DISEASE PREDICTION USING MACHINE LEARNING

A MINI PROJECT REPORT

Submitted by

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in partial fulfillment for the award of the degree
of
BACHELOR OF ENGINEERING
IN
Computer Science and Engineering

SRI SAI RAM INSTITUTE OF TECHNOLOGY

(An Autonomous Institution; Affiliated to Anna University, Chennai -600 025)

ANNA UNIVERSITY: CHENNAI 600 025

JUNE - 2022

SRI SAI RAM INSTITUTE OF TECHNOLOGY

(An Autonomous Institution; Affiliated to Anna University, Chennai -600 025)

COLLEGE VISION & MISSION STATEMENT

VISION

"To become an Internationally renowned Institution in technical education, research and development, by transforming the students into competent professionals with leadership skills and ethical values."

MISSION

- ❖ Providing the Best Resources and Infrastructure.
- ❖ Creating Learner centric Environment and continuous -Learning.
- ❖ Promoting Effective Links with Intellectuals and Industries.
- ❖ Enriching Employability and Entrepreneurial Skills.
- ❖ Adapting to Changes for Sustainable Development.

COMPUTER SCIENCE AND ENGINEERING

VISION

To produce competent software professionals, academicians, researchers and entrepreneurs with moral values through quality education in the field of Computer Science and Engineering.

MISSION

- Enrich the students' knowledge and computing skills through innovative teaching-learning process with state- of- art- infrastructure facilities.
- Endeavour the students to become an entrepreneur and employable through adequate industry institute interaction.
- Inculcating leadership skills, professional communication skills with moral and ethical values to serve the society and focus on students' overall development.

PROGRAM OUTCOMES:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give

and receive clear instructions.

11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life Long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM EDUCATIONAL OBJECTIVES

- **PEO I:** Graduates shall be professionals with expertise in the fields of Software Engineering, Networking, Data Mining and Cloud computing and shall undertake Software Development, Teaching and Research.
- **PEO II:** Graduates will analyze problems, design solutions and develop programs with sound Domain Knowledge.
- **PEO III:** Graduates shall have professional ethics, team spirit, life-long learning, good oral and written communication skills and adopt corporate culture, core values and leadership skills.

PROGRAM SPECIFIC OUTCOMES (PSO's)

- **PSO1: Professional skills:** Students shall understand, analyze and develop computer applications in the field of Data Mining/Analytics, Cloud Computing, Networking etc., to meet the requirements of industry and society.
- **PSO2: Competency:** Students shall qualify at the State, National and International level competitive examination for employment, higher studies and research.

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BONAFIDE CERTIFICATE

Certify that this project report "**DISEASE PREDICTION USING MACHINE LEARNING"** is a Bonafide work out by **SRIRAM A (412419104125), VIGNESH S.B (412419104147), JAGADISH DHANRAJ TIDKE (412419104039)** who carried out the project work under my supervision.

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Submitted for University Project Examination held on

Internal Examiner **External Examiner**

ACKNOWLEDGEMENT

A successful man is one who can lay a firm foundation with the bricks others have thrown at him.
—*David Brinkley*

Such a successful personality is our beloved Founder Chairman,
Thiru.MJF.Ln. LEO MUTHU. At first, we express our sincere gratitude to our beloved chairman through prayers, who in the form of a guiding star has spread his wings of external support with immortal blessings.

We express our gratitude to our Chairman and CEO **Mr. J.SAI PRAKASH LEOMUTHU** and our Trustee **Mrs. J. SHARMILA RAJA** for their constant encouragement for completing this project.

We express our sincere thanks to our beloved Principal,
Dr. K. PALANIKUMAR for having given us spontaneous and whole hearted encouragement for completing this project.

We are indebted to our HEAD OF THE DEPARTMENT **Dr. B. SREEDEVI** for her support during the entire course of this project work.

We express our gratitude and sincere thanks to our guide **Mrs. K.VIJAYALAKSHMI** for his valuable suggestions and constant encouragement for successful completion of this project.

Our sincere thanks to our project coordinator **Mr.ANNADURAI** for her kind support in bringing out this project.

We thank all the teaching and non-teaching staff members of the Department of Computer Science and Engineering and all others who contributed directly or indirectly for the successful completion of the project.

ABSTRACT

Challenges faced by many people are looking online for health information regarding diseases, diagnoses and different treatments. In this type of system, the user face problem in understanding the heterogeneous medical vocabulary as the users is laymen. User is confused because a large amount of medical information on different mediums is available. With the rise in number of patient and disease every year medical system is overloaded and with time have become overpriced in many countries. Most of the disease involves a consultation with doctors to get treated. With sufficient data prediction of disease by an algorithm can be very easy and cheap. Prediction of disease by looking at the symptoms is an integral part of treatment. In our project we have tried accurately predict a disease by looking at the symptoms of the patient. We have used 4 different algorithms. They are Decision tree, Random Forest tree, Gaussian Naïve bayes, KNN Such a system can have a very large potential in medical treatment of the future. We have also designed an interactive interface to facilitate interaction with the system. We have also attempted to show and visualized the result of our study and this project.

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LIST OF ABBREVIATION

ML	**M**achine **L**earning
KNN	**K N**earest **N**eighbor
NB	**N**aïve **B**ayes
API	**A**pplication **P**rogramming **I**nterface
VS	**V**isual **S**tudio Code

x

CHAPTER 1
INTRODUCTION

1.1 OBJECTIVE

The project "**DISEASE PREDICTION USING ML**" was developed with the aim of easing the process of attendance marking for students as well as for institutions to handle their records. Machine learning is a sub-domain of computer science which evolved from the study of pattern recognition in data, and also from the computational learning theory in artificial intelligence. It is the first-class ticket to most interesting careers in data analytics today. As data sources proliferate along with the computing power to process them, going straight to the data is one of the most straightforward ways to quickly gain insights and make predictions

Python Programming language

Python is one of the many open sources object oriented programming application software available in the market. Python is developed by Guido van Rossum. Guido van Rossum started implementing Python in 1989. Python is a very simple programming language so even if you are new to programming, you can learn python without facing any issues. Some of the many uses of Python are application development, implementation of automation testing process, allows multiple programming build, fully constructed programming library, can be used in all the major operating systems and platforms, database system accessibility, simple and readable code, easy to apply on complex software development processes, aids in test driven software application development approach, machine learning/ data analytics, helps pattern recognitions, supported in multiple tools, permitted by many of the provisioned frameworks, etc.

Applications of Python programming language

Python can be used to develop different applications like web applications, graphical user interface-based applications, software development application, scientific and numeric applications, network programming, Games and 3D applications and other business applications. It makes an interactive interface and easy development of applications. You may be wondering what all are the applications of Python. There are so many applications of Python, here are some of the them.

Machine learning

There are many machine learning applications written in Python. Machine learning is a way to write a logic so that a machine can learn and solve a particular problem on its own. For example, products recommendation in websites like Amazon, Flipkart, eBay etc. is a machine learning algorithm that recognizes user's interest. Face recognition and Voice recognition in your phone is another example of machine learning.

1.2 ARCHITECTURE DIAGRAM

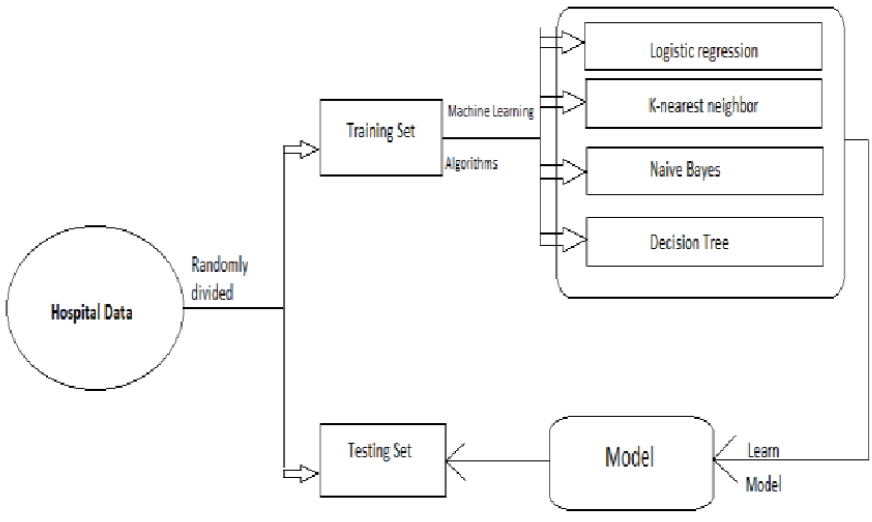


Fig 1.1: SYSTEM ARCHITECTURE

1.3 TOOLS

VISUAL STUDIO CODE

Visual Studio Code is a commercial source code editor. It natively supports many programming languages and markup languages. Users can expand its functionality with plug ins, typically community-built and maintained under free-software licenses. To facilitate plug ins, VS code features a Python API.

THEMES

VS Code contains 23 different visual themes, with the option to download additional themes and configure custom themes via third-party plug ins. The mini map feature shows a reduced overview of the entire file in the top-right corner of the screen. The portion of the file visible in the main editor pane is highlighted and clicking or dragging in this view scrolls the editor through the file.

In-editor code building

This feature allows users to run code for certain languages from within the editor, which eliminates the need to switch out to the command line and back again. This function can also be set to build the code automatically every time the file is saved.

Snippets

This feature allows users to save blocks of frequently used codes and assign keywords to them. The user can then type the keyword and press tab button to paste the block of code whenever they require it.

Auto completion

Vs code will offer to complete entries as the user is typing depending on the language being used. It also auto-completes variables created by the user.

The program offers a number of screen modes including panels that can show up to four files at once as well as full screen and distractions free modes which only shows one file without any of the additional menus around it.

CHAPTER 2

LITERATURE SURVEY

TOPIC: Designing Disease Prediction Model Using ML Approach

AUTHORS : Dhiraj Dahiwade; GajananPatle; EktaaMeshram

SUMMARY:

The prediction of disease at earlier stage becomes important task. But the accurate prediction on the basis of symptoms becomes too difficult for doctor. The correct prediction of disease is the most challenging task. To overcome this problem data mining plays an important role to predict the disease. After general disease prediction, this system able to gives the risk associated with general disease which is lower risk of general disease or higher.

Technics:

- K Nearest Neighbor
- Gaussian Naïve Bayes
- Random Forest Tree

Merits:

Increased accuracy for effective disease diagnosis.

Overcome:

It is advanced.

TOPIC: Image recognition using Machine Learning

AUTHORS: Salman Baig,KasuniGeetadhari, Mohd Atif Noor, AmarkantSonkar

SUMMARY:

The prediction of disease at earlier stage becomes important task. But the accurate prediction on the basis of symptoms becomes too difficult for doctor. The correct prediction of disease is the most challenging task. After general disease prediction, this system able to gives the risk associated with general disease which is lower risk of general disease or higher.

