Thyroid Disease Classification Using ML

TEAM SIZE : 4

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INTRODUCTION

Overview

The Thyroid gland is a vascular gland and one of the most important organs of the human body. This gland secretes two hormones which help in controlling the metabolism of the body.

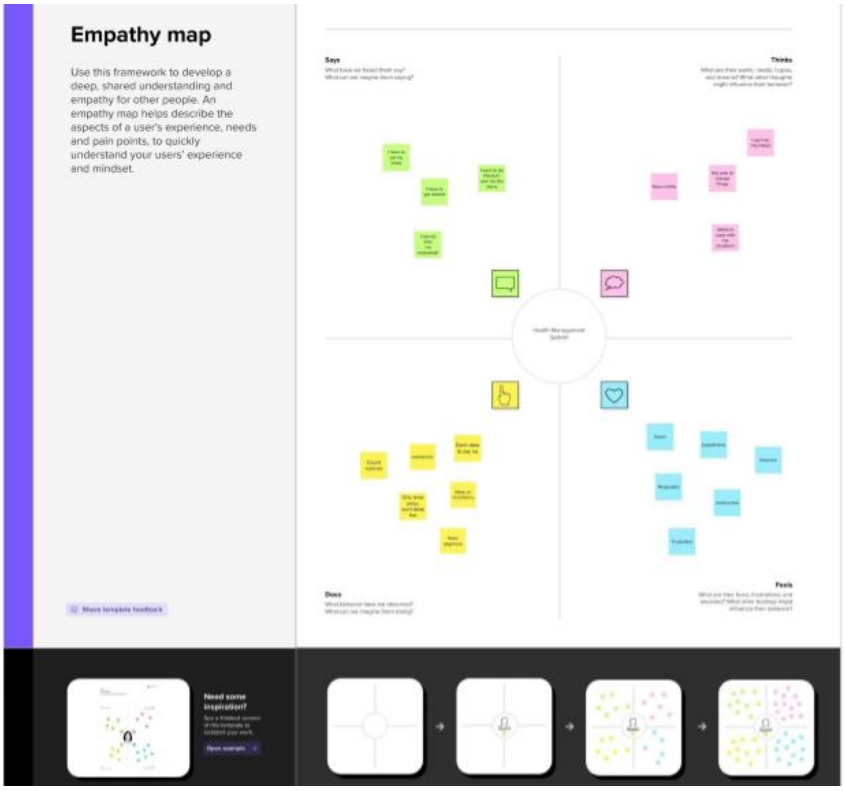
The two types of Thyroid disorders are Hyperthyroidism and Hypothyroidism. When this disorder occurs in the body, they release certain types of hormones into the body which imbalances the body's metabolism. A thyroid-related Blood test is used to detect this disease but it is often blurred and noise will be present. Data cleansing methods were used to make the data primitive enough for the analytics to show the risk of patients getting this disease. Machine Learning plays a very deciding role in disease prediction. Machine Learning algorithms, SVM - support vector machine, Random Forest Classifier, XGB Classifier and ANN - Artificial Neural Networks are used to predict the patient's risk of getting thyroid disease. The web app is created to get data from users to predict the type of disease.

Purpose

The Thyroid gland is a vascular gland and one of the most important organs of the human body. This gland secretes two hormones which help in controlling the metabolism of the body. The two types of Thyroid disorders are Hyperthyroidism and Hypothyroidism. When this disorder occurs in the body, they release certain types of hormones into the body which imbalances the body's metabolism. A thyroid-related Blood test is used to detect this disease but it is often blurred and noise will be present. Data cleansing methods were used to make the data primitive enough for the analytics to show the risk of patients getting this disease. Machine Learning plays a very deciding role in disease prediction. Machine Learning algorithms, SVM - support vector machine, Random Forest Classifier, XGB Classifier and ANN - Artificial Neural Networks are used to predict the patient's risk of getting thyroid disease. The web app is created to get data from users to predict the type of disease.

