An

Industry Oriented Mini Project Report

On

CHRONIC KIDNEY DISEASE PREDICTION

A report submitted in partial fulfilment of the requirements

for the award of degree of

Bachelor of Technology

By

Sairy Nithya

(20EG105440)

Bhavana Tulasi

(20EG105447)

Eslavath Latha

(20EG105409)

Under The Guidance Of

Dr B. V. V. Siva Prasad

Associate Professor

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

ANURAG UNIVERSITY

VENKATAPUR– 50008

TELANGANA

2023-2024

DECLARATION

We hereby declare that the Report entitled **Chronic Kidney Disease Prediction** submitted for the award of Bachelor of technology Degree is our original work and the report has not formed the basis for the award of any Degree , associateship or fellowship of similar other titles. It has not been submitted to any other University or Institution for the award of any Degree

S.Nithya
(20EG105440)

T.Bhavana
(20EG105447)

E.Latha
(20EG105409)

ANURAG UNIVERSITY | SCHOOL OF ENGINEERING

CERTIFICATE

This is to certify that the Report / Dissertation entitled **Chronic Kidney Disease Prediction** that is being submitted by **Miss.Sairy Nithya** bearing the Hall ticket number **20EG105440**, **Miss.Bhavana Tulasi** bearing the Hall ticket number **20EG105447**, **Miss. Eslavath Latha** bearing the Hall ticket number **20EG105409**, in partial fulfilment for the award of B.Tech in Computer Science And Engineering to the Anurag University is a record of bonafide work carried out by them under my guidance and supervision.

The results embodied in this report have not been submitted to any other University or Institute for the award of any Degree.

Signature of The Supervisior

Dr. B. V. V. Siva Prasad
Associate Professor

Dean ,CSE

External Examiner1

External Examiner2

ACKNOWLEDGEMENT

We would like to express our sincere thanks and deep sense of gratitude to project supervisor **Dr. B. V. V. Siva Prasad, Associate Professor, Department of CSE** for his constant encouragement and inspiring guidance without which this project could not have been completed. His critical reviews and constructive comments improved our grasp of the subject and steered to the fruitful completion of the work. His patience, guidance and encouragement made this project possible.

We would like acknowledge our sincere gratitude for the support extended by **Dr. G. Vishnu Murthy,** Dean, Department. of CSE, Anurag University. We also express our deep sense of gratitude to **Dr. V V S S S Balaram**, Academic co-ordinator, **Dr. Pallam Ravi,** Project in-Charge and Class in-Charge,Project co-ordinator and Project review committee members whose research expertise and commitment to the highest standards continuously motivated me during the crucial stage our project work.

We would like express our special thanks to **Dr. V. Vijaya Kumar,** Dean, School of Engineering, Anurag University, for his encouragement and timely support in our B. Tech program.

Sairy Nithya
(20eg105440)

Tulasi Bhavana
(20eg105447)

Eslavath Latha
(20eg105409)

ABSTRACT

Chronic Kidney Disease prediction is one of the most important issues in healthcare analytics. The most interesting and challenging tasks in day to day life is prediction in medical field. Chronic kidney disease (CKD) is defined by persistent urine abnormalities, structural abnormalities or impaired excretory renal function suggestive of a loss of functional nephrons. The majority of patients with CKD are at risk of accelerated cardiovascular disease and death. This disease is defined as a long-term condition in which the kidneys do not work as they should. It is a common condition often associated with aging. It can infect anyone, but it is more common in most countries such as those in South Asia. We come to the role that we have worked on now. Machine learning allows to build the models to quickly analyze data and deliver results for the given data. Healthcare service providers can make better decisions on patients disease diagnosis and treatment for the particular disease with the help of machine learning. The massive quantities of data are analyzed using machine learning. It delivers faster and more accurate results in order to identify the risks, it may also require additional time and resources to train it in proper manner. The machine learning provides better usage of the clinical data for better and accurate predictionofthe chronic kidney disease.

Key Words: Naïve Bayes Algorithm

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1.INTRODUCTION

Chronic Kidney Disease is one of the most critical illness nowadays and proper diagnosis is required as soon as possible.Chronic kidney Disease (CKD) means your kidneys are damaged and not filtering your blood the way it should. The primary role of kidneys is to filter extra water and waste from your blood to produce urine and if the person has suffered from CKD, it means that wastes are collected in the body. This disease is chronic because of the damage gradually over a long period.

