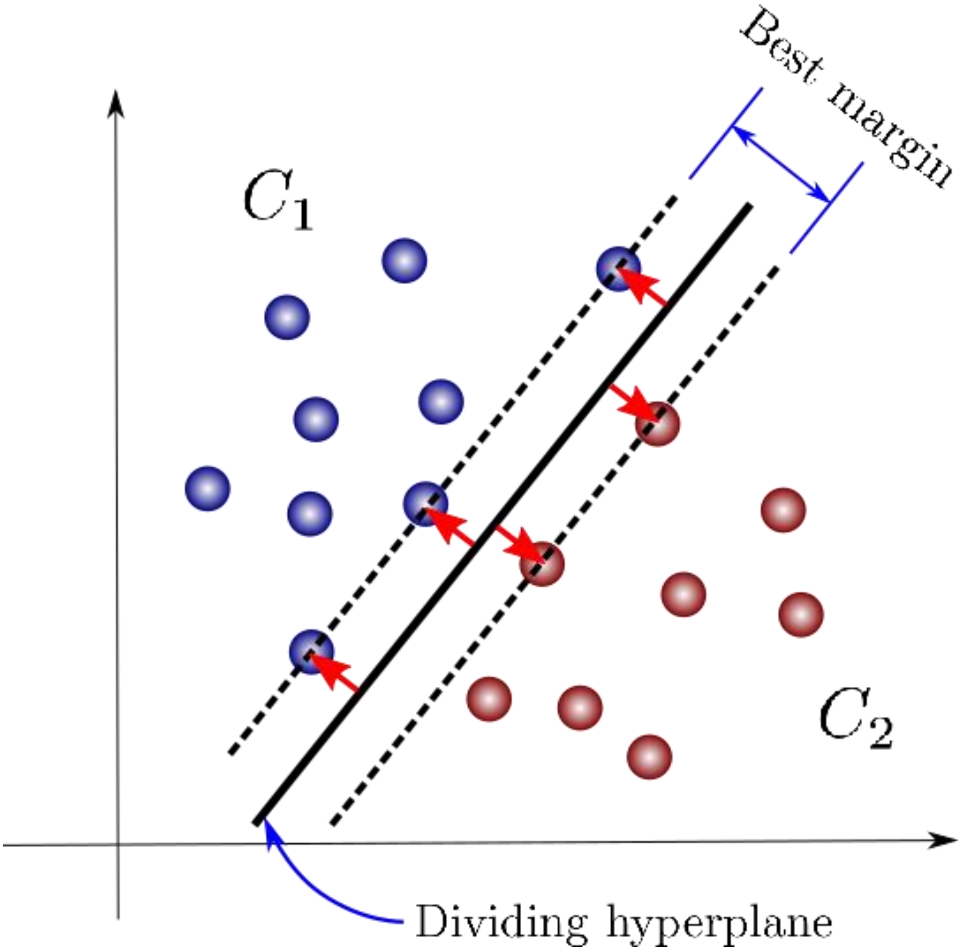
Disadvantages

- If categorical variable has a category (in test data set), which was not observed in training data set, then model will assign a 0 (zero) probability and will be unable to make a prediction. This is often known as Zero Frequency. To solve this, we can use the smoothing technique. One of the simplest smoothing techniques is called Laplace estimation.
- On the other side naive Bayes is also known as a bad estimator, so the probability outputs are not to be taken too seriously.
- Another limitation of Naive Bayes is the assumption of independent predictors. In real life, it is almost impossible that we get a set of predictors which are completely independent.

5. *Support Vector Machine*

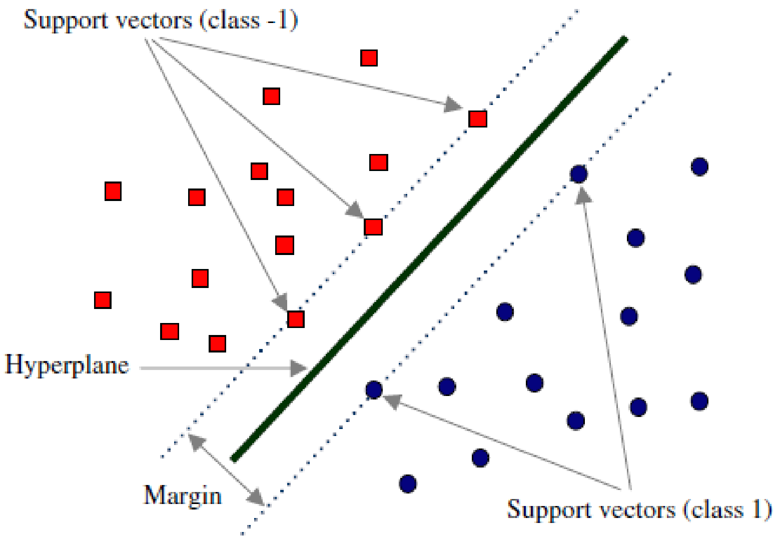
The objective of the support vector machine algorithm is to find a hyperplane in an N-dimensional space (N — the number of features) that distinctly classifies the data points.

