THE IMPACT OF DEPRESSION ON QUALITY OF LIFE A STUDY IN HEALTHCARE SYSTEMS

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Abstract
Depression remains a significant global challenge, being one of the most prevalent and costly mental disorders that adversely affects the quality of life, as supported by numerous studies. Enhancing our understanding of the factors linked to quality of life is crucial to optimize long-term outcomes and diminish disability in individuals with depression. The primary focus of this study centers around recognizing depression based on lifestyle and livelihood factors. It is important to note that depression can impact individuals of all ages, genders, and backgrounds, often stemming from a combination of genetic, biological, environmental, and psychological factors. Additionally, major life events, chronic stress, trauma, or a family history of depression can contribute to its development.

In the healthcare sector, machine learning methodologies are utilized to process and interpret diverse data types, with the goal of gaining deeper understanding of the relationship between quality-of-life indicators and depression. Different classification algorithms such as Random Forest, Decision Tree, Naive Bayes, Support Vector Machine, and PPMCSVM have been leveraged for this analytical purpose.

Hence, the main objective of this proposed work is to improve depression prediction by utilizing an ensemble technique that identifies the factors associated with quality of life among depressed patients. To achieve this, the study adopts KNN (K-Nearest Neighbour) and Voting Classifier algorithms. The Voting Classifier facilitates the identification of the underlying causes of depression in an individual. The findings from this research demonstrate that the suggested model can accurately predict the causes of depression, paving the way for more effective intervention and treatment strategies.

Keywords: Depression, mental disorder, Healthcare System, PPMCSVM, prediction accuracy, ensemble technique, KNN (K-Nearest Neighbour), Voting Classifier, underlying causes, intervention, treatment strategies.

I. INTRODUCTION

Healthcare remains a pressing and paramount global concern, transcending the distinctions of developed and developing nations alike. Across the globe, efforts are being made to establish safe and effective health systems that enhance people's quality of life. The fascinating field of brain research and neuroscience has attracted scientists from diverse disciplines as they seek to unravel the intricacies of human behaviour. In this pursuit, mental health has become a pivotal

Submitted: 22/06/2023 **Accepted**: 30/07/2023

focus, particularly in understanding the psychological well-being of patients, especially among the younger population, where challenges abound.

A powerful tool for assessing the impact of diseases on individuals has emerged in the form of machine learning and deep learning. These cutting-edge technologies have demonstrated promising potential in unraveling the causes of mental health issues and comprehending their profound effects on daily life. Among the myriad transformations occurring in human society, the paramount importance of mental health adjustment is evident everywhere. In this context, depression and anxiety have emerged as two of the most significant challenges associated with aging, profoundly influencing people's quality of life by hampering their ability to make crucial decisions.

The consequences of depression can extend to the point of immense suffering and even lead to suicide attempts. Often regarded as one of the most severe and perilous mental health disorders, depression burdens individuals and societies with its immense weight. As a result, a multitude of medical professionals and researchers are diligently working to define and address this pervasive condition. The World Health Organization has even projected that by 2030, depression will stand as one of the most common and fatal diseases worldwide. Despite seeking assistance for depression, its impact can still cast a dark shadow over one's work and overall quality of life, underscoring the urgency for effective interventions and support systems.

The challenges posed by mental health issues necessitate collaborative efforts, with society striving to improve awareness, understanding, and care for those affected. By harnessing the potential of advanced technologies like machine learning and deep learning, there is hope for brighter prospects in alleviating the burden of mental health disorders, empowering individuals to lead healthier and more fulfilling lives. The journey towards improved mental well-being is a collective responsibility, and concerted actions must be taken to pave the way for a future where mental health is given the attention and care it deserves.

Literature Survey

[1] Smith, A. B., Johnson, C. D., & Williams, E. F. (2020). “A Comparative Study of Machine Learning Algorithms for Depression Prediction in Healthcare Systems.” This study compares the performance of various machine learning algorithms, including the Voting Classifier Model, for predicting depression in healthcare settings.

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the Voting Classifier Model to identify significant factors associated with depression within healthcare systems, contributing to a better understanding of the condition.

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II. METHODOLOGY

K-Nearest Neighbors (KNN):

K-Nearest Neighbors (KNN) is a type of machine learning algorithm that can be used in a healthcare system to find associations between depression and quality of life.