Detecting CKD in its early stages is crucial for effective treatment and better outcomes.Machine learning technique has become reliable for medical treatment. The massive quantities of data are analyzed using machine learning. It delivers faster and more accurate results in order to identify the risks.With the help of a machine learning classifier algorithms using features like age,blood pressure,urine specific gravity,albumin&sugar range,blood urea&glucose,hemoglobin,diabetes mellitus..etc the doctor can detect the disease on time.

Now a day's in Health Industry there are various problems related to machines or devices which will give wrong or unaccepted results, so to avoid those results and get the correct and desired results we are building a program or project which will give the accurate predictions based on information provided by the user and also based on the datasets that are available in that machine. The health industry in information yet and knowledge poor and this industry is very vast industry which has lot of work to be done. So, with the help of all those algorithms, techniques and methodologies we have done this project which will help the peoples who are in the need. So the problem here is that many people goes to hospitals or clinic to know how is their health and how much they are improving in the given days, but they have to travel to get to know there answers and sometimes the patients may or may not get the results based on various factors such as doctor might be on leave or some whether problem so he might not have come to the hospital and many more reasons will be there so to avoid all those reasons and confusion we are making a project which will help all those person's and all the patients who are in need to know the condition of their health, and at sometimes if the person has been observing few symptoms and he/she is not sure about the disease he/she is encountered with so this will lead to various diseases in future.

This Chronic Kidney Disease Using Machine Learning is completely done with the help of Machine Learning and Python Programming language with for it and also using the dataset that is available previously by the hospitals using that we will predict the disease. we aim to improve CKD prediction using a powerful tool called the Naive Bayes algorithm.The Naive Bayes algorithm is used for predicting of the medical data. It examines various factors, such as medical history, test results, and patient demographics, to estimate the likelihood of someone having CKD. This algorithm has proven effective in many fields, including healthcareBy applying the Naive Bayes algorithm to CKD prediction, to enhance the accuracy of early diagnosis, enabling healthcare professionals to identify individuals at risk more efficiently.

1.1.Existing Method

Prediction using traditional methods and models involves various risk factors and it consists of various measures of algorithms such as datasets, programs and much more to add on. High-risk and Low-risk patient classification is done on the basis of the tests that are done in group. But these models are only valuable in clinical situations and not in big industry sector. So, to include the disease predictions in various health related industries, we have used the concepts of machine learning and supervised learning methods to build the predictions system. Existing model gives less accuracy.

2. LITERATURE REVIEW

Sujata Drall [1] worked on CKD dataset given by UCI with 400 instances and 25 attributes. Firstly, data was preprocessed, the missing data was found, filled with 0, then transformed and applied on the dataset. After preprocessing, authors applied algorithm for important attributes and found 5 most important features and then the classification algorithm: K-Nearest Neighbor. The gotten result KNN achieved the highest accuracy.

Chenetal[2] applied three models on the dataset that is provided by UCI. They used KNN, SVM and soft independent modelling of class analogy (SIMCA) for finding the risk calculation of patient using these classifiers. In which the SVM and KNN model attained, the best accuracy of 93.7% and SVM model has the greatest capability to endure noise disturbance. Because CKD is invasive, costly so that many patients reached at last stages without treatments. So that early detection of this disease remains important. Besides, **Amirgaliyev [3]** gave the experimental result of SVM machine learning classifier algorithm with accuracy 93%.

Shankaretal[4] applied three steps on the same UCI dataset: (i) data preprocessing & feature selection (ii), algorithms' accuracy determination and (iii) diet plan suggestion. In the feature selection method, they applied two approaches: one is the Wrapper and the other is the LASSO method. After the feature selection method, 4 classification algorithms were applied: Logistic Regression, Random forest tree K-Nearest Neighbors, Neural Network and Wide and Deep Learning. For diet plan suggestion blood potassium level was used. The blood potassium level was divided into three groups based on its value: Safe Zone, Caution Zone and Danger zone. Vijayarani and **Dhayanand [5]** collected kidney function test (KFT) dataset from medical labs, research centres and hospitals. The dataset contained 584 instances and 6 attributes and two classifier applied algorithms: support vector machine (SVM) and artificial neural network (ANN). It was found that ANN achieved the highest accuracy of 87.7%.