Problem definition & design thinking

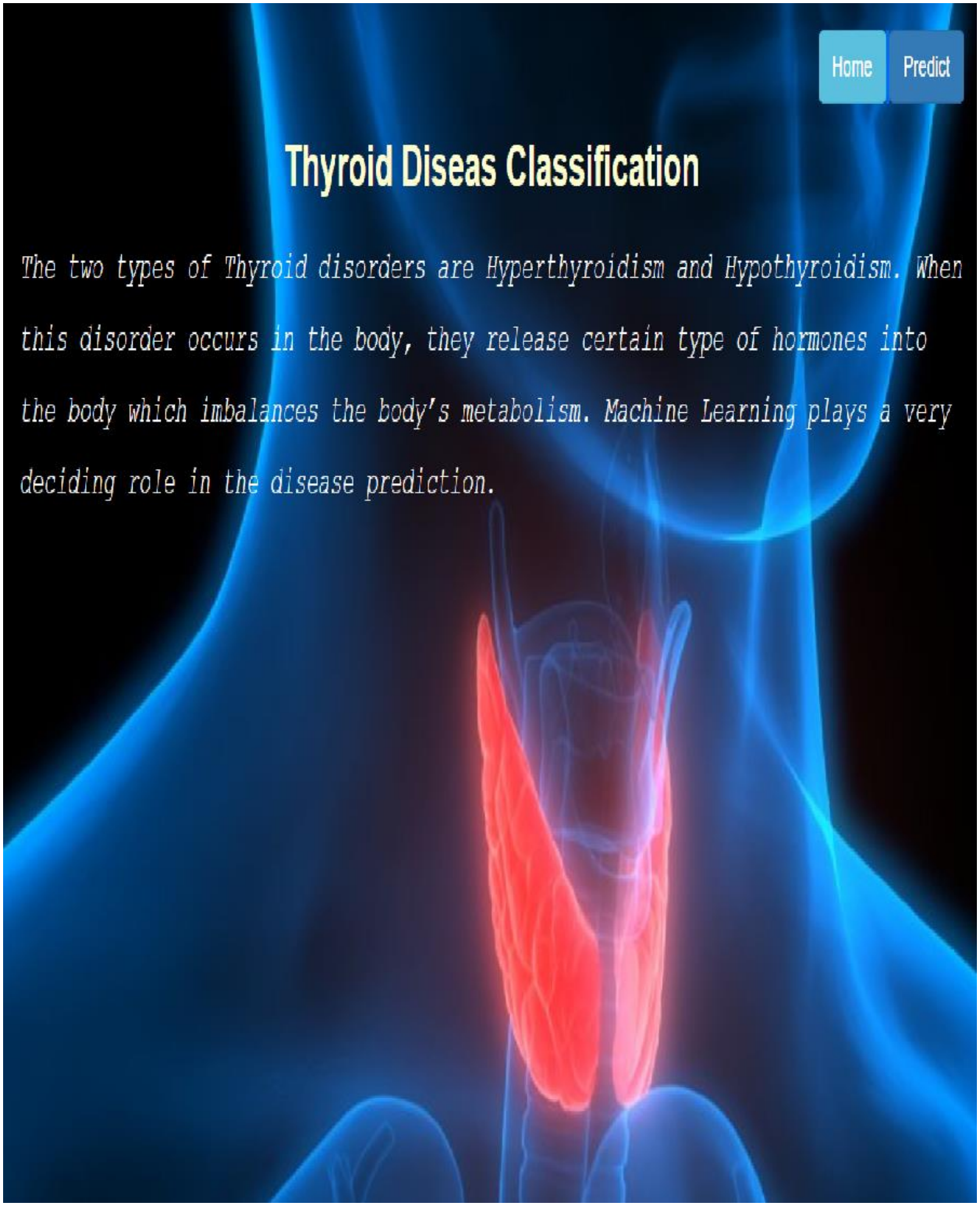
Empathy Map

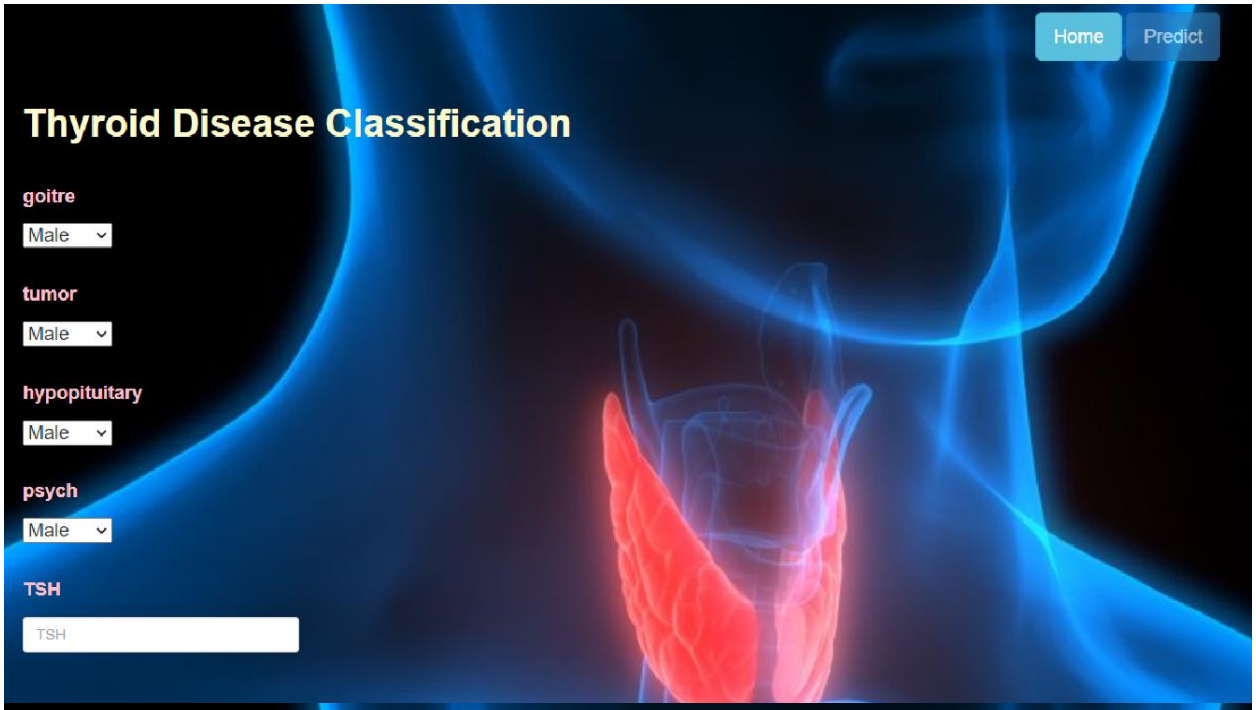


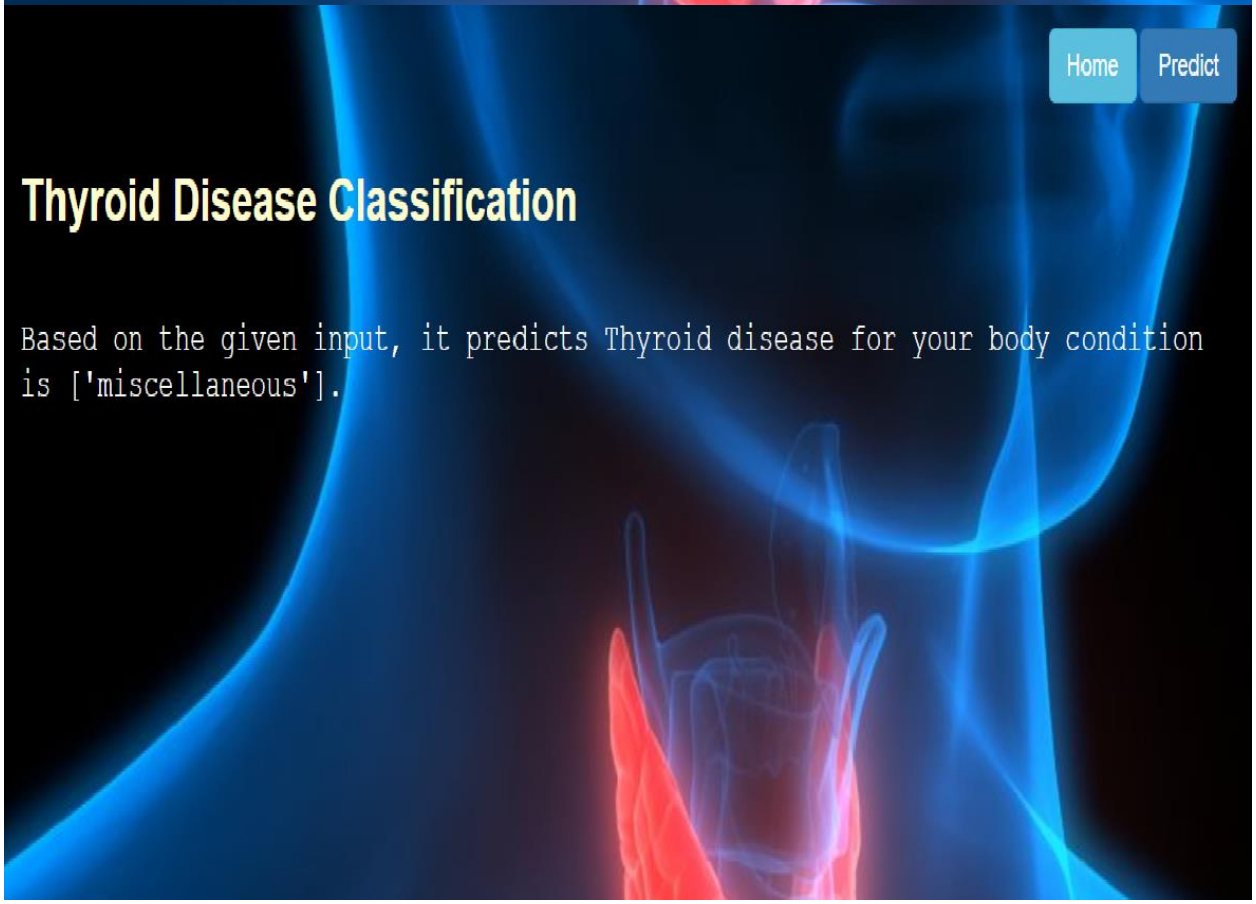
Ideation & Brainstorming Map

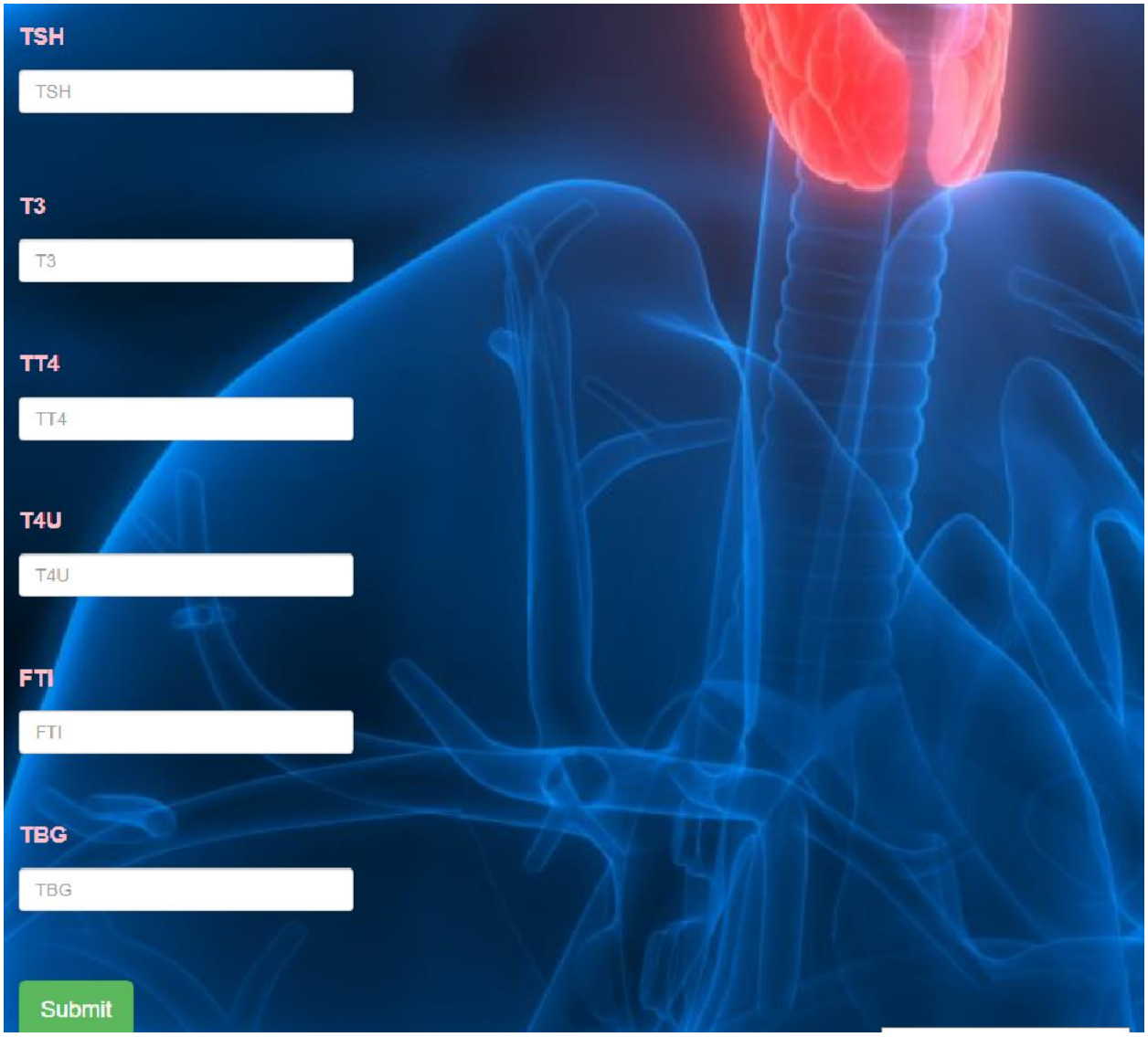
Ideation & Brainstorming Map

RESULT


Home
Predict
Thyroid Diseas Classification
The two types of Thyroid disorders are Hyperthyroidism and Hypothyroidism. When this disorder occurs in the body, they release certain type of hormones into the body which imbalances the body's metabolism. Machine Learning plays a very deciding role in the disease prediction.


Home
Predict
Thyroid Disease Classification
goitre
Male
tumor
Male
hypopituitary
Male
psych
Male
TSH
TSH


Home
Predict
Thyroid Disease Classification
Based on the given input, it predicts Thyroid disease for your body condition is ['miscellaneous'].