Following is the visual representation:

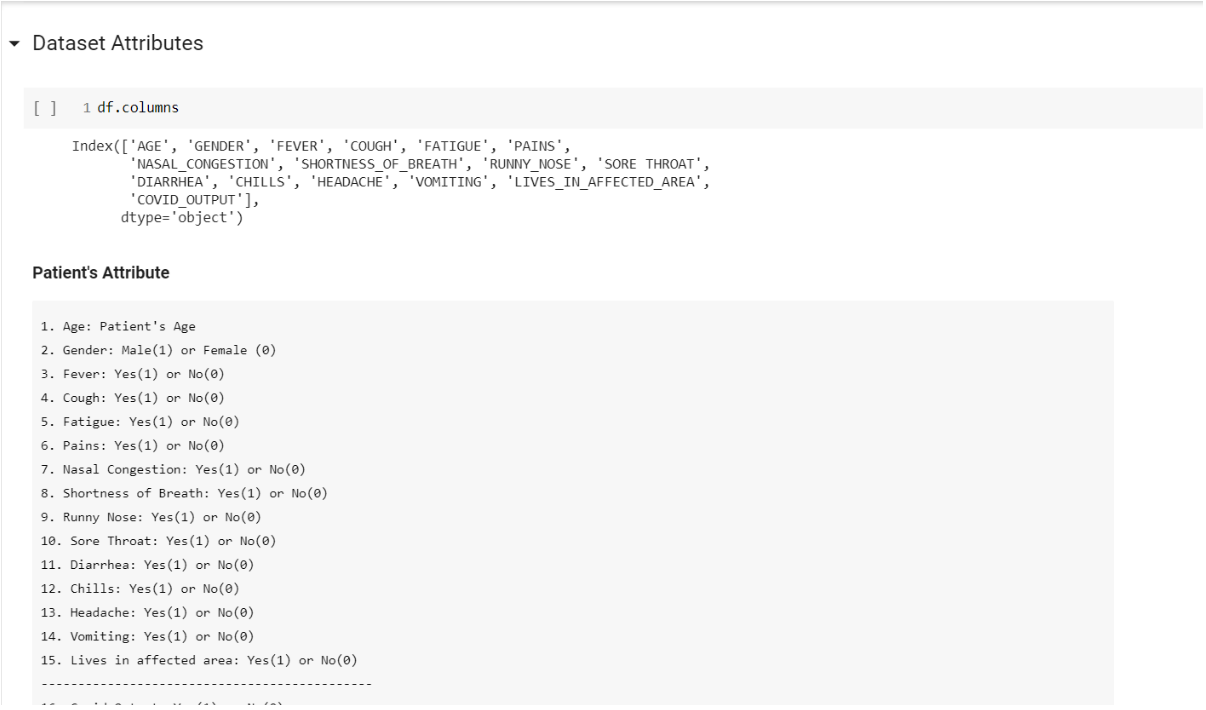


To separate the two classes of data points, there are many possible hyperplanes that could be chosen. Our objective is to find a plane that has the maximum margin, i.e the maximum distance between data points of both classes. Maximizing the margin distance provides some reinforcement so that future data points can be classified with more confidence.

Hyperplanes are decision boundaries that help classify the data points. Data points falling on either side of the hyperplane can be attributed to different classes. Also, the dimension of the hyperplane depends upon the number of features. If the number of input features is 2, then the hyperplane is just a line. If the number of input features is 3, then the hyperplane becomes a two-dimensional plane. It becomes difficult to imagine when the number of features exceeds 3.



In logistic regression, we take the output of the linear function and squash the value within the range of [0,1] using the sigmoid function. If the squashed value is greater than a threshold value(0.5) we assign it a label 1, else we assign it a label 0. In SVM, we take the output of the linear function and if that output is greater than 1, we identify it with one class and if the output is -1, we identify is with another class. Since the threshold values are changed to 1 and -1 in SVM, we obtain this reinforcement range of values([-1,1]) which acts as margin.