Maetal[6] proposed the deep learning algorithm for predicting the Chronic Kidney Disease s at early stage. The deep neural network was built from Heterogeneous Modified artificial neural network algorithm. For building the model, ultrasound images were used. For comparing the result, there were three different classifiers: Support Vector machine, artificial neural network and multilayer perceptron. **UIHaqet al[7]** proposed the machine learning model to predict the diabetes disease at early stage. They concluded that machine learning can play vital role in the healthcare. **Aminetal. [8]** proposed machine learning model for the prediction of Parkinson's disease at early stage. For building the model, they used SVM classifier. Feature selection algorithms were also applied for extract the important features: Relief and ACO feature selection algorithm.

2.1 Comparison of Existing Methods

S.NO	Author(s)	Method	Advantages	Disadvantages
1	Amirgaliyev, Y., Shamiluulu, S., & Serek,	Support Vector Machine	Objective Diagnosis ReducedRisk	Data Reliance Generalization
2	Sujata Drall, Gurdeep Singh Drall, Sugandha Singh,	K-Nearest Neigbour, feature selection	Inclusion of Risk Factors Diverse Causative Factors Large Dataset	Datasource quality ModelInterpretability
3	SaurabhPal	logistic regression decision tree	Early Detection ofCKD Diagnosis Data Source	External Validation Clinical Application

3. Proposed Method

The proposed system of disease prediction using machine learning is that we have used many techniques and algorithm and all other various tools to build a system which predicts the disease of the patient using the symptoms and by taking those symptoms we are comparing with the system's dataset that is previously available. By taking those datasets and comparing with the patient's disease we will predict the accurate percentage disease of the patient. The dataset and symptoms go to the prediction model of the system where the data is pre-processed for the future references and then the feature selection is done by the user where he will enter the various fields. Then the classification of those data is done with the help of Naïve Bayes Algorithm. Then the data goes in the recommendation model, there it shows the risk analysis that is involved in the system. Here we have combined the overall structure and unstructured form of data for the overall risk analysis that is required for doing the prediction of the disease. Using the structured analysis, we can identify the chronic types of disease in a particular region and particular community. In unstructured analysis we select the features automatically with the help of algorithms and techniques. This system takes data from the user and predicts the disease accordingly based on the symptoms that it takes and also from the previous datasets, it also helps in continuous evaluation of viral diseases, heart rate, blood pressure, sugar level and much more which is in the system and along with other external symptoms its predicts the appropriate and accurate.

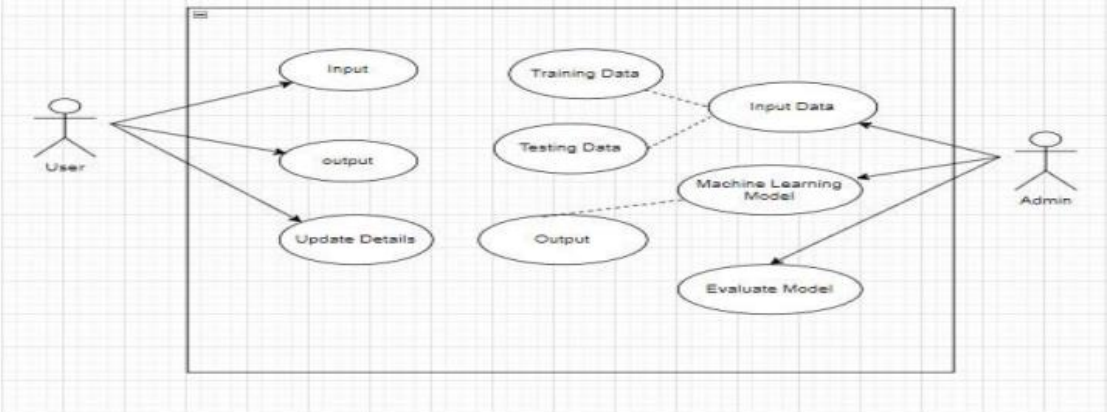

Figure 3.1.Block Diagram of Proposed Method

3.2. Naïve Bayes Algorithm

Naïve Bayes algorithm is a supervised learning algorithm, which is based on **Bayes theorem** and used for solving predictive problems. It is a probabilistic classifier, which means it predicts on the basis of the probability of an object. The Naïve Bayes algorithm is comprised of two words Naïve and Bayes, Which can be described as:

Naïve: It is called Naïve because it assumes that the occurrence of a certain feature is independent of the occurrence of other features.