Technics:

- K Nearest Neighbor
- Gaussian Naïve Bayes
- Decision Tree

Merits:

- Cost effective for patients.

Overcome:

Data mining plays an important role to predict the disease.

CHAPTER 3
SYSTEM ANALYSIS

3.1 EXISTING SYSTEM

There are many prevalent systems used for disease prediction. The existing system only predict the diseases. The various approaches used for predicting disease is by using machine learning algorithms such as naïve bayes, Random Forest, k-mean algorithm. Also, one of the approaches to build a disease prediction system by using big data prediction using traditional disease risk model usually involves machine learning and supervised learning algorithm which used training data with the labels for the training of the model.

3.1.1 Demerits

- Prediction of disease results is not accurate.
- Data mining techniques does not help to provide effective decision making.
- Cannot handle enormous datasets for patient record**.**

3.2 PROPOSED SYSTEM

In the proposed system, a disease prediction model is built using a Machine Learning algorithm that is Random Forest Algorithm. Based on the symptoms that are input by the user, the disease is predicted and the drug that is most commonly prescribed by the doctor is suggested.

3.2.1 Merits

- Increased accuracy for effective disease diagnosis.
- Handle roughest amount of data using random forest algorithm and feature selection.
- Cost effective for patients.

CHAPTER 4
SYSTEM DESIGN

4.1 SYSTEM REQUIREMENT

HARDWARE REQUIREMENT

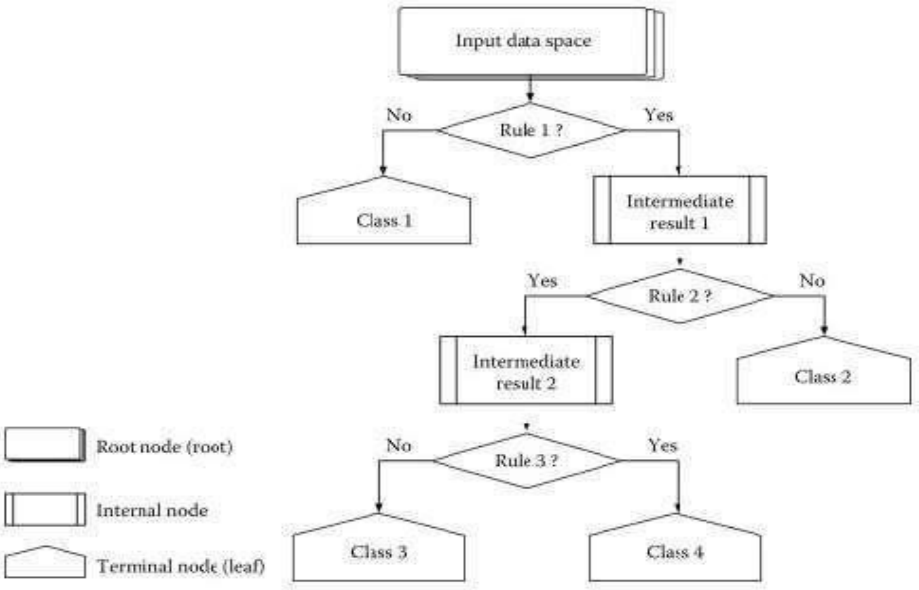
- Processor : i3 intel core
- RAM : 4GB
- Keyboard : Standard keyboard
- Monitor : 15.6 inch color monitor

SOFTWARE REQUIREMENT

- Operating system : Windows OS
- Editor : Visual Studio Code
- Graphic card :1 GB Nvidia GT740M
- Programming Language : Python

CHAPTER 5
SYSTEM ARCHITECTURE

Figure 5.1ER DIAGRAM



5.1 MODULE DESCRIPTION

To help for see whether a patient is experiencing chronic disease or not as indicated by his/her medical history. The input esteem is the attribute value of the patient, which incorporates the patient's close to home data. For example, age ,sex ,the pervasiveness of side effects, and living propensities (smoking or not) and other structured information and unstructured information. The yield esteem shows whether the patient is experiencing chronic disease or not. For disease hazard demonstrating the precision of disk expectation realize upon the assorted variety highlight of the doctor's facility information., The better is the element depiction of the disease, the higher the exactness will be. For some straightforward sickness, example hyperlipidemia, just a couple of highlights of organized information can get a decent depiction of the illness, bringing about genuinely great impact of disease expectation. Be that as it may, for an unpredictable disease for

example, cerebral infarction, diabetics, hypertension and asthma just utilizing highlights of structured data is not a decent method to depict the disease. In this way, use the structured data as well as the content information of patient in view of the support vector machine and naive bayes (NB) algorithms.

5.2 ALGORITHM DETAILS

DECISION TREE

Decision trees classified as a very effective and versatile classification technique. It is used in pattern recognition and classification for image. It is used for classification in very complex problems dew to its high adaptability. It is also capable of engaging problems of higher dimensionality. It mainly consists of three parts root, nodes and leaf. Roots consists of attribute which has most effect on the outcome, leaf tests for value of certain attribute and leaf gives out the output of tree.

Decision tree is the first prediction method we have used in our project. It gives us an accuracy of ~95%.

RANDOM FOREST TREE

Random Forest Algorithms a supervised learning algorithm used for both classification and regression. This algorithm works on 4 basic steps –

1. It chooses random data samples from dataset.

2. It constructs decision trees for every sample dataset chosen.

In this project we have used random forest classifier with 100 random samples and the result given is ~95% accuracy.

K Nearest Neighbor

Itis a supervised learning algorithm. It is a basic yet essential algorithm. It finds extensive use in pattern finding and data mining. It works by finding a pattern in data which links data to results and it improves upon the pattern recognition with every iteration.

CHAPTER 6

SIMULATION SETUP & RESULT DISCUSSION

Screenshots

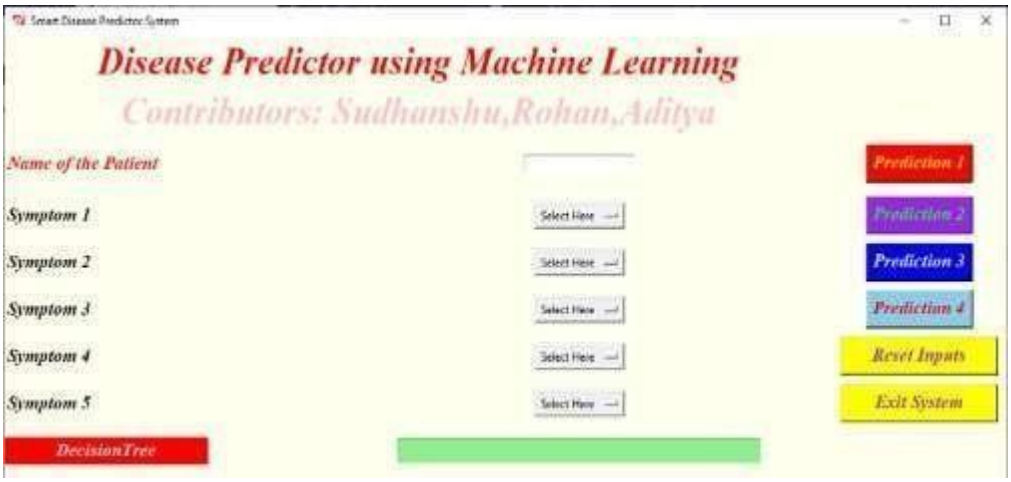


Fig. No. 6.1 Home page

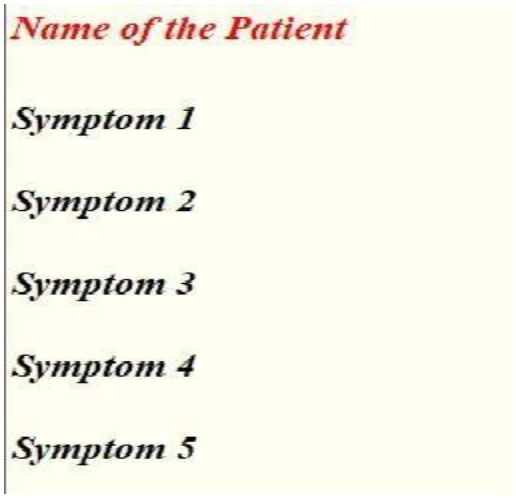


Fig. No. 6.2 Symptoms dialog box

Fig.No.6.3 Predictions dialog box

Fig.no.6.5 Name box

Fig.no. Symptom box

CHAPTER 7
CONCLUSION

We set out to create a system which can predict disease on the basis of symptoms given to it. Such a system can decrease rush at OPDs of hospitals and reduce the workload on medical staff. We were successful in creating such a system and use four different algorithms to do so. On an average we achieved accuracy of ~94%. Such a system can be largely reliable to do the job. Creating this system, we also added a way to store the data entered by the user in the database which can be used in future to help in creating better version of such system. Our system also has an easy-to-use interface. It also has various visual representation of data collected and results achieved.