ADVANTAGES & DISADVANTAGES

Advantages:

- The thyroid gland is one of the body's most visible endocrine glands. Its size is determined by the individual's age, gender, and physiological

states, such as pregnancy or lactation. It is divided into two lobes (right and left) by an isthmus (a band of tissue).

- It is imperceptible in everyday life yet can be detected when swallowing. The thyroid hormones T4 and T3 are needed for normal thyroid function. These hormones have a direct effect on the body's metabolic rate. It contributes to the stimulation of glucose, fatty acid, and other molecule consumption.
- Additionally, it enhances oxygen consumption in the majority of the body's cells by assisting in the processing of uncoupling proteins, which contributes to an improvement in the rate of cellular respiration.

Disadvantages :

- Thyroid conditions are difficult to detect in test results, and only trained professionals can do so. However, reading such extensive reports and predicting future results is difficult.
- The thyroid disease can then be easily identified based on the symptoms in the patient's history. Currently, models are evaluated using accuracy metrics on a validation dataset that is accessible.

- Social Impact:- Untreated/undetected thyroid disease is more dangerous at times it can lead to fatal of the person. So, we can detect it at the earliest then people can get treatment and get cured.
- Business Model/Impact:- We can make this application public, offer services as a subscription based or can collaborate with healthcare centres or specialists.

APPLICATION

- Open anaconda prompt from the start menu
- Navigate to the folder where your python script is.
- Now type "python app.py" command
- Navigate to the localhost where you can view your web page.
- Click on the predict button from the top right corner, enter the inputs, click on the submit button, and see the result/prediction on the web

CONCLUSION

Saving the best model after comparing its performance using different evaluation metrics means selecting the model with the highest performance and saving its weights and configuration. This can be useful in avoiding the need to retrain the model every time it is needed and also to be able to use it in the future.

FUTURE SCOPE

In this section, we will be building a web application that is integrated to the model we built. A UI is provided for the uses where he has to enter the values for predictions. The enter values are given to the saved model and prediction is showcased on the UI.