Bayes: It is called Bayes because it depends on the principle of Bayes' Theorem.

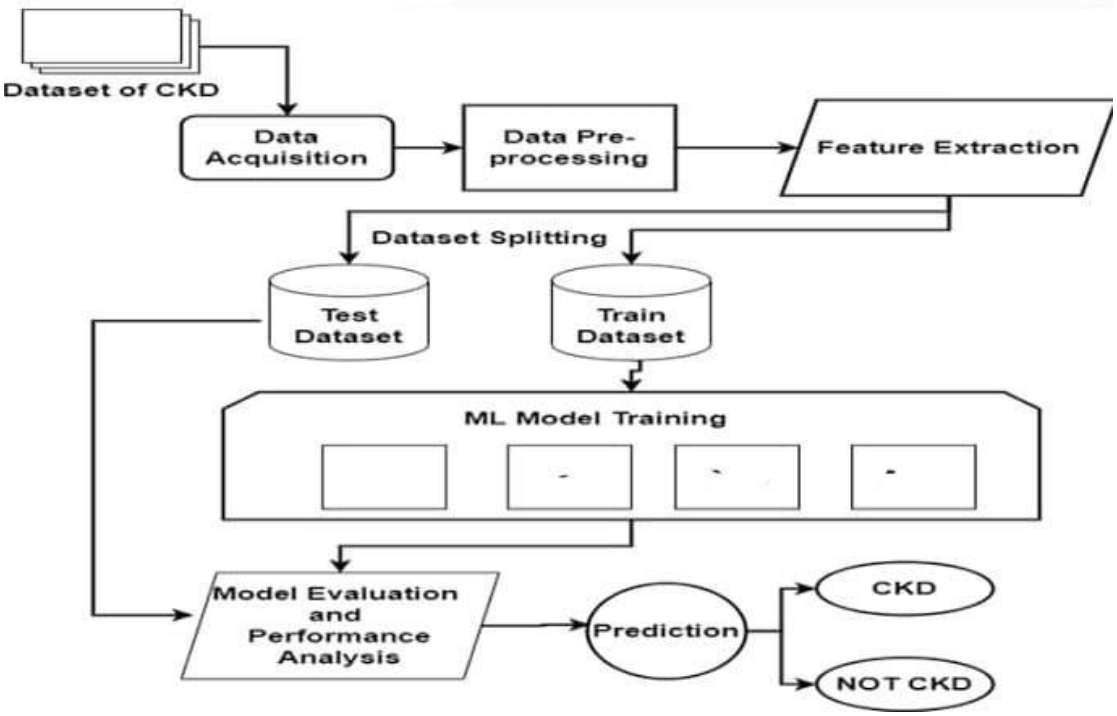

Figure 3.3.Activity Diagram

The most popular types of Naive bayes are:

- **Gaussian Naïve Bayes (GaussianNB):** This is a variant of the Naïve Bayes classifier, which is used with Gaussian distributions—i.e., normal distributions—and continuous variables. This model is fitted by finding the mean and standard deviation of each class

. • **Multinomial Naïve Bayes (MultinomialNB):** This type of Naïve Bayes classifier assumes that the features are from multinomial distributions. This variant is useful

when using discrete data, such as frequency counts, and it is typically applied within natural language processing use cases, like spam classification.

• **Bernoulli Naïve Bayes (BernoulliNB):** This is another variant of the Naïve Bayes classifier, which is used with Boolean variables—that is, variables with two values, such as True and False or 1 and 0.

3.4.Bayes Theorem:

Bayes' theorem is also known as **Bayes' Rule** or **Bayes' law**, which is used to determine the probability of a hypothesis with prior knowledge. It depends on the conditional probability.

The formula for Bayes' theorem is given as

$$P(A|B)= P(B|A)\cdot P(A)/ P(B)$$

Where:

P(A|B) is the conditional probability of event A occurring given that event B has occurred.

P(B|A) is the conditional probability of event B occurring given that event A has occurred.

P(A) is the prior probability (the initial probability of event A occurring).

P(B) is the prior probability of event B occurring.