CHAPTER 8
ANNEXURE

CODING

```
#Importing Libraries
from mpl_toolkits.mplot3d import Axes3D
from sklearn.preprocessing import StandardScaler
import matplotlib.pyplot as plt
from tkinter import *
import numpy as np
import pandas as pd
import os

l1=['back_pain','constipation','abdominal_pain','diarrhoea','mild_fever','yellow_urine',
    'yellowing_of_eyes','acute_liver_failure','fluid_overload','swelling_of_stomach',

'swelled_lymph_nodes','malaise','blurred_and_distorted_vision','phlegm','throat_irritation'
,

'redness_of_eyes','sinus_pressure','runny_nose','congestion','chest_pain','weakness_in_lim
bs',
    'fast_heart_rate','pain_during_bowel_movements','pain_in_anal_region','bloody_stool',
    'irritation_in_anus','neck_pain','dizziness','cramps','bruising','obesity','swollen_legs',
    'swollen_blood_vessels','puffy_face_and_eyes','enlarged_thyroid','brittle_nails',

'swollen_extremeties','excessive_hunger','extra_marital_contacts','drying_and_tingling_li
ps',

'slurred_speech','knee_pain','hip_joint_pain','muscle_weakness','stiff_neck','swelling_join
ts',
    'movement_stiffness','spinning_movements','loss_of_balance','unsteadiness',
    'weakness_of_one_body_side','loss_of_smell','bladder_discomfort','foul_smell_of
urine',
    'continuous_feel_of_urine','passage_of_gases','internal_itching','toxic_look_(typhos)',

'depression','irritability','muscle_pain','altered_sensorium','red_spots_over_body','belly_p
ain',
    'abnormal_menstruation','dischromic
```

```
_patches','watering_from_eyes','increased_appetite','polyuria','family_history','mucoid_sputum',

'rusty_sputum','lack_of_concentration','visual_disturbances','receiving_blood_transfusion',
   'receiving_unsterile_injections','coma','stomach_bleeding','distention_of_abdomen',

'history_of_alcohol_consumption','fluid_overload','blood_in_sputum','prominent_veins_on_calf',
'palpitations','painful_walking','pus_filled_pimples','blackheads','scurring','skin_peeling',
'silver_like_dusting','small_dents_in_nails','inflammatory_nails','blister','red_sore_around_nose',
   'yellow_crust_ooze']


#List of Diseases is listed in list disease.

disease=['Fungal infection', 'Allergy', 'GERD', 'Chronic cholestasis',
      'Drug Reaction', 'Peptic ulcer diseae', 'AIDS', 'Diabetes ',
      'Gastroenteritis', 'Bronchial Asthma', 'Hypertension ', 'Migraine',
      'Cervical spondylosis', 'Paralysis (brain hemorrhage)', 'Jaundice',
      'Malaria', 'Chicken pox', 'Dengue', 'Typhoid', 'hepatitis A',
      'Hepatitis B', 'Hepatitis C', 'Hepatitis D', 'Hepatitis E',
      'Alcoholic hepatitis', 'Tuberculosis', 'Common Cold', 'Pneumonia',
      'Dimorphic hemmorhoids(piles)', 'Heart attack', 'Varicose veins',
      'Hypothyroidism', 'Hyperthyroidism', 'Hypoglycemia',
      'Osteoarthristis', 'Arthritis',
      '(vertigo) Paroymsal  Positional Vertigo', 'Acne',
      'Urinary tract infection', 'Psoriasis', 'Impetigo']

#disease = [df['prognosis'].unique()]
#print(disease)
```

```
#Reading the training .csv file df=pd.read_csv(r"C:\Users\VIGNESH
\Desktop\Projects\Disease Predictor usingML\training.csv")
DF= pd.read_csv(r"C:\Users\SYSTEM\Desktop\Projects\Disease Predictor using
ML\training.csv", index_col='prognosis')
#Replace the values in the imported file by pandas by the inbuilt function replace in
pandas.
df.replace({'prognosis':{'Fungal infection':0,'Allergy':1,'GERD':2,'Chronic
cholestasis':3,'Drug Reaction':4,
   'Peptic ulcer diseae':5,'AIDS':6,'Diabetes ':7,'Gastroenteritis':8,'Bronchial
Asthma':9,'Hypertension ':10,
   'Migraine':11,'Cervical spondylosis':12,
   'Paralysis (brain hemorrhage)':13,'Jaundice':14,'Malaria':15,'Chicken
pox':16,'Dengue':17,'Typhoid':18,'hepatitis A':19,
   'Hepatitis B':20,'Hepatitis C':21,'Hepatitis D':22,'Hepatitis E':23,'Alcoholic
hepatitis':24,'Tuberculosis':25,
   'Common Cold':26,'Pneumonia':27,'Dimorphic hemmorhoids(piles)':28,'Heart
attack':29,'Varicose veins':30,'Hypothyroidism':31,
   'Hyperthyroidism':32,'Hypoglycemia':33,'Osteoarthristis':34,'Arthritis':35,
   '(vertigo) Paroymsal  Positional Vertigo':36,'Acne':37,'Urinary tract
infection':38,'Psoriasis':39,
   'Impetigo':40}},inplace=True)
#df.head()
DF.head()

# Distribution graphs (histogram/bar graph) of column data
defplotPerColumnDistribution(df1, nGraphShown, nGraphPerRow):
nunique = df1.nunique()
   df1 = df1[[col for col in df if nunique[col] > 1 and nunique[col] < 50]] # For displaying
purposes, pick columns that have between 1 and 50 unique values
nRow, nCol = df1.shape
columnNames = list(df1)
nGraphRow = (nCol + nGraphPerRow - 1) / nGraphPerRow
plt.figure(num = None, figsize = (6 * nGraphPerRow, 8 * nGraphRow), dpi = 80,
facecolor = 'w', edgecolor = 'k')
   for i in range(min(nCol, nGraphShown)):
plt.subplot(nGraphRow, nGraphPerRow, i + 1)
```

```
columnDf = df.iloc[:, i]
    if (not np.issubdtype(type(columnDf.iloc[0]), np.number)):
valueCounts = columnDf.value_counts()
valueCounts.plot.bar()
    else:
columnDf.hist()
plt.ylabel('counts')
plt.xticks(rotation = 90)
plt.title(f'{columnNames[i]} (column {i})')
plt.tight_layout(pad = 1.0, w_pad = 1.0, h_pad = 1.0)
plt.show()

#Reading the  testing.csv file
```

```
tr=pd.read_csv(r"C:\Users\SYSTEM\Desktop\Projects\Disease Predictor using ML\testing.csv")

#Using inbuilt function replace in pandas for replacing the values

tr.replace({'prognosis':{'Fungal infection':0,'Allergy':1,'GERD':2,'Chronic cholestasis':3,'Drug Reaction':4,
   'Peptic ulcer diseae':5,'AIDS':6,'Diabetes ':7,'Gastroenteritis':8,'Bronchial Asthma':9,'Hypertension ':10,
   'Migraine':11,'Cervical spondylosis':12,
   'Paralysis (brain hemorrhage)':13,'Jaundice':14,'Malaria':15,'Chicken pox':16,'Dengue':17,'Typhoid':18,'hepatitis A':19,
   'Hepatitis B':20,'Hepatitis C':21,'Hepatitis D':22,'Hepatitis E':23,'Alcoholic hepatitis':24,'Tuberculosis':25,
   'Common Cold':26,'Pneumonia':27,'Dimorphic hemmorhoids(piles)':28,'Heart attack':29,'Varicose veins':30,'Hypothyroidism':31,
   'Hyperthyroidism':32,'Hypoglycemia':33,'Osteoarthristis':34,'Arthritis':35,
   '(vertigo) Paroymsal  Positional Vertigo':36,'Acne':37,'Urinary tract infection':38,'Psoriasis':39,
   'Impetigo':40}},inplace=True)
tr.head()


#list1 = DF['prognosis'].unique()
defscatterplt(disea):
   x = ((DF.loc[disea]).sum())#total sum of symptom reported for given disease
x.drop(x[x==0].index,inplace=True)#droping symptoms with values 0
   print(x.values)
   y = x.keys()#storing nameof symptoms in y
   print(len(x))
   print(len(y))
plt.title(disea)
plt.scatter(y,x.values)
plt.show()

defscatterinp(sym1,sym2,sym3,sym4,sym5):
   x = [sym1,sym2,sym3,sym4,sym5]#storing input symptoms in y
   y = [0,0,0,0,0]#creating and giving values to the input symptoms
   if(sym1!='Select Here'):
```

```
        y[0]=1
    if(sym2!='Select Here'):
        y[1]=1
    if(sym3!='Select Here'):
        y[2]=1
    if(sym4!='Select Here'):
        y[3]=1
    if(sym5!='Select Here'):
        y[4]=1
    print(x)
    print(y)
plt.scatter(x,y)
plt.show()


root = Tk()
pred1=StringVar()
defDecisionTree():
    if len(NameEn.get()) == 0:
        pred1.set(" ")
        comp=messagebox.askokcancel("System","Kindly Fill the Name")
        if comp:
root.mainloop()
elif((Symptom1.get()=="Select Here") or (Symptom2.get()=="Select Here")):
        pred1.set(" ")
sym=messagebox.askokcancel("System","Kindly Fill atleast first two Symptoms")
        if sym:
root.mainloop()
    else:
        from sklearn import tree

        clf3 = tree.DecisionTreeClassifier()
        clf3 = clf3.fit(X,y)

        from sklearn.metrics import classification_report,confusion_matrix,accuracy_score
y_pred=clf3.predict(X_test)
        print("Decision Tree")
        print("Accuracy")
        print(accuracy_score(y_test, y_pred))
```

```
        print(accuracy_score(y_test, y_pred,normalize=False))
        print("Confusion matrix")
conf_matrix=confusion_matrix(y_test,y_pred)
        print(conf_matrix)

psymptoms =
[Symptom1.get(),Symptom2.get(),Symptom3.get(),Symptom4.get(),Symptom5.get()]
for k in range(0,len(l1)):
            for z in psymptoms:
                if(z==l1[k]):
                    l2[k]=1

inputtest = [l2]
        predict = clf3.predict(inputtest)
        predicted=predict[0]

        h='no'
        for a in range(0,len(disease)):
            if(predicted == a):
                h='yes'
                break


        if (h=='yes'):
            pred1.set(" ")
            pred1.set(disease[a])
        else:
            pred1.set(" ")
            pred1.set("Not Found")
        #Creating the database if not exists named as database.db and creating table if not
exists named as DecisionTree using sqlite3
        import sqlite3
        conn = sqlite3.connect('database.db')
        c = conn.cursor()
c.execute("CREATE TABLE IF NOT EXISTS DecisionTree(Name StringVar,Symtom1
StringVar,Symtom2 StringVar,Symtom3 StringVar,Symtom4 TEXT,Symtom5
TEXT,DiseaseStringVar)")
c.execute("INSERT INTO
DecisionTree(Name,Symtom1,Symtom2,Symtom3,Symtom4,Symtom5,Disease)
```

```
        VALUES(?,?,?,?,?,?,?)",(NameEn.get(),Symptom1.get(),Symptom2.get(),Symptom3.get(
        ),Symptom4.get(),Symptom5.get(),pred1.get()))
        conn.commit()
        c.close()
        conn.close()

            #printing scatter plot of input symptoms
            #printing scatter plot of disease predicted vs its symptoms

        scatterinp(Symptom1.get(),Symptom2.get(),Symptom3.get(),Symptom4.get(),Symptom5.
        get())
scatterplt(pred1.get())

        pred2=StringVar()
        defrandomforest():
           if len(NameEn.get()) == 0:
              pred1.set(" ")
              comp=messagebox.askokcancel("System","Kindly Fill the Name")
              if comp:
        root.mainloop()
        elif((Symptom1.get()=="Select Here") or (Symptom2.get()=="Select Here")):
              pred1.set(" ")
        sym=messagebox.askokcancel("System","Kindly Fill atleast first two Symptoms")
              if sym:
        root.mainloop()
           else:
              from sklearn.ensemble import RandomForestClassifier
              clf4 = RandomForestClassifier(n_estimators=100)
              clf4 = clf4.fit(X,np.ravel(y))

              # calculating accuracy
              from sklearn.metrics import classification_report,confusion_matrix,accuracy_score
        y_pred=clf4.predict(X_test)
              print("Random Forest")
              print("Accuracy")
              print(accuracy_score(y_test, y_pred))
              print(accuracy_score(y_test, y_pred,normalize=False))
              print("Confusion matrix")
        conf_matrix=confusion_matrix(y_test,y_pred)
```

```
        print(conf_matrix)

psymptoms =
[Symptom1.get(),Symptom2.get(),Symptom3.get(),Symptom4.get(),Symptom5.get()]

for k in range(0,len(l1)):
            for z in psymptoms:
                if(z==l1[k]):
                    l2[k]=1

inputtest = [l2]
        predict = clf4.predict(inputtest)
        predicted=predict[0]

        h='no'
        for a in range(0,len(disease)):
            if(predicted == a):
                h='yes'
                break
        if (h=='yes'):
            pred2.set(" ")
            pred2.set(disease[a])
        else:
            pred2.set(" ")
            pred2.set("Not Found")
         #Creating the database if not exists named as database.db and creating table if not
exists named as RandomForest using sqlite3
        import sqlite3
        conn = sqlite3.connect('database.db')
        c = conn.cursor()
c.execute("CREATE TABLE IF NOT EXISTS RandomForest(Name
StringVar,Symtom1 StringVar,Symtom2 StringVar,Symtom3 StringVar,Symtom4
TEXT,Symtom5 TEXT,DiseaseStringVar)")
c.execute("INSERT INTO
RandomForest(Name,Symtom1,Symtom2,Symtom3,Symtom4,Symtom5,Disease)
VALUES(?,?,?,?,?,?,?)",(NameEn.get(),Symptom1.get(),Symptom2.get(),Symptom3.get(
),Symptom4.get(),Symptom5.get(),pred2.get()))
conn.commit()
c.close()
```

```
conn.close()
        #printing scatter plot of disease predicted vs its symptoms
scatterplt(pred2.get())

pred4=StringVar()
def KNN():
    if len(NameEn.get()) == 0:
        pred1.set(" ")
        comp=messagebox.askokcancel("System","Kindly Fill the Name")
        if comp:
root.mainloop()
elif((Symptom1.get()=="Select Here") or (Symptom2.get()=="Select Here")):
        pred1.set(" ")
sym=messagebox.askokcancel("System","Kindly Fill atleast first two Symptoms")
        if sym:
root.mainloop()
    else:
        from sklearn.neighbors import KNeighborsClassifier
knn=KNeighborsClassifier(n_neighbors=5,metric='minkowski',p=2)
knn=knn.fit(X,np.ravel(y))

        from sklearn.metrics import classification_report,confusion_matrix,accuracy_score
y_pred=knn.predict(X_test)
        print("kNearestNeighbour")
        print("Accuracy")
        print(accuracy_score(y_test, y_pred))
        print(accuracy_score(y_test, y_pred,normalize=False))
        print("Confusion matrix")
conf_matrix=confusion_matrix(y_test,y_pred)
        print(conf_matrix)

psymptoms =
[Symptom1.get(),Symptom2.get(),Symptom3.get(),Symptom4.get(),Symptom5.get()]

for k in range(0,len(l1)):
            for z in psymptoms:
                if(z==l1[k]):
                    l2[k]=1
```

```
inputtest = [l2]
        predict = knn.predict(inputtest)
        predicted=predict[0]

        h='no'
        for a in range(0,len(disease)):
            if(predicted == a):
                h='yes'
                break


        if (h=='yes'):
            pred4.set(" ")
            pred4.set(disease[a])
        else:
            pred4.set(" ")
            pred4.set("Not Found")
         #Creating the database if not exists named as database.db and creating table if not
exists named as KNearestNeighbour using sqlite3
        import sqlite3
        conn = sqlite3.connect('database.db')
        c = conn.cursor()
c.execute("CREATE TABLE IF NOT EXISTS KNearestNeighbour(Name
StringVar,Symtom1 StringVar,Symtom2 StringVar,Symtom3 StringVar,Symtom4
TEXT,Symtom5 TEXT,DiseaseStringVar)")
c.execute("INSERT INTO
KNearestNeighbour(Name,Symtom1,Symtom2,Symtom3,Symtom4,Symtom5,Disease)
VALUES(?,?,?,?,?,?,?)",(NameEn.get(),Symptom1.get(),Symptom2.get(),Symptom3.get(
),Symptom4.get(),Symptom5.get(),pred4.get()))
conn.commit()
c.close()
conn.close()
        #printing scatter plot of disease predicted vs its symptoms
scatterplt(pred4.get())

pred3=StringVar()
defNaiveBayes():
    if len(NameEn.get()) == 0:
        pred1.set(" ")
```

```
        comp=messagebox.askokcancel("System","Kindly Fill the Name")
        if comp:
root.mainloop()
elif((Symptom1.get()=="Select Here") or (Symptom2.get()=="Select Here")):
        pred1.set(" ")
sym=messagebox.askokcancel("System","Kindly Fill atleast first two Symptoms")
        if sym:
root.mainloop()
    else:
        from sklearn.naive_bayes import GaussianNB
gnb = GaussianNB()
gnb=gnb.fit(X,np.ravel(y))

        from sklearn.metrics import classification_report,confusion_matrix,accuracy_score
y_pred=gnb.predict(X_test)
        print("Naive Bayes")
        print("Accuracy")
        print(accuracy_score(y_test, y_pred))
        print(accuracy_score(y_test, y_pred,normalize=False))
        print("Confusion matrix")
conf_matrix=confusion_matrix(y_test,y_pred)
        print(conf_matrix)
psymptoms =
[Symptom1.get(),Symptom2.get(),Symptom3.get(),Symptom4.get(),Symptom5.get()]
for k in range(0,len(l1)):
            for z in psymptoms:
                if(z==l1[k]):
                    l2[k]=1

inputtest = [l2]
        predict = gnb.predict(inputtest)
        predicted=predict[0]

        h='no'
        for a in range(0,len(disease)):
            if(predicted == a):
                h='yes'
                break
        if (h=='yes'):
```

```
            pred3.set(" ")
            pred3.set(disease[a])
        else:
            pred3.set(" ")
            pred3.set("Not Found")
         #Creating the database if not exists named as database.db and creating table if not
exists named as NaiveBayes using sqlite3
        import sqlite3
        conn = sqlite3.connect('database.db')
        c = conn.cursor()
c.execute("CREATE TABLE IF NOT EXISTS NaiveBayes(Name StringVar,Symtom1
StringVar,Symtom2 StringVar,Symtom3 StringVar,Symtom4 TEXT,Symtom5
TEXT,DiseaseStringVar)")
c.execute("INSERT INTO
NaiveBayes(Name,Symtom1,Symtom2,Symtom3,Symtom4,Symtom5,Disease)
VALUES(?,?,?,?,?,?,?)",(NameEn.get(),Symptom1.get(),Symptom2.get(),Symptom3.get(
),Symptom4.get(),Symptom5.get(),pred3.get()))
conn.commit()
c.close()
conn.close()
        #printing scatter plot of disease predicted vs its symptoms
scatterplt(pred3.get())

#Tk class is used to create a root window
root.configure(background='white')
root.title('Smart Disease Predictor System')
root.resizable(0,0)

Symptom1 = StringVar()
Symptom1.set("Select Here")

Symptom2 = StringVar()
Symptom2.set("Select Here")

Symptom3 = StringVar()
Symptom3.set("Select Here")

Symptom4 = StringVar()
Symptom4.set("Select Here")
```

```
Symptom5 = StringVar()
Symptom5.set("Select Here")
Name = StringVar()

prev_win=None
def Reset():
    global prev_win

    Symptom1.set("Select Here")
    Symptom2.set("Select Here")
    Symptom3.set("Select Here")
    Symptom4.set("Select Here")
    Symptom5.set("Select Here")
NameEn.delete(first=0,last=100)
    pred1.set(" ")
    pred2.set(" ")
    pred3.set(" ")
    pred4.set(" ")
    try:
prev_win.destroy()
prev_win=None
    except
        AttributeError:pass
```

```
#Showing the output of different aldorithms
t1=Label(root,font=("Times",15,"bold italic"),text="Decision Tree",height=1,bg="Light
green"
      ,width=40,fg="black",textvariable=pred1,relief="sunken").grid(row=15, column=1,
padx=10)

t2=Label(root,font=("Times",15,"bold italic"),text="Random Forest",height=1,bg="Light
green"
      ,width=40,fg="black",textvariable=pred2,relief="sunken").grid(row=17, column=1,
padx=10)

t3=Label(root,font=("Times",15,"bold italic"),text="Naive Bayes",height=1,bg="Light
green"
      ,width=40,fg="black",textvariable=pred3,relief="sunken").grid(row=19, column=1,
padx=10)

t4=Label(root,font=("Times",15,"bold
italic"),text="kNearestNeighbour",height=1,bg="Light green"
      ,width=40,fg="black",textvariable=pred4,relief="sunken").grid(row=21, column=1,
padx=10)


#calling this function because the application is ready to run
root.mainloop()
```