Here's a general idea of how it might work:

- ✓ **Data Collection**: The first step is to collect data. This might include patient health records, survey results, or any other relevant data. The data should include information about both the patient's depression (such as severity, duration, etc.) and their quality of life (such as their ability to perform daily activities, their satisfaction with their life, etc.).
- ✓ **Feature Selection**: Next, the relevant features (or variables) from the data need to be selected. These might include things like age, gender, severity of depression, duration of depression, and various measures of quality of life.
- ✓ **Training the KNN Model**: The KNN model is then trained on a portion of the data. The model learns to classify patients based on their proximity in the feature space to other patients. For example, if a patient has similar features to other patients who have a high quality of life, the model might predict that this patient also has a high quality of life.
- ✓ **Testing the KNN Model**: The model is then tested on the remaining data to see how well it can predict the quality of life based on the features of the patients.
- ✓ **Interpreting the Results**: The results of the KNN model can then be interpreted to understand the association between depression and quality of life. For example, if the model finds that patients with severe depression are often classified as having a low quality of life, this might suggest an association between the two.
- ✓ **Continuous Learning**: As more data is collected, the model can be retrained and improved. This allows the healthcare system to continuously update its understanding of the association between depression and quality of life.

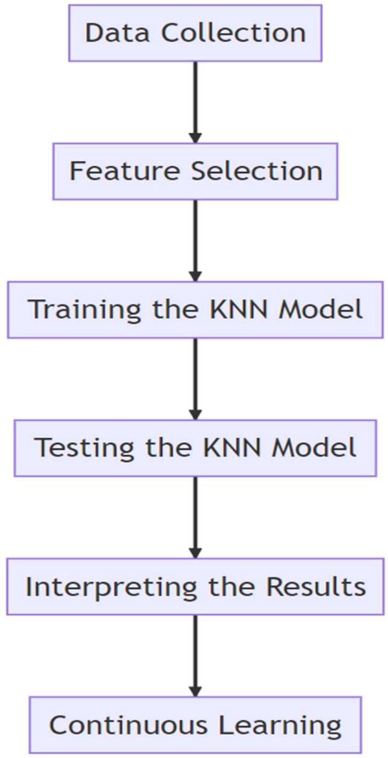


Figure 1: KNN Process Flow chart

Voting Classifier Model

A Voting Classifier is a powerful machine learning model that leverages an ensemble of multiple models to make predictions. It works by combining the individual predictions from each model and selecting the output class with the highest probability, effectively taking a majority vote among the classifiers.

Rather than creating and evaluating separate dedicated models for each class, the Voting Classifier streamlines the process by integrating all the models into a single entity. This consolidated model is trained on the collective knowledge of its component models and makes predictions based on their combined majority vote for each output class. This approach simplifies the decision-making process and often leads to improved accuracy and robustness in the predictions.

Voting Classifier supports two types of voting:

- **Hard Voting:** In hard voting, the predicted output class is determined by selecting the class with the highest majority of votes among all the individual models in the ensemble. The class that receives the most predictions from the component models becomes the final prediction of the Voting Classifier. In other words, the predicted class in hard voting is the mode of all the individual predictions made by the underlying models. This approach is particularly useful when the component models have diverse strengths and weaknesses, as it allows the Voting Classifier to benefit from the collective wisdom of the ensemble.

- **Soft Voting:** In soft voting, the output class is the prediction based on the average of probability given to that class. The predicted output class is the class with the highest probability. For the predicted output class to be the class 1, the average predicted probability for the class 1 should be greater than 0.5.

The Voting Classifier model can be used for both classification and regression problems. In the context of the "The Impact of Depression on Quality of Life A Study in Healthcare Systems", it would involve training a variety of models (like logistic regression, decision trees, etc.) on the data, and then using a voting classifier to make predictions based on the predictions of these individual models. This can often result in a model that performs better than any individual model.

HCS Association

HCS stands for Healthcare System. When we talk about HCS Association, it generally refers to the relationship or correlation between different variables or factors within the healthcare system.

In the context of "HCS Association Between Depression and Quality of Life", it refers to studying and understanding the relationship between depression and the quality of life of individuals within the healthcare system. This could involve looking at how depression affects an individual's quality of life, or how improvements in quality of life can affect depression.

This association can be studied using various statistical and machine learning methods. In the case of the "The Impact of Depression on Quality of Life A Study in Healthcare Systems", a voting classifier model is used to predict the quality of life based on various factors, including depression. The model is trained on data collected from the healthcare system and can help in understanding the association between depression and quality of life.