3.5. Steps in Proposed Method

Step 1: **Data Collection**

Gathering a dataset of patient records that includes relevant features such as age, gender, blood pressure, serum creatinine levels, blood glucose levels, family history of CKD, and other relevant medical information.

Step 2: **Data Preprocessing**

Clean and preprocess the data by handling missing values, normalizing numerical features, and encoding categorical variables. This step ensures that the data is in a suitable format for training the machine learning model.

Step 3: **Feature Selection**

Select specific columns (features) for analysis and drop some columns ('ba', 'sod', 'pot', 'appet', 'id', 'ane') that you don't want to use in your model.Fill missing values in numerical columns with the mean.

Step 4: **Data Splitting and Model Training**

Split the dataset into training and testing sets.Train a machine learning model using Navie Bayes algorithm using the training data.

Step 5: **Model Evaluation**

Evaluate the performance of the Naive Bayes model using the testing dataset.calculate accuracy and generate a classification report which includes metrics such as precision, recall, and F1-score .

4.IMPLEMENTATION

Program file is kidneydisease_prediction.py

Used google colab notebook for executing machine learning models.

4.1. Packages Used

Pandas: It provides data structure and function for efficiently working with structured data as tables.

NumPy: It stands for numerical python and is used for numerical computation. It supports arrays, matrices and mathematical functions.

Seaborn: Seaborn is a data visualization library built on top of Matplotlib, another popular data visualization library in Python. Seaborn provides a high-level interface for creating informative and attractive statistical graphics.

Matplotlib: It is used for creating various types of static, animated and interactive visualizations.

Scikit-learn :It is the most useful and robust library for machine learning in Python. It provides a selection of efficient tools for machine learning and statistical modelling.

Naïve Bayes: It is a supervised algorithm provided by scikit-learn, a popular machine learning library in Python. It is used to build and evaluate a gaussian naïve bayes classifier.

4.2.FUNCTIONALITIES:

1.Read.csv (): It is used to read a csv file

2.Head(): It return the first 5 rows of the dataset.

3.replace(): It is used to replace the null values.

4.drop(): It is used to drop the selected features.

5.data.corr(): It is used to find the correlation of data features

6.GaussianNB(): It is used to train the naïve bayes classifier.

7. nb_classifier.fit(): Training and Testing the data and fitting it into naïve bayes classifier.

4.3.ATTRIBUTES:

1.categorical_cols:Stores the categorical data present in the dataset.

2. numerical_cols:Stores the numerical data present in the dataset.

3. nb_classifier:Stores the guassian classifier of the model.

4. accuracy: Stores the accuracy of the prediction model.

5.report: Stores the classification report which consist of precision,recall,f1 score.

6. X_test: It is used for testing the data.

7. y_test: It is used for testing the new label.

8. y_train: It is used for reading labels and loading for training. y_train: It is used for reading labels and loading for training.

4.4.Python Code

#Import Libraries

```
import pandas as pd

import numpy as np
```

```
from sklearn.model_selection import train_test_split

from sklearn.naive_bayes import GaussianNB

from sklearn.metrics import accuracy_score, precision_score, recall_score,
    f1_score,classification_report

from sklearn.preprocessing import StandardScaler

import matplotlib.pyplot as plt

import seaborn as sns
```

#Reading Csv file

```
data = pd.read_csv('/content/kidney_disease (1) (1).csv')

data.head()
```

#Replacing missing values

```
data = data.replace('?', np.nan)
```

 # Encode Categorical Features

```
categorical_cols = ['rbc', 'pc', 'pcc', 'ba', 'htn', 'dm', 'cad', 'appet', 'pe', 'ane']

data[categorical_cols]=data[categorical_cols].apply(lambda x:
    x.astype('category').cat.codes)
```