Compiled Report for Disease Prediction using Symptoms

```
#Importing Libraries
from mpl_toolkits.mplot3d import Axes3D
from sklearn.preprocessing import StandardScaler
import matplotlib.pyplot as plt
from tkinter import *
import numpy as np
import pandas as pd
import os
```

These are the imported libraries that are utilized to use various tools that are available in that specific library. Tkinter is used to build a Graphical User Interface in Python.

```
#List of the symptoms is listed here in list l1.

l1=['back_pain','constipation','abdominal_pain','diarrhoea','mild_fever','yellow_urine',
    'yellowing_of_eyes','acute_liver_failure','fluid_overload','swelling_of_stomach',
    'swelled_lymph_nodes','malaise','blurred_and_distorted_vision','phlegm','throat_irritation',
    'redness_of_eyes','sinus_pressure','runny_nose','congestion','chest_pain','weakness_in_limbs',
    'fast_heart_rate','pain_during_bowel_movements','pain_in_anal_region','bloody_stool',
    'irritation_in_anus','neck_pain','dizziness','cramps','bruising','obesity','swollen_legs',
    'swollen_blood_vessels','puffy_face_and_eyes','enlarged_thyroid','brittle_nails',
    'swollen_extremeties','excessive_hunger','extra_marital_contacts','drying_and_tingling_lips',
    'slurred_speech','knee_pain','hip_joint_pain','muscle_weakness','stiff_neck','swelling_joints',
    'movement_stiffness','spinning_movements','loss_of_balance','unsteadiness',
    'weakness_of_one_body_side','loss_of_smell','bladder_discomfort','foul_smell_of urine',
    'continuous_feel_of_urine','passage_of_gases','internal_itching','toxic_look_(typhos)',
    'depression','irritability','muscle_pain','altered_sensorium','red_spots_over_body','belly_pain',
    'abnormal_menstruation','dischromic _patches','watering_from_eyes','increased_appetite','polyuria',
    'family_history','mucoid_sputum','rusty_sputum','lack_of_concentration','visual_disturbances',
    'receiving_blood_transfusion','receiving_unsterile_injections','coma','stomach_bleeding','distention_of_abdomen',
    'history_of_alcohol_consumption','fluid_overload','blood_in_sputum','prominent_veins_on_calf',
    'palpitations','painful_walking','pus_filled_pimples','blackheads','scurring','skin_peeling',
    'silver_like_dusting','small_dents_in_nails','inflammatory_nails','blister','red_sore_around_nose',
    'yellow_crust_ooze']
```