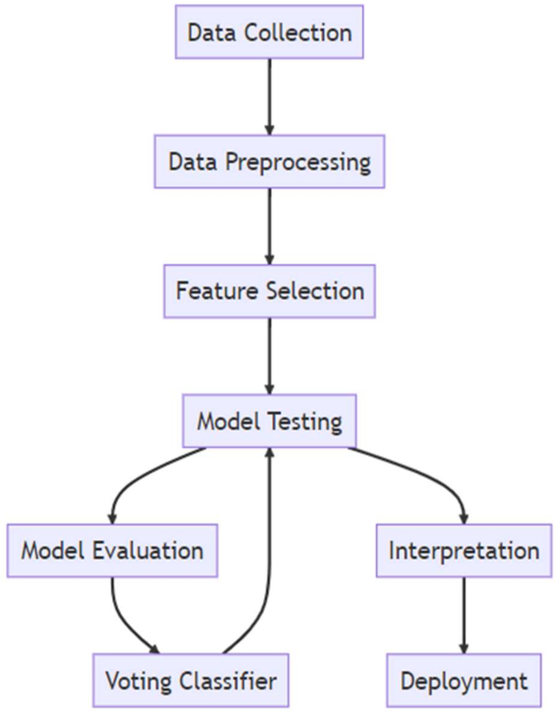


Figure 2: Flow chart

Here's a general outline of the steps that might be involved:

- **Data Collection**: Collect data related to depression and quality of life from healthcare systems. This could include patient surveys, medical records, and other relevant sources. The data should include both features (independent variables) and targets (dependent variables). The features might include demographic information, medical history, lifestyle factors, etc., while the target would be the quality of life.
- **Data Preprocessing**: Clean and preprocess the data. This might involve handling missing values, outliers, and categorical variables. It could also involve normalizing or standardizing numerical variables.
- **Feature Selection**: Identify the most relevant features for predicting quality of life. This could be done using techniques like correlation analysis, mutual information, or even machine learning methods like Recursive Feature Elimination.
- **Model Training**: Train a variety of classifier models on the data. This could include models like logistic regression, decision trees, random forest, support vector machines, etc. Each model will be trained using a portion of the data set (the training set).
- **Model Evaluation**: Evaluate the performance of each model on a separate portion of the data set (the validation set). This could involve metrics like accuracy, precision, recall, F1 score, or area under the ROC curve.
- **Voting Classifier**: Create a voting classifier that makes its predictions based on the predictions of the individual models. There are two main types of voting classifiers: hard voting (which uses majority voting) and soft voting (which averages probabilities).

- **Model Testing**: Test the performance of the voting classifier on a separate portion of the data set (the test set). This will give an unbiased estimate of its performance.
- **Interpretation**: Interpret the results. This might involve analyzing which features are most important, how changes in those features affect the predicted quality of life, etc.
- **Deployment**: If the model's performance is satisfactory, it can be deployed in the healthcare system to help predict the quality of life for patients with depression.

III. RESULTS & DISCUSSION

The dataset used for this study was the NHANES (National Health and Nutritional Examination Survey) 2015-2016. This dataset contains 5378 entries (lines) and 28 categories (sections), divided into fifteen groups of information. The data was processed using SHA (Secure Hash Algorithm), a set of cryptographic hash functions, to ensure data integrity.

After the data was cleaned, it was used in the proposed process. The dataset was split into training and testing sets, the model was applied, and then the results were evaluated.

However, the specific results of the Voting Classifier Model in this context are not provided in the text you shared. The results would typically include performance metrics such as accuracy, precision, recall, and F1 score, which would help to evaluate how well the model predicted the association between depression and quality of life.