#Handling missing numerical values

```
numerical_cols = ['age', 'bp', 'sg', 'al', 'su', 'bgr', 'bu', 'sc', 'sod', 'pot', 'hemo', 'pcv', 'wc',
    'rc']

data[numerical_cols] = data[numerical_cols].apply(pd.to_numeric, errors='coerce')
```

```
data[numerical_cols] = data[numerical_cols].fillna(data[numerical_cols].mean())

#Dropping the unwanted features

d=data.drop(['sod','pot','id','bgr', 'bu', 'sc','hemo', 'pcv', 'wc', 'rc','cad', 'pe' ],axis=1)

#Finding the correlation among features

corr=data.corr()

sns.heatmap(corr)

#Model

from sklearn.model_selection import train_test_split

from sklearn.naive_bayes import GaussianNB

X=d.iloc[:,:-1]

print(X.keys())

y=d.iloc[:,-1]

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

print(y_test.unique)

nb_classifier = GaussianNB()

nb_classifier.fit(X_train, y_train)

y_pred = nb_classifier.predict(X_test)

print(len(y_pred))

accuracy = accuracy_score(y_test, y_pred)
```

```
print(f"Accuracy: {accuracy}")

report = classification_report(y_test, y_pred)

print('Classification Report:\n', report)

precision = precision_score(y_test, y_pred,pos_label='ckd',average=None)

recall = recall_score(y_test, y_pred,pos_label='ckd',average=None)

f1 = f1_score(y_test, y_pred,pos_label='ckd',average=None)

print(f"Precision: {precision}")

print(f"Recall: {recall}")

print(f"F1-Score: {f1}")
```

#Collect the user data

```
age = float(input("Enter age: "))

blood_pressure = float(input("Enter blood pressure: "))

specific_gravity = float(input("Enter specific gravity: "))

albumin = float(input("Enter albumin: "))

sugar = float(input("Enter sugar: "))

red_blood_cells = float(input("Enter red blood cells count: "))

pus_cells = float(input("Enter pus cells count: "))

pus_cell_clumps = input("Pus Cell Clumps (present/absent): ").lower()

bacteria = input("Bacteria (present/absent): ").lower()
```

```
hypertension = input("Hypertension (yes/no): ").lower()

diabetes = input("Diabetes (yes/no): ").lower()

appetite = input("Appetite (good/poor): ").lower()

anemia = input("Anemia (yes/no): ").lower()

user_data = np.array([[age, blood_pressure, specific_gravity, albumin, sugar,
red_blood_cells, pus_cells,

        pus_cell_clumps == "present", bacteria == "present",

        hypertension == "yes", diabetes == "yes", appetite == "good", anemia ==
"yes"]])
```

 # Make a prediction for user data

```
prediction = nb_classifier.predict(user_data)

if prediction[0] == 1:

  print("You may be suffering from Chronic Kidney Disease (CKD). Please consult a
healthcare professional.")

else:

  print("You are not predicted to have Chronic Kidney Disease (CKD).")
```

4.5.DATASET:

The below mentioned dataset consists of 25 features such as age ,sugar,red blood cell count etc.There are 400 rows.The target is the classification which is either CKD or NOTCKD.

https://www.kaggle.com/datasets/mansoordaku/ckdisease

5.EXPERIMENT RESULTS

5.1.Experiment Screen Shots

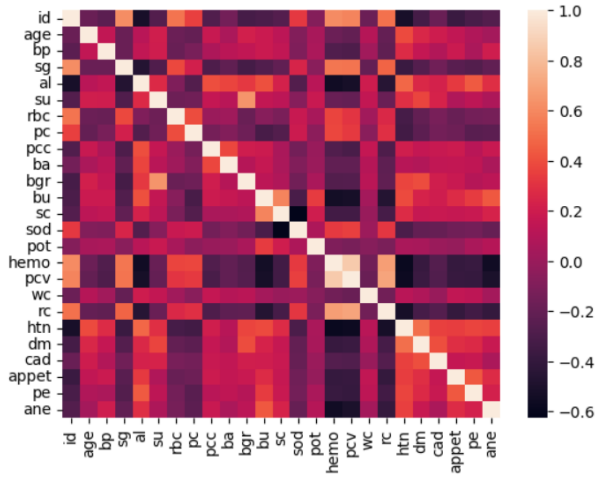

Figure.5.1.1.Correlation of dataset

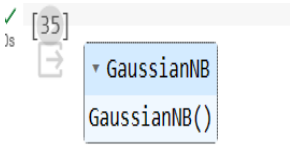

Figure.5.1.2.GaussianNB() Classifierfit

```
print(f"Accuracy: {accuracy}")

Accuracy: 0.95
```

Figure5.1.3.Accuracy of Naïve Bayes

```
Classification Report:
              precision    recall  f1-score   support

        ckd       0.94      0.98      0.96        52
     notckd       0.96      0.89      0.93        28

   accuracy                           0.95        80
  macro avg       0.95      0.94      0.94        80
weighted avg      0.95      0.95      0.95        80
```