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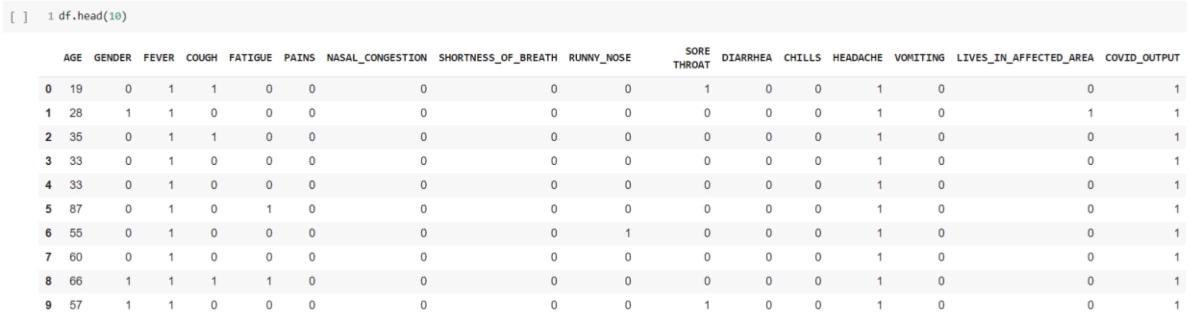
```

Patient's Attribute

```
1. Age: Patient's Age
2. Gender: Male(1) or Female (0)
3. Fever: Yes(1) or No(0)
4. Cough: Yes(1) or No(0)
5. Fatigue: Yes(1) or No(0)
6. Pains: Yes(1) or No(0)
7. Nasal Congestion: Yes(1) or No(0)
8. Shortness of Breath: Yes(1) or No(0)
9. Runny Nose: Yes(1) or No(0)
10. Sore Throat: Yes(1) or No(0)
11. Diarrhea: Yes(1) or No(0)
12. Chills: Yes(1) or No(0)
13. Headache: Yes(1) or No(0)
14. Vomiting: Yes(1) or No(0)
15. Lives in affected area: Yes(1) or No(0)
---------------------------------------------
16. Covid Output: Yes(1) or No(0)
```



```
df.head(10)
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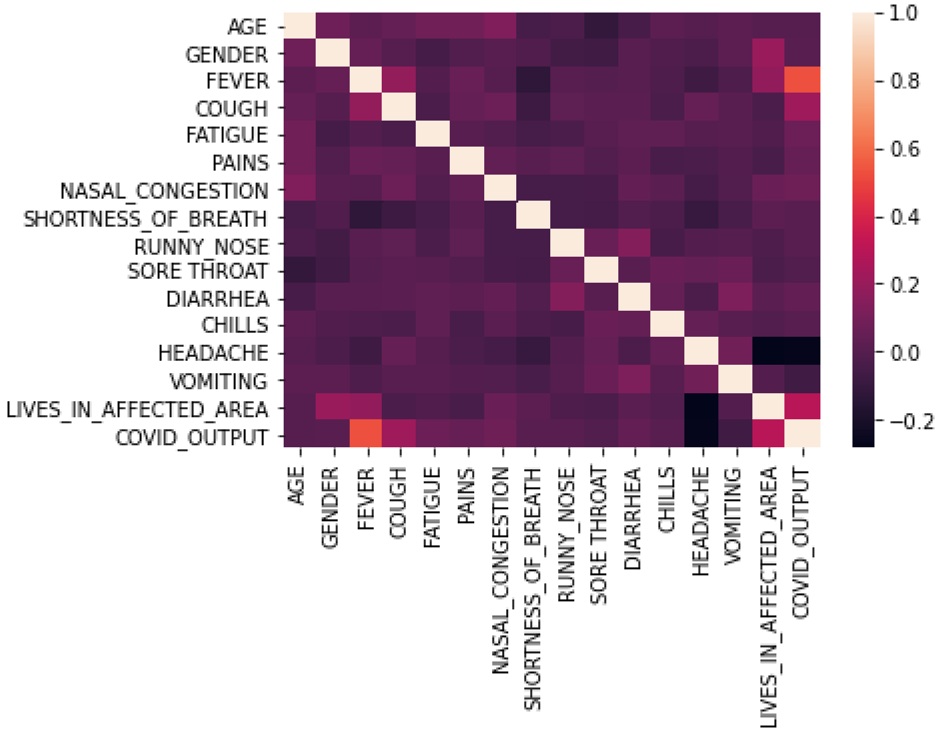
	AGE	GENDER	FEVER	COUGH	FATIGUE	PAINS	NASAL_CONGESTION	SHORTNESS_OF_BREATH	RUNNY_NOSE	SORE THROAT	DIARRHEA	CHILLS	HEADACHE	VOMITING	LIVES_IN_AFFECTED_AREA	COVID_OUTPUT
0	19	0	1	1	0	0	0	0	0	1	0	0	1	0	0	1
1	28	1	1	0	0	0	0	0	0	0	0	0	1	0	1	1
2	35	0	1	1	0	0	0	0	0	0	0	0	1	0	0	1
3	33	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1
4	33	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1
5	87	0	1	0	1	0	0	0	0	0	0	0	1	0	0	1
6	55	0	1	0	0	0	0	0	1	0	0	0	1	0	0	1
7	60	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1
8	66	1	1	1	1	0	0	0	0	0	0	0	1	0	0	1
9	57	1	1	0	0	0	0	0	0	1	0	0	1	0	0	1