L1 is the list made for various Symptoms which are generally showed up in people for various Diseases.

```
#List of Diseases is listed in list disease.

disease=['Fungal infection','Allergy','GERD','Chronic cholestasis','Drug Reaction',
    'Peptic ulcer diseae','AIDS','Diabetes','Gastroenteritis','Bronchial Asthma','Hypertension',
    ' Migraine','Cervical spondylosis',
    'Paralysis (brain hemorrhage)','Jaundice','Malaria','Chicken pox','Dengue','Typhoid','hepatitis A',
    'Hepatitis B','Hepatitis C','Hepatitis D','Hepatitis E','Alcoholic hepatitis','Tuberculosis',
    'Common Cold','Pneumonia','Dimorphic hemmorhoids(piles)',
    'Heartattack','Varicoseveins','Hypothyroidism','Hyperthyroidism','Hypoglycemia','Osteoarthristis',
    'Arthritis','(vertigo) Paroymsal  Positional Vertigo','Acne','Urinary tract infection','Psoriasis',
    'Impetigo']
```

Disease is the list made for different Diseases which are for the most part appeared in different individuals.

```
l2=[]
for i in range(0,len(l1)):
    l2.append(0)
print(l2)
```

First L2 is the vacant list made. At that point, equivalent to a number of diseases in list L1, L2 is appended in a number of zeroes.

```
#Reading the training .csv file
df=pd.read_csv("training.csv")
#Replace the values in the imported file by pandas by the inbuilt function replace in pandas.
df.replace({'prognosis':{'Fungal infection':0,'Allergy':1,'GERD':2,'Chronic cholestasis':3,'Drug Reaction':4,
    'Peptic ulcer diseae':5,'AIDS':6,'Diabetes ':7,'Gastroenteritis':8,'Bronchial Asthma':9,'Hypertension ':10,
    'Migraine':11,'Cervical spondylosis':12,
    'Paralysis (brain hemorrhage)':13,'Jaundice':14,'Malaria':15,'Chicken pox':16,'Dengue':17,'Typhoid':18,'hepatitis A':19,
    'Hepatitis B':20,'Hepatitis C':21,'Hepatitis D':22,'Hepatitis E':23,'Alcoholic hepatitis':24,'Tuberculosis':25,
    'Common Cold':26,'Pneumonia':27,'Dimorphic hemmorhoids(piles)':28,'Heart attack':29,'Varicose veins':30,'Hypothyroidism':
    'Hyperthyroidism':32,'Hypoglycemia':33,'Osteoarthristis':34,'Arthritis':35,
    '(vertigo) Paroymsal  Positional Vertigo':36,'Acne':37,'Urinary tract infection':38,'Psoriasis':39,
    'Impetigo':40}},inplace=True)
df.head()
```

There is a CSV document containing diseases and symptoms, named training.csv, which is utilized to prepare the model. Read_csv() function is utilized to store the information in the dataframe, named df. Utilizing replace() function, prognosis column that are the different diseases, it is replaced by the numbers from 0 to n-1, where n is the number of different diseases present in .csv record. Head() function is utilized to print the initial five rows of the preparation dataframe.

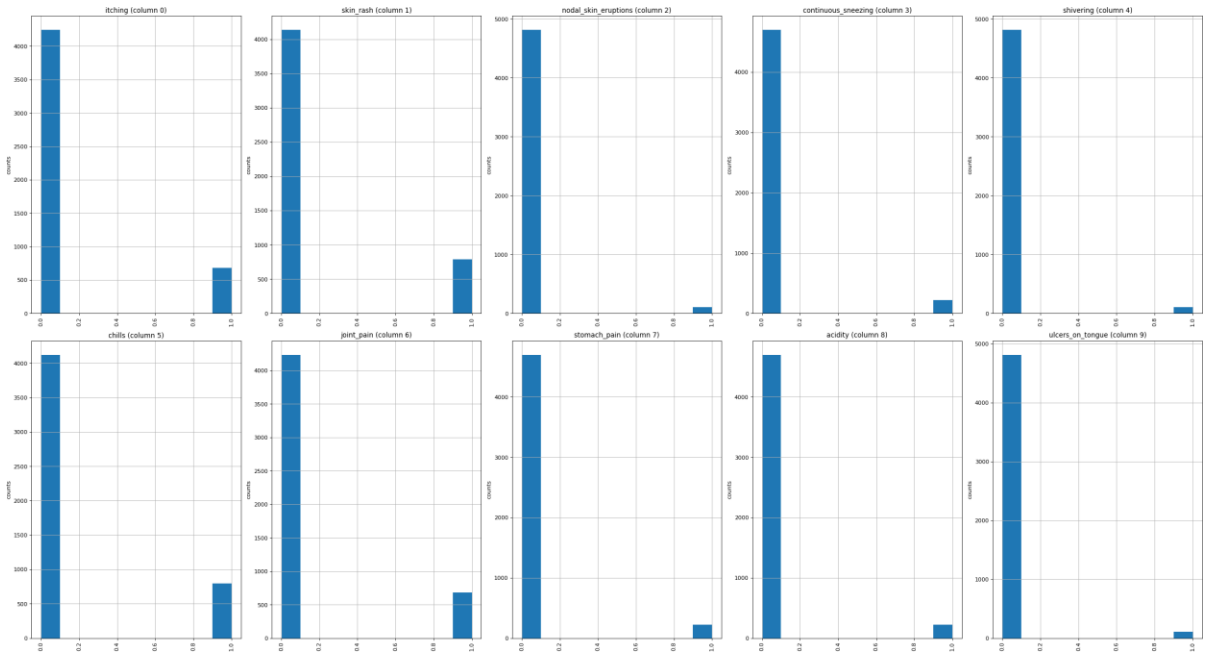
	itching	skin_rash	nodal_skin_eruptions	continuous_sneezing	shivering	chills	joint_pain	stomach_pain	acidity	ulcers_on_tongue	...	blackheads	scurri
0	1	1	1	0	0	0	0	0	0	0	...	0	
1	0	1	1	0	0	0	0	0	0	0	...	0	
2	1	0	1	0	0	0	0	0	0	0	...	0	
3	1	1	0	0	0	0	0	0	0	0	...	0	
4	1	1	1	0	0	0	0	0	0	0	...	0	

5 rows × 133 columns

This is the output produced which contains the initial five rows of the dataframe df.

```
# Distribution graphs (histogram/bar graph) of column data
def plotPerColumnDistribution(df1, nGraphShown, nGraphPerRow):
    nunique = df1.nunique()
    df1 = df1[[col for col in df if nunique[col] > 1 and nunique[col] < 50]] # For displaying purposes, pick columns that have b
    nRow, nCol = df1.shape
    columnNames = list(df1)
    nGraphRow = (nCol + nGraphPerRow - 1) / nGraphPerRow
    plt.figure(num = None, figsize = (6 * nGraphPerRow, 8 * nGraphRow), dpi = 80, facecolor = 'w', edgecolor = 'k')
    for i in range(min(nCol, nGraphShown)):
        plt.subplot(nGraphRow, nGraphPerRow, i + 1)
        columnDf = df.iloc[:, i]
        if (not np.issubdtype(type(columnDf.iloc[0]), np.number)):
            valueCounts = columnDf.value_counts()
            valueCounts.plot.bar()
        else:
            columnDf.hist()
        plt.ylabel('counts')
        plt.xticks(rotation = 90)
        plt.title(f'{columnNames[i]} (column {i})')
    plt.tight_layout(pad = 1.0, w_pad = 1.0, h_pad = 1.0)
    plt.show()
plotPerColumnDistribution(df, 10, 5)
```

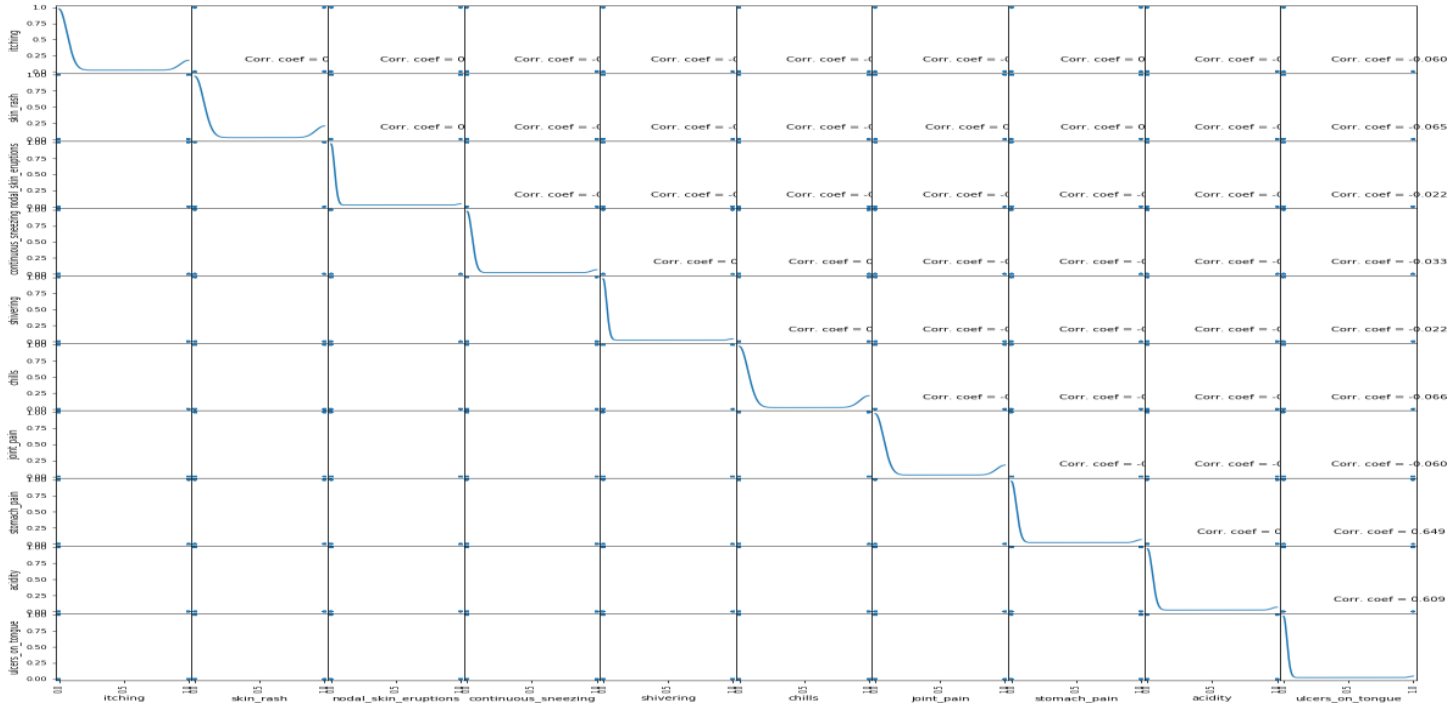
This is the code for the distribution graph of the columns of training.csv file.