Figure5.1.4.Classification Report

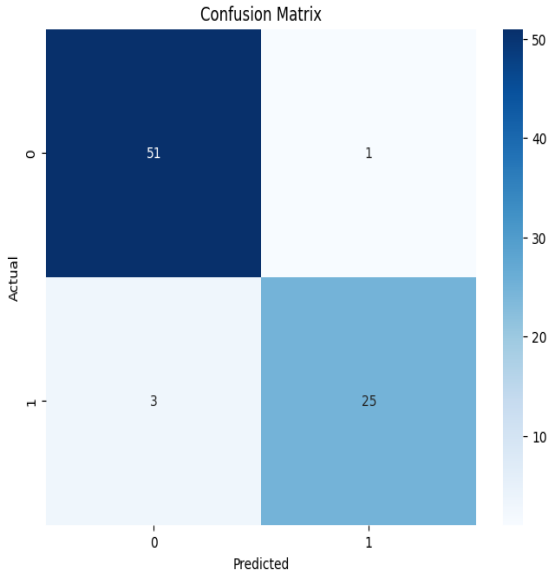

Figure5.1.5.Confusion Matrix

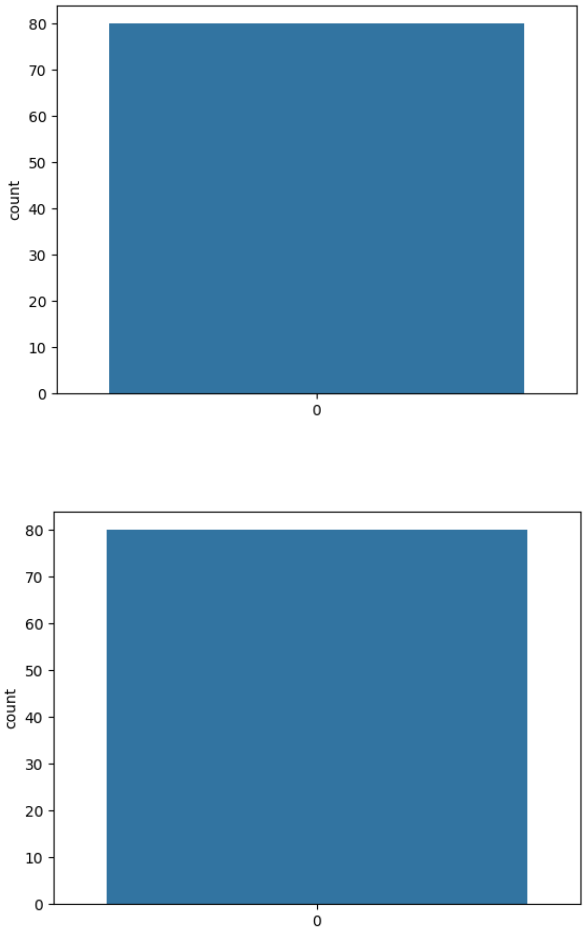

Figure5.1.6.Countplot()

```
import numpy as np
age = float(input("Enter age: "))
blood_pressure = float(input("Enter blood pressure: "))
specific_gravity = float(input("Enter specific gravity: "))
albumin = float(input("Enter albumin: "))
sugar = float(input("Enter sugar: "))
red_blood_cells = float(input("Enter red blood cells count: "))
pus_cells = float(input("Enter pus cells count: "))
pus_cell_clumps = input("Pus Cell Clumps (present/absent): ").lower()
bacteria = input("Bacteria (present/absent): ").lower()
hypertension = input("Hypertension (yes/no): ").lower()
diabetes = input("Diabetes (yes/no): ").lower()
appetite = input("Appetite (good/poor): ").lower()
anemia = input("Anemia (yes/no): ").lower()

user_data = np.array([[age, blood_pressure, specific_gravity, albumin, sugar, red_blood_cells, pus_cells,
                       pus_cell_clumps == "present", bacteria == "present",
                       hypertension == "yes", diabetes == "yes", appetite == "good", anemia == "yes"]])

prediction = clf.predict(user_data)

if prediction[0] == 1:
    print("You may be suffering from Chronic Kidney Disease (CKD). Please consult a healthcare professional.")
else:
    print("You are not predicted to have Chronic Kidney Disease (CKD).")
```

Figure5.1.7.User Input Collection

5.2.Parameters

We've carried out the prediction of chronic kidney disease using naïve bayes algorithm. It predicts whether patient or the user suffering from ckd based on the information or the symptoms he/she enter into the system and provides the accurate results based on that information.