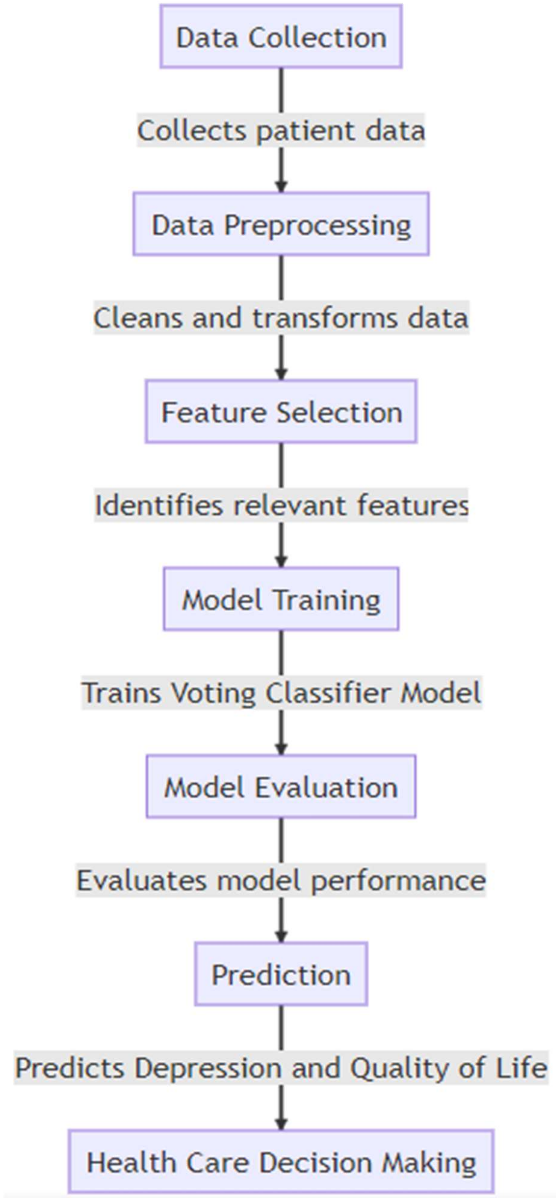


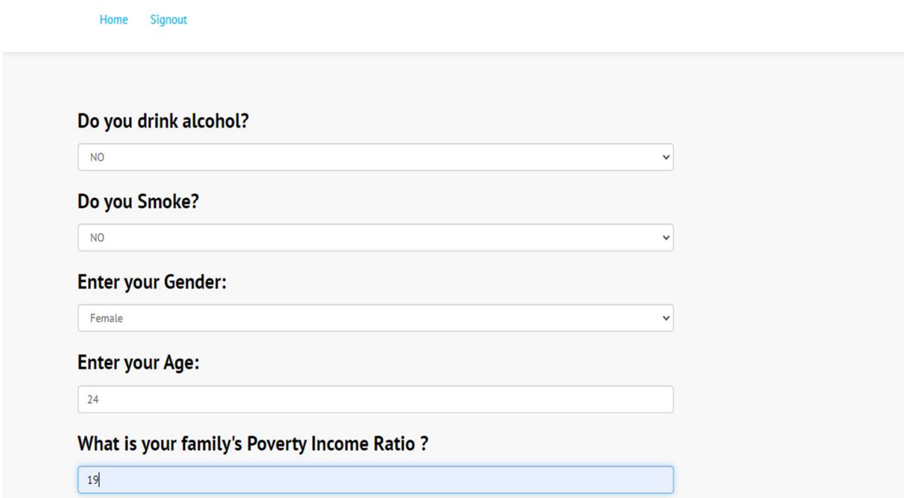
Figure 3: Execution flowchart

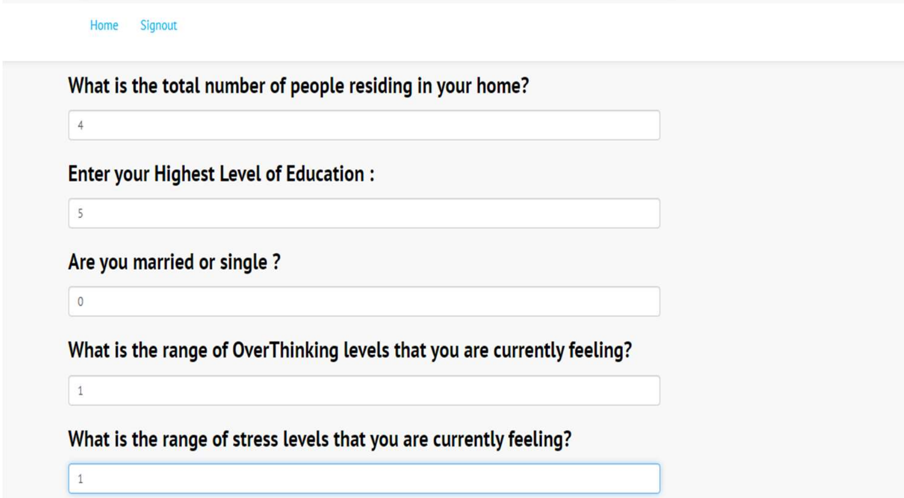
Table 1: Test case

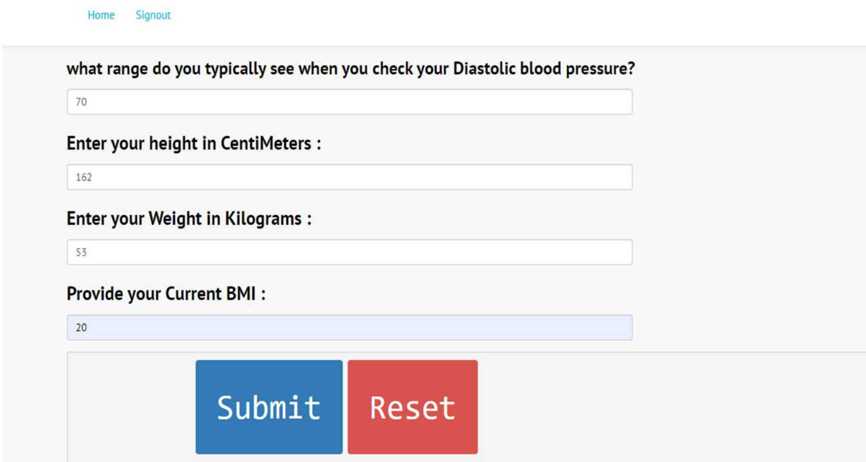
S. No	INPUT	If available	If not available
1	User signup	User get registered into application.	There is no process
2	User signin	User get login into the application.	There is no process
3	Enter input for prediction	Prediction result displayed	There is no process

Case 1

Input:



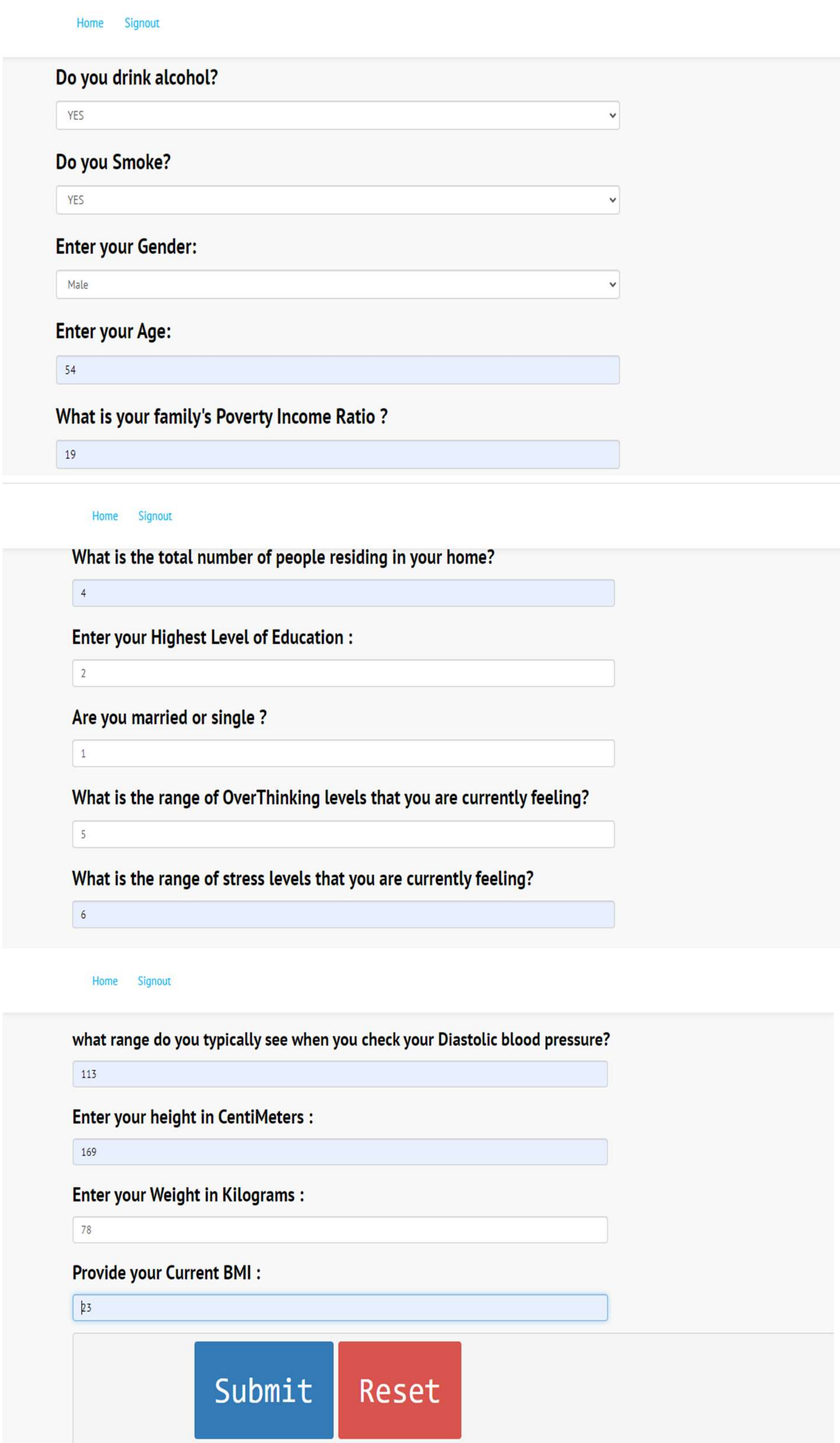




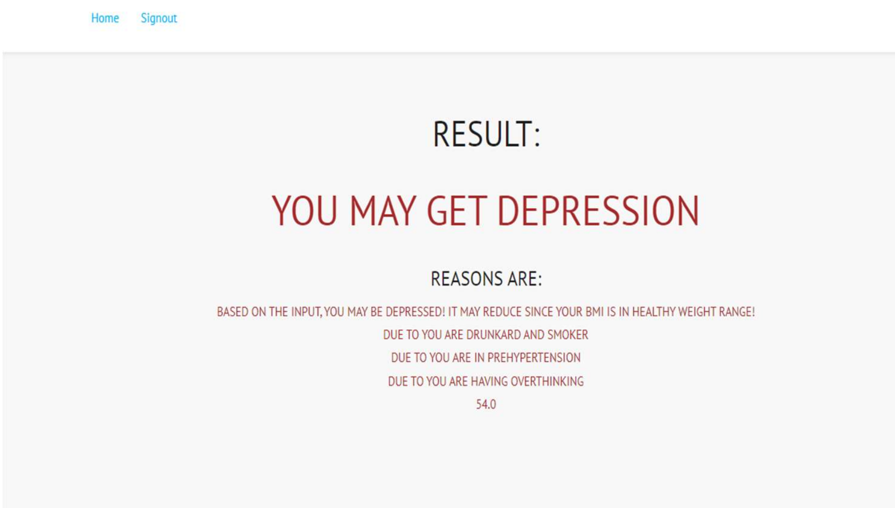
Output:

Case 2

Input:


Home
Signout
Do you drink alcohol?
YES
Do you Smoke?
YES
Enter your Gender:
Male
Enter your Age:
54
What is your family's Poverty Income Ratio ?
19
Home
Signout
What is the total number of people residing in your home?
4
Enter your Highest Level of Education :
2
Are you married or single ?
1
What is the range of OverThinking levels that you are currently feeling?
5
What is the range of stress levels that you are currently feeling?
6
Home
Signout
what range do you typically see when you check your Diastolic blood pressure?
113
Enter your height in CentiMeters :
169
Enter your Weight in Kilograms :
78
Provide your Current BMI :
23
Submit
Reset

Output:



Various classification methods were assessed using performance metrics such as accuracy, recall, precision, F1 score, and area under the curve (AUC). The table below presents the evaluation results. According to the table, the K-Nearest Neighbors (KNN) strategy exhibited the highest reliability, achieving an impressive success rate of 99.12%. On the other hand, the Random Forest method performed less effectively with an accuracy of only 88%.

Table 2: Accuracies of various Models

Methods	Precision (%)	Re-call (%)	F1scor (%)	Accuracy (%)
Naïve Bayes	91	96	93	93.35
MCSVMPP	98	98	99	97.66
KNN	98	98	99	99.12
Voting Classifier	98	99	99	98.132

IV. CONCLUSION

Emotional wellness issues are hard for specialists and medical care organizations to detect. Utilizing NHANES information, our review shows that there is a connection between various everyday environments and indications of wretchedness. The first step in putting together things that have to do with Living Standards is to learn more about the various facts about mental health issues. Clustering is the process. K-Means is utilized to partition the data into two gatherings. People use Naive Bayes, MCSVMPP, a standard SVM extension, and K-nearest neighbor to solve classification issues. Utilizing Voting Classifier, we can sort out why an individual is discouraged. Thus, the outcomes demonstrated that the model was able to accurately predict what causes sadness.

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