Output for the distribution graph of the columns of training.csv file.

```
# Scatter and density plots
def plotScatterMatrix(df1, plotSize, textSize):
    df1 = df1.select_dtypes(include =[np.number]) # keep only numerical columns
    # Remove rows and columns that would lead to df being singular
    df1 = df1.dropna('columns')
    df1 = df1[[col for col in df if df[col].nunique() > 1]] # keep columns where there are more than 1 unique values
    columnNames = list(df)
    if len(columnNames) > 10: # reduce the number of columns for matrix inversion of kernel density plots
        columnNames = columnNames[:10]
    df1 = df1[columnNames]
    ax = pd.plotting.scatter_matrix(df1, alpha=0.75, figsize=[plotSize, plotSize], diagonal='kde')
    corrs = df1.corr().values
    for i, j in zip(*plt.np.triu_indices_from(ax, k = 1)):
        ax[i, j].annotate('Corr. coef = %.3f' % corrs[i, j], (0.8, 0.2), xycoords='axes fraction', ha='center', va='center', siz
    plt.suptitle('Scatter and Density Plot')
    plt.show()
plotScatterMatrix(df, 20, 10)
```

This is the code for the scatter and density plots of the columns of training.csv file.



Putting the Symptoms in X and prognosis/diseases in y for training the model.

	back_pain	constipation	abdominal_pain	diarrhoea	mild_fever	\
0	0	0	0	0	0	
1	0	0	0	0	0	
2	0	0	0	0	0	
3	0	0	0	0	0	
4	0	0	0	0	0	
5	0	0	0	0	0	
6	0	0	0	0	0	
7	0	0	0	0	0	
8	0	0	0	0	0	
9	0	0	0	0	0	
10	0	0	0	0	0	
11	0	0	0	0	0	
12	0	0	0	0	0	
13	0	0	0	0	0	
14	0	0	0	0	0	
15	0	0	0	0	0	
16	0	0	0	0	0	
17	0	0	0	0	0	
18	0	0	0	0	0	

Output for the print(X) in which different symptoms has the values ‘0’ or ‘1’ according to their presencein

the particular diseases

```
print(y)
```

```
    prognosis
0           0
1           0
2           0
3           0
4           0
5           0
6           0
7           0
8           0
9           0
10          1
11          1
12          1
13          1
14          1
15          1
16          1
17          1
18          1
19          1
20          2
21          2
```

Output for the print(y) in which different disease has values according to their symptoms 1

To build the precision of the model, we utilized four distinctive algorithms which are as per the following

- Decision Tree algorithm
- Random Forest algorithm
- KNearestNeighbour algorithm
- Naive Bayes algorithm

```
#list1 = DF['prognosis'].unique()
def scatterplt(disea):
    x = ((DF.loc[disea]).sum())#total sum of symptom reported for given disease
    x.drop(x[x==0].index,inplace=True)#droping symptoms with values 0
    print(x.values)
    y = x.keys()#storing nameof symptoms in y
    print(len(x))
    print(len(y))
    plt.title(disea)
    plt.scatter(y,x.values)
    plt.show()

def scatterinp(sym1,sym2,sym3,sym4,sym5):
    x = [sym1,sym2,sym3,sym4,sym5]#storing input symptoms in y
    y = [0,0,0,0,0]#creating and giving values to the input symptoms
    if(sym1!='Select Here'):
        y[0]=1
    if(sym2!='Select Here'):
        y[1]=1
    if(sym3!='Select Here'):
        y[2]=1
    if(sym4!='Select Here'):
        y[3]=1
    if(sym5!='Select Here'):
        y[4]=1
    print(x)
    print(y)
    plt.scatter(x,y)
    plt.show()
```

These are the function to plot the scatterplot of the predictions of the diseases and the symptoms enteredby the user.

Decision Tree Function:

```
root = Tk()
pred1=StringVar()
def DecisionTree():
```

Root=Tk() is used to for start working with the tkinter to build the gui. Definition of DecisionTree()

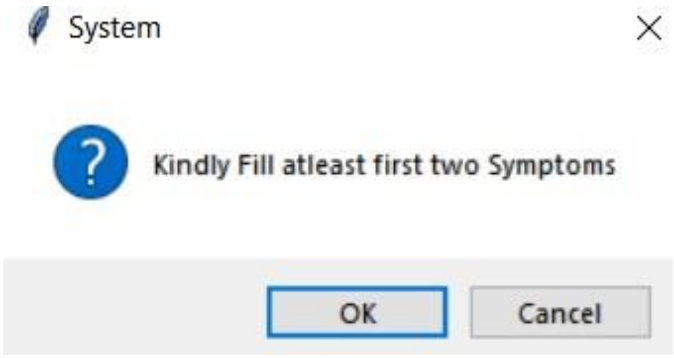
function. “pred1” is used to store the predicted disease using decision tree algorithm.

```
if len(NameEn.get()) == 0:
    pred1.set(" ")
    comp=messagebox.askokcancel("System","Kindly Fill the Name")
    if comp:
        root.mainloop()
```

If user tries to run the gui without entering the name, then System will prompt the following message.


```
elif((Symptom1.get()=="Select Here") or (Symptom2.get()=="Select Here")):
    pred1.set(" ")
    sym=messagebox.askokcancel("System","Kindly Fill atleast first two Symptoms")
    if sym:
        root.mainloop()
```

After filling the name, user have to fill five symptoms and out of which first two are compulsory. Ifuser will not select atleast two symptoms, then following message will be prompt from the system



```
from sklearn import tree
clf3 = tree.DecisionTreeClassifier()
clf3 = clf3.fit(X,y)
from sklearn.metrics import classification_report,confusion_matrix,accuracy_score
y_pred=clf3.predict(X_test)
print("Decision Tree")
print("Accuracy")
print(accuracy_score(y_test, y_pred))
print(accuracy_score(y_test, y_pred,normalize=False))
print("Confusion matrix")
conf_matrix=confusion_matrix(y_test,y_pred)
print(conf_matrix)
psymptoms = [Symptom1.get(),Symptom2.get(),Symptom3.get(),Symptom4.get(),Symptom5.get()]
for k in range(0,len(l1)):
    for z in psymptoms:
        if(z==l1[k]):
            l2[k]=1
inputtest = [l2]
predict = clf3.predict(inputtest)
predicted=predict[0]

h='no'
for a in range(0,len(disease)):
    if(predicted == a):
        h='yes'
        break
if (h=='yes'):
    pred1.set(" ")
    pred1.set(disease[a])
else:
    pred1.set(" ")
    pred1.set("Not Found")
```

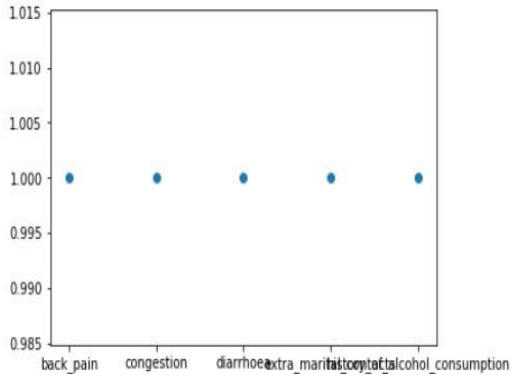
DecisionTreeClassifier() is used to train the model and predict the disease on testing dataset according to symptoms entered by the user. Final disease for decision tree is stored in a variable named “pred1”. Accuracy of predicting the disease is printed using accuracy_score and confusion matrix is created using confusion_matrix which are imported from sklearn.metrices.

```
#Creating the database if not exists named as database.db and creating table if not exists named as DecisionTree using sqlite3
import sqlite3
conn = sqlite3.connect('database.db')
c = conn.cursor()
c.execute("CREATE TABLE IF NOT EXISTS DecisionTree(Name StringVar,Symtom1 StringVar,Symtom2 StringVar,Symtom3 StringVar,Symtom
c.execute("INSERT INTO DecisionTree(Name,Symtom1,Symtom2,Symtom3,Symtom4,Symtom5,Disease) VALUES(?,?,?,?,?,?,?)",(NameEn.get()
conn.commit()
c.close()
conn.close()
```

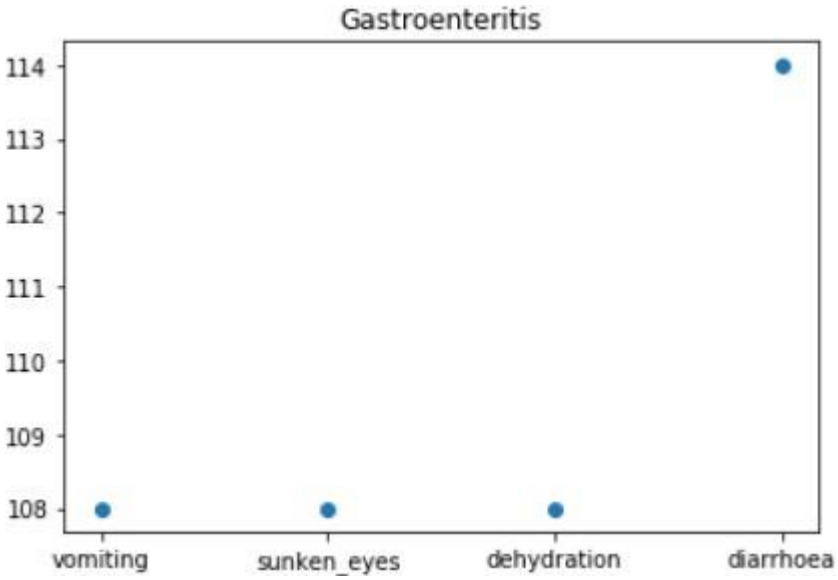
Creating a database named “database.db”, if not exists, using “sqlite3” database. For storing data for decision tree algorithm "DecisionTree" table is created, if not exists, in database.db using “CREATE” function in sqlite. Values are inserted in DecisionTree table using “INSERT” function in sqlite

```
#printing scatter plot of input symptoms
#printing scatter plot of disease predicted vs its symptoms
scatterinp(Symptom1.get(),Symptom2.get(),Symptom3.get(),Symptom4.get(),Symptom5.get())
scatterplt(pred1.get())
```

```
['back_pain', 'congestion', 'diarrhoea', 'extra_marital_contacts', 'history_of_alcohol_consumption']
[1, 1, 1, 1, 1]
```



The scatterplot for the symptoms which are given by the user as input



The scatter plot for the disease on the basis of symptoms which given by the user as input