5.2.1.Accuracy in Predicting Chronic kidney Disease

When Navie Bayes algorithm were applied on the datasert containing the features of kidney disease.It has shown that the naïve bayes algorithm have achieved 95% accuracy in predicting the chronic kidney disease .

5.2.3.Prediction using User Input

The Model takes the input given by the user such as age,blood pressure,sugar level,red blood cells count etc and predicts whether he/she is suffering from the chronic kidney disease or not.

6. DISCUSSION OF RESULTS

Discussing the results of a chronic kidney disease (CKD) prediction model using the Naive Bayes algorithm is crucial to evaluate its performance and make informed decisions about its utility. For a CKD prediction model, a high accuracy 95% is achieved which have practical relevance for early CKD detection and patient care.
Precision, which measures the accuracy of positive predictions (CKD in this case), yielded a value of 94. This indicates that 94% of cases predicted as CKD were actually CKD. Recall, which measures the model's ability to correctly identify all actual CKD cases, produced an 95 value. This means that 95% of actual CKD cases were correctly identified by the model.The F1-Score, which balances precision and recall.The F1-Score achieved is 96.

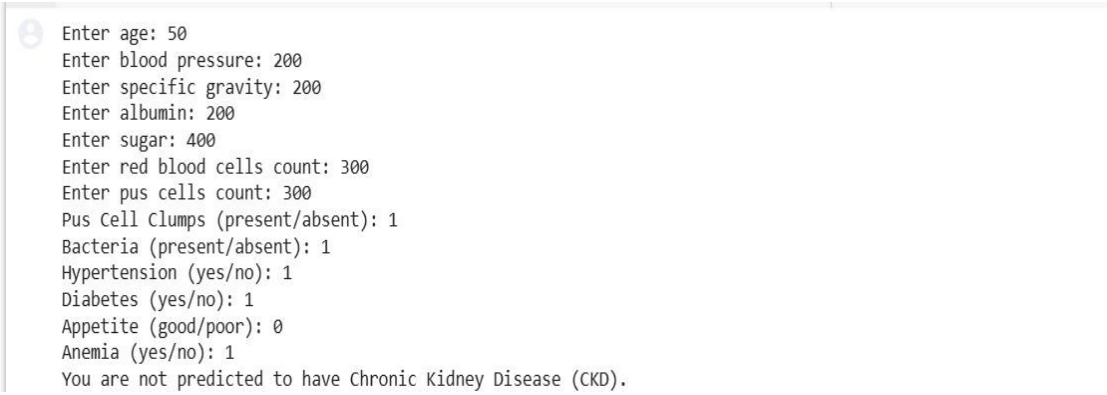

Figure.6.1.Prediction Using User Input

The interactive interface asks for the information of user such as:

- AGE
- BLOOD PRESSURE
- SPECIFIC GRAVITY
- ALBUMIN
- SUGAR

It predicts whether patient or the user suffering from ckd based on the information or the symptoms he/she enter into the system and provides the accurate results based on that information.

7.CONCLUSION

In conclusion ,our proposed chronic kidney Disease prediction using machine learning is very much useful in everyone ’s day to day life and it is mainly more important for the healthcare sector, because they are the one that daily uses these systems to predict the diseases of the patients based on their general information and there data that they are been through. Now a day’s health industry plays major role in finding the severity ofdiseases of the patients so this is also some kind of help for the health industry to tell the user and also it is useful for the user in case he/she doesn’t want to go to the hospital or any other clinics, so just by entering the data and all other useful information the user can get to know the severity of disease he/she is suffering from and the health industry can also get benefit from this system by just asking the symptoms from the user and entering in the system and in just few seconds they can tell the exact and up to some extent the accurate diseases. If health industry adopts this project then the work of the doctors can be reduced and they can easily predict the disease of the patient. The Disease prediction is to provide prediction for the various and generally occurring diseases that when unchecked and sometimes ignored can turns into fatal disease and cause lot of problem to the patient and as well as their family members.

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