This section has the following tasks

- Building HTML Pages
- Building server side script

APPENDIX

SOURCE CODE :

```
data = pd.read_csv("data.csv")
```

```
data.head()
```

	age	sex	on_thyroxine	query_on_thyroxine	on_antithyroid_meds	sick	pregnant	thyroid_surgery	I131_treatment	query_hypothyroid	...	TT4	T4U_measu
0	29	F	f	f	f	f	f	f	f	t	...	NaN	
1	29	F	f	f	f	f	f	f	f	f	...	128.0	
2	41	F	f	f	f	f	f	f	f	f	...	NaN	
3	36	F	f	f	f	f	f	f	f	f	...	NaN	
4	32	F	f	f	f	f	f	f	f	f	...	NaN	

5 rows × 31 columns

```
data.shape
```

```
(9172, 31)
```

```
#re-mapping target values to diagnostic group
diagnoses = {'A': 'hyperthyroid conditions',
             'B': 'hyperthyroid conditions',
             'C': 'hyperthyroid conditions',
             'D': 'hyperthyroid conditions',
             'E': 'hypothyroid conditions',
             'F': 'hypothyroid conditions',
             'G': 'hypothyroid conditions',
             'H': 'hypothyroid conditions',
             'I': 'binding protein',
             'J': 'binding protein',
             'K': 'general health',
             'L': 'replacement therapy',
             'M': 'replacement therapy',
             'N': 'replacement therapy',
             'O': 'antithyroid treatment',
             'P': 'antithyroid treatment',
             'Q': 'antithyroid treatment',
             'R': 'miscellaneous',
             'S': 'miscellaneous',
             'T': 'miscellaneous'}
data['target'] = data['target'].map(diagnoses) #remapping
```

```
#Removing Redundant attributes from dataset
data.drop(['TSH_measured','T3_measured','TT4_measured','T4U_measured','FTI_measured','TBG_measured','referral_source','patient_id
```

```
data.dropna(subset=['target'],inplace=True)
```

```
data['target'].value_counts()
```

```
hypothyroid conditions     593
general health             436
binding protein            376
replacement therapy        336
miscellaneous              281
hyperthyroid conditions    182
antithyroid treatment       33
Name: target, dtype: int64
```

```
x['sex'].unique()
```

```
array(['F', 'M', nan], dtype=object)
```

```
x['sex'].replace(np.nan, 'F', inplace=True)
```

```
x['sex'].value_counts()
```

```
F    1701
M     536
Name: sex, dtype: int64
```

```
data.isnull().sum()
```

```
age                        0
sex                      307
on_thyroxine               0
query_on_thyroxine         0
on_antithyroid_meds        0
sick                       0
pregnant                   0
thyroid_surgery            0
I131_treatment             0
query_hypothyroid          0
query_hyperthyroid         0
lithium                    0
goitre                     0
tumor                      0
hypopituitary              0
psych                      0
TSH_measured               0
TSH                      842
T3_measured                0
T3                      2604
TT4_measured               0
TT4                      442
T4U_measured               0
T4U                      809
FTI_measured               0
FTI                      802
TBG_measured               0
TBG                     8823
referral_source            0
target                     0
patient_id                 0
dtype: int64
```

```
#Checking whether the age above 100
data[data.age>100]
```

age	sex	on_thyroxine	query_on_thyroxine	on_antithyroid_meds	sick	pregnant	thyroid_surgery	I131_treatment	query_hypothyroid	...	tumor	hypopituitary

0 rows × 23 columns

```
x
```

	age	sex	on_thyroxine	query_on_thyroxine	on_antithyroid_meds	sick	pregnant	thyroid_surgery	I131_treatment	query_hypothyroid	...	goitre	tumor
4	32.0	F	f	f	f	f	f	f	f	f	...	f	f
18	63.0	F	t	f	f	t	f	f	f	f	...	f	f
32	41.0	M	f	f	f	f	f	f	f	f	...	f	f
33	71.0	F	t	f	f	f	f	f	f	f	...	f	f
39	55.0	F	t	f	f	f	f	f	f	t	...	f	f
...	...	...	...	...	...	...	...	...	...	...	...	...	...
9153	64.0	M	f	f	f	f	f	f	f	f	...	f	f
9157	60.0	M	f	f	t	f	f	f	f	f	...	f	f
9158	64.0	M	f	f	f	f	f	f	f	t	...	f	f
9162	36.0	F	f	f	f	f	f	f	f	f	...	f	f
9169	69.0	M	f	f	f	f	f	f	f	f	...	f	f

2237 rows × 22 columns

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import tensorflow
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Layer, Dense, Dropout
```