Random Forest function:

```
pred2=StringVar()
def randomforest():
```

Definition of randomforest() function. “pred2” is used to store the predicted disease using random forest algorithm.

```
from sklearn.ensemble import RandomForestClassifier
clf4 = RandomForestClassifier(n_estimators=100)
clf4 = clf4.fit(X,np.ravel(y))
# calculating accuracy
from sklearn.metrics import classification_report,confusion_matrix,accuracy_score
y_pred=clf4.predict(X_test)
print("Random Forest")
print("Accuracy")
print(accuracy_score(y_test, y_pred))
print(accuracy_score(y_test, y_pred,normalize=False))
print("Confusion matrix")
conf_matrix=confusion_matrix(y_test,y_pred)
print(conf_matrix)
psymptoms = [Symptom1.get(),Symptom2.get(),Symptom3.get(),Symptom4.get(),Symptom5.get()]
for k in range(0,len(l1)):
    for z in psymptoms:
        if(z==l1[k]):
            l2[k]=1
inputtest = [l2]
predict = clf4.predict(inputtest)
predicted=predict[0]
h='no'
for a in range(0,len(disease)):
    if(predicted == a):
        h='yes'
        break
if (h=='yes'):
    pred2.set(" ")
    pred2.set(disease[a])
else:
    pred2.set(" ")
    pred2.set("Not Found")
```

RandomForestClassifier() is used to train the model and predict the disease on testing dataset accordingto symptoms entered by the user. Final disease for random forest is stored in a variable named “pred2”. Accuracy of predicting the disease is calculated using accuracy_score and confusion matrix is created using confusion_matrix which are imported from sklearn.metrices.

```
 #Creating the database if not exists named as database.db and creating table if not exists named as RandomForest using sqlite3
import sqlite3
conn = sqlite3.connect('database.db')
c = conn.cursor()
c.execute("CREATE TABLE IF NOT EXISTS RandomForest(Name StringVar,Symtom1 StringVar,Symtom2 StringVar,Symtom3 StringVar,Symtom4
c.execute("INSERT INTO RandomForest(Name,Symtom1,Symtom2,Symtom3,Symtom4,Symtom5,Disease) VALUES(?,?,?,?,?,?,?)",(NameEn.get(),
conn.commit()
c.close()
conn.close()
```

Same database is used i.e.,database.db that is used in decision tree algorithm with different table for random forest algorithm which is name as “RandomForest”.

kNearest Neighbour function:

```
pred4=StringVar()
def KNN():
    if len(NameEn.get()) == 0:
```

Definition of KNN() function. “pred4” is used to store the predicted disease using kNearestNeighbour algorithm.

```
from sklearn.neighbors import KNeighborsClassifier
knn=KNeighborsClassifier(n_neighbors=5,metric='minkowski',p=2)
knn=knn.fit(X,np.ravel(y))
from sklearn.metrics import classification_report,confusion_matrix,accuracy_score
y_pred=knn.predict(X_test)
print("kNearest Neighbour")
print("Accuracy")
print(accuracy_score(y_test, y_pred))
print(accuracy_score(y_test, y_pred,normalize=False))
print("Confusion matrix")
conf_matrix=confusion_matrix(y_test,y_pred)
print(conf_matrix)
psymptoms = [Symptom1.get(),Symptom2.get(),Symptom3.get(),Symptom4.get(),Symptom5.get()]
for k in range(0,len(l1)):
    for z in psymptoms:
        if(z==l1[k]):
            l2[k]=1
inputtest = [l2]
predict = knn.predict(inputtest)
predicted=predict[0]
h='no'
for a in range(0,len(disease)):
    if(predicted == a):
        h='yes'
        break
if (h=='yes'):
    pred4.set(" ")
    pred4.set(disease[a])
else:
    pred4.set(" ")
    pred4.set("Not Found")
```

KNeighboursClassifier() is used to train the model and predict the disease on testing dataset according to symptoms entered by the user. Final disease for kNearestNeighbour is stored in a variable named “pred4”. Accuracy of predicting the disease is calculated using accuracy_score and confusion matrix is created using confusion_matrix which are imported from sklearn.metrices.

```
#Creating the database if not exists named as database.db and creating table if not exists named as KNearestNeighbour using sql
import sqlite3
conn = sqlite3.connect('database.db')
c = conn.cursor()
c.execute("CREATE TABLE IF NOT EXISTS KNearestNeighbour(Name StringVar,Symtom1 StringVar,Symtom2 StringVar,Symtom3 StringVar,Sym
c.execute("INSERT INTO KNearestNeighbour(Name,Symtom1,Symtom2,Symtom3,Symtom4,Symtom5,Disease) VALUES(?,?,?,?,?,?,?)",(NameEn.ge
conn.commit()
c.close()
conn.close()
```

Same database is used i.e.,database.db that is used in all previous algorithms with different table for kNearest Neighbour algorithm which is name as “KNearestNeighbour”.

Naïve Bayes function:

```
pred3=StringVar()
def NaiveBayes():
```

Definition of NaiveBayes() function. “pred3” is used to store the predicted disease using Naïve Bayes algorithm.

```
from sklearn.naive_bayes import GaussianNB
gnb = GaussianNB()
gnb=gnb.fit(X,np.ravel(y))
from sklearn.metrics import classification_report,confusion_matrix,accuracy_score
y_pred=gnb.predict(X_test)
print("Naive Bayes")
print("Accuracy")
print(accuracy_score(y_test, y_pred))
print(accuracy_score(y_test, y_pred,normalize=False))
print("Confusion matrix")
conf_matrix=confusion_matrix(y_test,y_pred)
print(conf_matrix)
psymptoms = [Symptom1.get(),Symptom2.get(),Symptom3.get(),Symptom4.get(),Symptom5.get()]
for k in range(0,len(l1)):
    for z in psymptoms:
        if(z==l1[k]):
            l2[k]=1
inputtest = [l2]
predict = gnb.predict(inputtest)
predicted=predict[0]
h='no'
for a in range(0,len(disease)):
    if(predicted == a):
        h='yes'
        break
if (h=='yes'):
    pred3.set(" ")
    pred3.set(disease[a])
else:
    pred3.set(" ")
    pred3.set("Not Found")
```

GaussianNB() is used to train the model and predict the disease on testing dataset according to symptoms entered by the user. Final disease for Naïve Bayes is stored in a variable named “pred3”. Accuracy of predicting the disease is calculated using accuracy_score and confusion matrix is created using confusion_matrix which are imported from sklearn.metrices

```
 #Creating the database if not exists named as database.db and creating table if not exists named as NaiveBayes using sqlite3
import sqlite3
conn = sqlite3.connect('database.db')
c = conn.cursor()
c.execute("CREATE TABLE IF NOT EXISTS NaiveBayes(Name StringVar,Symtom1 StringVar,Symtom2 StringVar,Symtom3 StringVar,Symtom4 TE
c.execute("INSERT INTO NaiveBayes(Name,Symtom1,Symtom2,Symtom3,Symtom4,Symtom5,Disease) VALUES(?,?,?,?,?,?,?)",(NameEn.get(),Sym
conn.commit()
c.close()
conn.close()
```

Same databse is used i.e.,databse.db that is used in all previous algorithms with different table for Naïve Bayes algorithm which is name as “NaiveBayes”.

Building the Graphical User Interface:

```
#Tk class is used to create a root window
root.configure(background='Ivory')
root.title('Smart Disease Predictor System')
root.resizable(0,0)
```

Graphical User Interface is build using tkinter library in Python. Root is used to start the GUI. It is configured with the background that is set to “Ivory”. GUI tittle is given as “Smart Disease Predictor System” using title() function in tkinter library. Resizable function is used to fix the size GUI.

```
Symptom1 = StringVar()
Symptom1.set("Select Here")

Symptom2 = StringVar()
Symptom2.set("Select Here")

Symptom3 = StringVar()
Symptom3.set("Select Here")

Symptom4 = StringVar()
Symptom4.set("Select Here")

Symptom5 = StringVar()
Symptom5.set("Select Here")
Name = StringVar()
```

Here, variables are defined like Name, Symptom1, Symptom2, etc and they initialised to “Select Here” using set() function in tkinter library.

This is how the above variables are looking like in GUI.

```
prev_win=None
def Reset():
    global prev_win

    Symptom1.set("Select Here")
    Symptom2.set("Select Here")
    Symptom3.set("Select Here")
    Symptom4.set("Select Here")
    Symptom5.set("Select Here")
    NameEn.delete(first=0,last=100)
    pred1.set(" ")
    pred2.set(" ")
    pred3.set(" ")
    pred4.set(" ")
    try:
        prev_win.destroy()
        prev_win=None
    except AttributeError:
```

It is the definition of the function “Reset()” which is used to reset the GUI inputs which are given bythe user. It is called when user click on the button “Reset Inputs” from the GUI.

“Reset Inputs” button in GUI

```
from tkinter import messagebox
def Exit():
    qExit=messagebox.askyesno("System","Do you want to exit the system")

    if qExit:
        root.destroy()
        exit()
```

It is the definition of the function “Exit()” which is used to come out from the GUI. It is called whenuser click on the button “Exit System” from the GUI.

“Exit System” button in GUI

```
#Headings for the GUI written at the top of GUI
w2 = Label(root, justify=LEFT, text="Disease Predictor using Machine Learning", fg="Red", bg="Ivory")
w2.config(font=("Times",30,"bold italic"))
w2.grid(row=1, column=0, columnspan=2, padx=100)
w2 = Label(root, justify=LEFT, text="Contributors: Sudhanshu,Rohan,Aditya", fg="Pink", bg="Ivory")
w2.config(font=("Times",30,"bold italic"))
w2.grid(row=2, column=0, columnspan=2, padx=100)
```

“W2” is the label created for showing the headings in the GUI using label() function from tkinter library. Two text are written under label w2 in row1 and row2 with font features as “Times”,”30”,”bold italic”.


```
#Label for the name
NameLb = Label(root, text="Name of the Patient *", fg="Red", bg="Ivory")
NameLb.config(font=("Times",15,"bold italic"))
NameLb.grid(row=6, column=0, pady=15, sticky=W)
```

“NameLb” is the label created for showing the “Name of the Patient *” using label() function in tkinter library. It is configured using config() function and the grid of the label is set using grid() function.