Correlation Matrix



Results and Discussion

In machine learning, the performance of individual model which is tested is measured by the following factors:

AUC Score: From the prediction scores, the Receiver Operating Characteristic Curve (ROC) is plotted and the area under the curve defines the following metric.

Recall: It is defined as the number of true positives divided by the total count of false negatives and true positives.

Accuracy: It is one of the metrics which is used to compare the correct predictions with all the data points of the classifier.

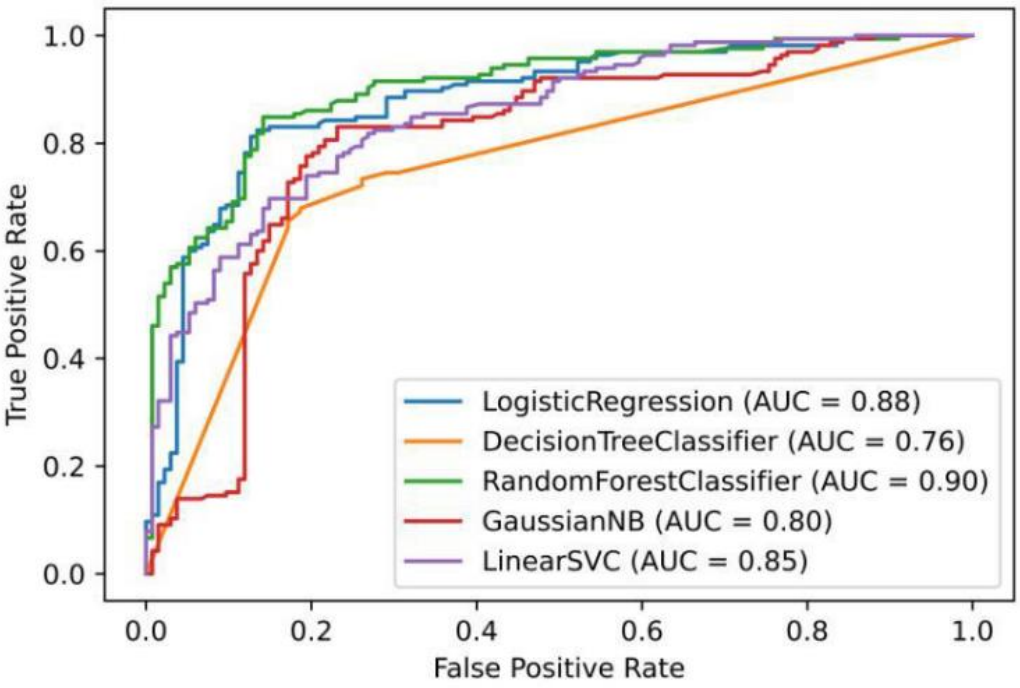
Precision: It is defined as the number of true positives divided by the total count of false positives and true positives.

F1 Score: It is defined as the weighted average of the precision and recall.

Various classification algorithms are applied and the COVID19 Symptoms dataset is provided for the performance analysis of different models.

Conclusion

At present the information about the symptoms to COVID-19 infected outcome is present at a very small scale while the future work will be able to draw a better understanding between the symptoms and the infection in a greater detail as the contribution of adding new data will be done.



This paper gives an insight of the different symptoms linked to COVID-19 and proposed a probabilistic classification of getting infected. The work concludes that men have a higher tendency to get infected having common symptoms as fever and cough. To choose the best algorithm to train the dataset, statistical analysis is carried out. Random Forest Classifier Algorithm is superior to other models in comparison to various performance factors such as accuracy, AUC

Score, F1 Score and Recall. The approximate mean accuracy score using these algorithms was found to be 78%.