NameLb label in GUI. ‘ * ’ shows that it is compulsory for the user to give his/her name.

```
#Creating Labels for the symtoms
S1Lb = Label(root, text="Symptom 1 *", fg="Black", bg="Ivory")
S1Lb.config(font=("Times",15,"bold italic"))
S1Lb.grid(row=7, column=0, pady=10, sticky=W)

S2Lb = Label(root, text="Symptom 2 *", fg="Black", bg="Ivory")
S2Lb.config(font=("Times",15,"bold italic"))
S2Lb.grid(row=8, column=0, pady=10, sticky=W)

S3Lb = Label(root, text="Symptom 3", fg="Black",bg="Ivory")
S3Lb.config(font=("Times",15,"bold italic"))
S3Lb.grid(row=9, column=0, pady=10, sticky=W)

S4Lb = Label(root, text="Symptom 4", fg="Black", bg="Ivory")
S4Lb.config(font=("Times",15,"bold italic"))
S4Lb.grid(row=10, column=0, pady=10, sticky=W)

S5Lb = Label(root, text="Symptom 5", fg="Black", bg="Ivory")
S5Lb.config(font=("Times",15,"bold italic"))
S5Lb.grid(row=11, column=0, pady=10, sticky=W)
```

These are the labels for showing the Symptoms of the disease. It is created using label() function from tkinter library. Its features are configured using config() function and their grid is set by using grid() function from tkinter library.

```
#Taking name as input from user
NameEn = Entry(root, textvariable=Name)
NameEn.grid(row=6, column=1)

#Taking Symptoms as input from the dropdown from the user
S1 = OptionMenu(root, Symptom1,*OPTIONS)
S1.grid(row=7, column=1)

S2 = OptionMenu(root, Symptom2,*OPTIONS)
S2.grid(row=8, column=1)

S3 = OptionMenu(root, Symptom3,*OPTIONS)
S3.grid(row=9, column=1)

S4 = OptionMenu(root, Symptom4,*OPTIONS)
S4.grid(row=10, column=1)

S5 = OptionMenu(root, Symptom5,*OPTIONS)
S5.grid(row=11, column=1)
```

NameEn is the entry box created for getting the name of the patient using Entry() function in tkinter library. S1, S2, S3, S4, S5 are the option menu used to get symtoms from the user which is created usingOptionmenu

in tkinter library. *OPTIONS is the list of unique symtoms.

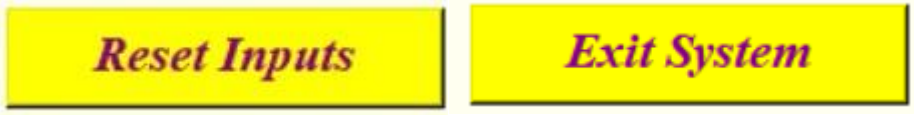
```
#Labels for the different algorithms
lrLb = Label(root, text="DecisionTree", fg="white", bg="red", width = 20)
lrLb.config(font=("Times",15,"bold italic"))
lrLb.grid(row=15, column=0, pady=10,sticky=W)

destreeLb = Label(root, text="RandomForest", fg="Red", bg="Orange", width = 20)
destreeLb.config(font=("Times",15,"bold italic"))
destreeLb.grid(row=17, column=0, pady=10, sticky=W)

ranfLb = Label(root, text="NaiveBayes", fg="White", bg="green", width = 20)
ranfLb.config(font=("Times",15,"bold italic"))
ranfLb.grid(row=19, column=0, pady=10, sticky=W)

knnLb = Label(root, text="kNearestNeighbour", fg="Red", bg="Sky Blue", width = 20)
knnLb.config(font=("Times",15,"bold italic"))
knnLb.grid(row=21, column=0, pady=10, sticky=W)
OPTIONS = sorted(l1)
```

These are the labels created for showing the texts of different algorithms

```
#Buttons for predicting the disease using different algorithms
dst = Button(root, text="Prediction 1", command=DecisionTree,bg="Red",fg="yellow")
dst.config(font=("Times",15,"bold italic"))
dst.grid(row=6, column=3,padx=10)

rnf = Button(root, text="Prediction 2", command=randomforest,bg="Light green",fg="red")
rnf.config(font=("Times",15,"bold italic"))
rnf.grid(row=7, column=3,padx=10)

lr = Button(root, text="Prediction 3", command=NaiveBayes,bg="Blue",fg="white")
lr.config(font=("Times",15,"bold italic"))
lr.grid(row=8, column=3,padx=10)

kn = Button(root, text="Prediction 4", command=KNN,bg="sky blue",fg="red")
kn.config(font=("Times",15,"bold italic"))
kn.grid(row=9, column=3,padx=10)

rs = Button(root,text="Reset Inputs", command=Reset,bg="yellow",fg="purple",width=15)
rs.config(font=("Times",15,"bold italic"))
rs.grid(row=10,column=3,padx=10)

ex = Button(root,text="Exit System", command=Exit,bg="yellow",fg="purple",width=15)
ex.config(font=("Times",15,"bold italic"))
ex.grid(row=11,column=3,padx=10)
```

Buttons created for predicting the disease using different algorithms.

- Press Prediction 1 for Decision tree algorithm
- Press Prediction 2 for Random forest algorithm
- Press Prediction 3 for Naive bayes algorithm
- Press Prediction 4 for K-Nearest neighbour
- Press Reset Inputs for resetting the inputs
- Press Exit System for Exiting from the System

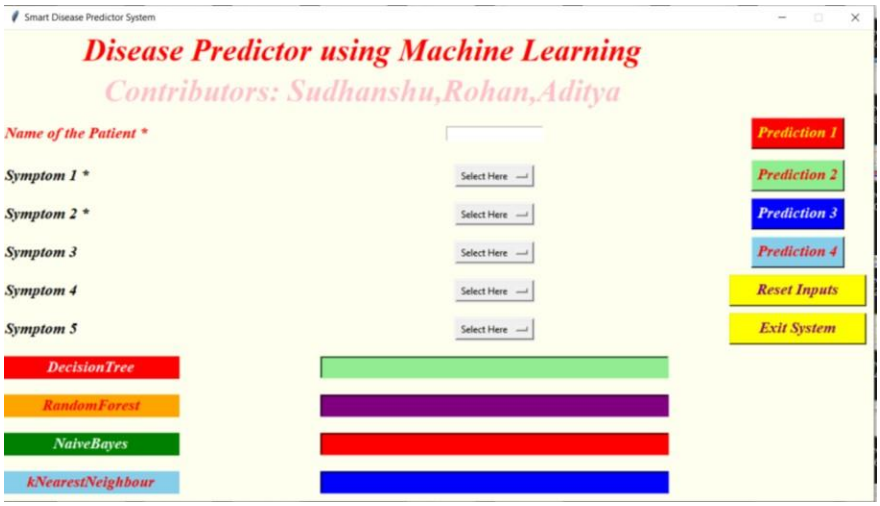


```
#Showing the output of different aldorithms
t1=Label(root,font=("Times",15,"bold italic"),text="Decision Tree",height=1,bg="Light green"
         ,width=40,fg="red",textvariable=pred1,relief="sunken").grid(row=15, column=1, padx=10)

t2=Label(root,font=("Times",15,"bold italic"),text="Random Forest",height=1,bg="Purple"
         ,width=40,fg="white",textvariable=pred2,relief="sunken").grid(row=17, column=1, padx=10)

t3=Label(root,font=("Times",15,"bold italic"),text="Naive Bayes",height=1,bg="red"
         ,width=40,fg="orange",textvariable=pred3,relief="sunken").grid(row=19, column=1, padx=10)

t4=Label(root,font=("Times",15,"bold italic"),text="kNearest Neighbour",height=1,bg="Blue"
         ,width=40,fg="yellow",textvariable=pred4,relief="sunken").grid(row=21, column=1, padx=10)
```

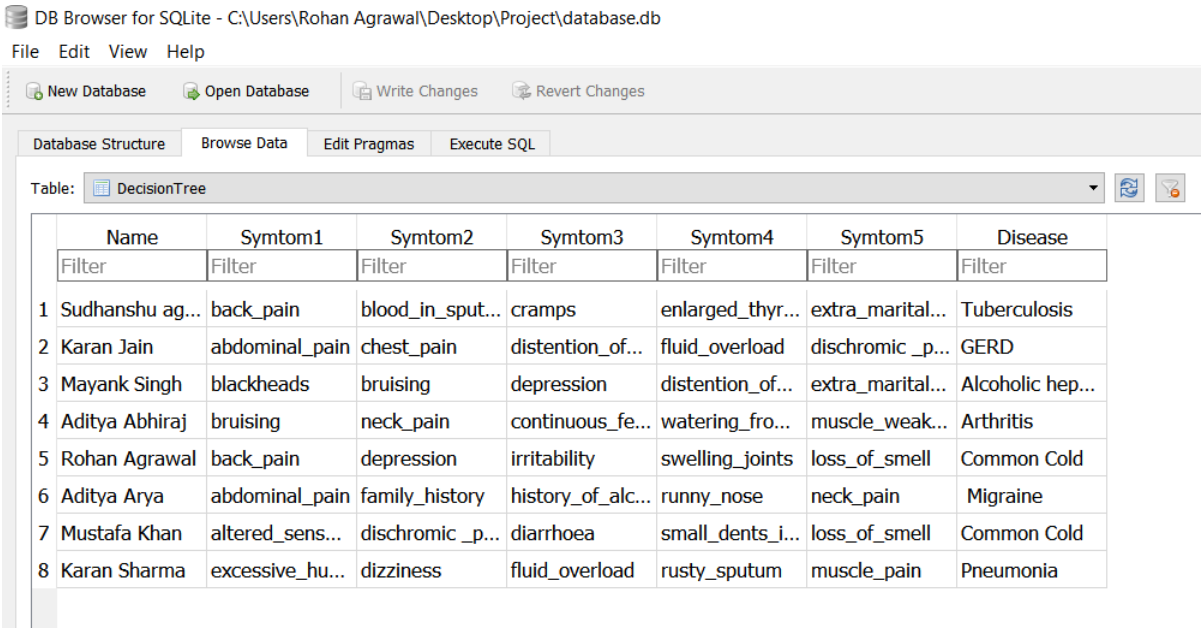
These are label created for showing the predicted disease using different algorithm.


```
#calling this function because the application is ready to run
root.mainloop()
```

This is the calling of the GUI.



The Final GUI presented to the user.



	Name	Symtom1	Symtom2	Symtom3	Symtom4	Symtom5	Disease
	Filter	Filter	Filter	Filter	Filter	Filter	Filter
1	Sudhanshu ag...	back_pain	blood_in_sput...	cramps	enlarged_thyr...	extra_marital...	Tuberculosis
2	Karan Jain	abdominal_pain	chest_pain	distention_of...	fluid_overload	dischromic _p...	GERD
3	Mayank Singh	blackheads	bruising	depression	distention_of...	extra_marital...	Alcoholic hep...
4	Aditya Abhiraj	bruising	neck_pain	continuous_fe...	watering_fro...	muscle_weak...	Arthritis
5	Rohan Agrawal	back_pain	depression	irritability	swelling_joints	loss_of_smell	Common Cold
6	Aditya Arya	abdominal_pain	family_history	history_of_alc...	runny_nose	neck_pain	Migraine
7	Mustafa Khan	altered_sens...	dischromic _p...	diarrhoea	small_dents_i...	loss_of_smell	Common Cold
8	Karan Sharma	excessive_hu...	dizziness	fluid_overload	rusty_sputum	muscle_pain	Pneumonia

The database Created using Sqlite3

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