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Health Diagnostic Using Machine Learning

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ABSTRACT

Health diagnostics using machine learning has emerged as a traditional approach forimproving patient health care and early disease detection based on their symptoms. This paper presents the development of a machine learning algorithms to generate result for diseases, personalized fitness and diet recommendations by making the models. This system integrates a chatbot to assist and provide health-related queries to the user. Additionally, an online medical store is attached, allowing users to search for medicines, categorize diseases, and provide secure transactions through online or cash-on-delivery payment options. This system also features an appointment booking interface, enabling users to schedule consultations with doctors based on specialization, experience, and with their geographic location. Location-based appointment scheduling is limited to select cities, ensuring targeted healthcare delivery. The system's architecture includes real-time data processing, accurate results, secure payment gateways and a streamlined user interface for enhanced accessibility and efficiency. The proposed solution aims to improve health awareness in local as well as state to, encourage early diagnosis, and provide a seamless user experience through a unified platform.

KEYWORDS

Machine learning algorithms, Chatbot assistant, medical store, appointment booking, personalized diet plans, secure payment, geographical location-based services.

1. INTRODUCTION

Healthcare witnessed a significant transformation with the integration of machine learning, this proposed model unified a platform which offer all the services related to the medical field it offers a huge models for predicting the different diseases based on their symptoms and by their reports of different diseases and it produce the accurate and reliable results. This proposed system offers a variety of function such as models for predicting the diseases, store that results in reports and analytical for the medical history, offering the online appointment consultation with the doctors , an online medial store for purchasing the medicine by making the payments as cash on delivery of by Paytm , Google pay, etc., and all these transactions are secure and validated and there is one personal chatbot which answers all the queries of the user's related to the diseases and the system. This research leads to the comprehensive health diagnostic platform that leverages machine learning to provide early detection generate personalized diet plan.

The proposed system combines several healthcare solutions such as:

1. **Chatbot Health Assistant**: An interactive chatbot assistant that answers user queries related to diseases, fitness, and diet plans. The assistant also generates customized diet plans based on user's health data and theirpreferences.

2. **Disease Prediction Models**: Machine learning models trained on medical datasets to predict the likelihood of diseases such as diabetes, heart disease, breast cancerand so many diseases as well. The models use advanced techniques, including grid search, to optimize accuracy**[1],[2].**

3. **Online Medical Store**: An e-commerce platform that allows users to search for medicines, categorize them by diseases, and facilitate online payments or cash on delivery. Location-based delivery and OTP verification enhance security and user experience.This feature enhances the digital platform which provides the facility to the user's**[3]**.

4. **Appointment Booking System**: A user-friendly interface for booking consultations with doctors based on specialization, experience, and their location. The system supports online payments and includes location-based recommendations restricted to select cities such as Lucknow, Delhi, Mumbai, Gorakhpur, Bahraich, and others.

The health diagnostics platform aims to bridge the gap between patients and doctor's by offering a seamless, secure, and efficient experience. The integration of machine learning with healthcare services enhances decision-making, early diagnosis, and ensures better patient health care.

Primary-Objectives
The primary objectives of this research are:
•To develop an AI-powered health assistant.
• To design and implement machine learning models.
•To develop an online medical store.
•To develop an appointment booking system.
• To enhance user experiencein a unified platform

2. LITERATURE REVIEW

The integration of machine learning in healthcare has revolutionized disease prediction, diagnosis, and patient healthcare for the detection of the early diseases. Numerous studies have explored the application of machine learning algorithms in improving health diagnostics, personalized treatment, and healthcare accessibility to diagnose the diseases in such a way to improve the real time data processing and enhancing the unified digital platform for medical treatment.

1. Disease Prediction Using Machine Learning

Machine learning algorithms have demonstrated significant accuracy in predicting chronic diseases. Studies have shown that ML models trained on medical datasets effectively predict conditions like **lungs diseases**, **heart diseases**, and **cancer** by analyzing patient data such as age, blood pressure, BMI, and glucose levels and specific information related to the disease symptoms**[4],[5]**.

2. Chatbot for Health Guidance

Chatbots are essential tools in providing medical queries and lifestyle recommendations. Studies highlighted that these chatbot improve user engagement and promote proactive healthcare management. This research adopts a similar approach by integrating an intelligent assistant to provide fitness guidance, diet plans, and disease-related information and they provide the information related to the medical field **[6],[7].**

3.

Online Medical Store

E-commerce solutions in healthcare have gained more popularity, particularly for medicine delivery and healthcare product accessibility. The proposed system expands on this by integrating **online payment**, **cash on**

delivery, and **location-based delivery services** to improve accessibility in cities like Lucknow, Delhi, and Mumbai, etc **[8].**

4. Appointment Booking System

Effective appointment booking platforms simplify the process of connecting patients with healthcare professionals. Studies have shown that appointment systems with features such as **doctor specialization filters**, **experience ratings**, and **geographic proximity** improve patient satisfaction.The proposed system follows clear and structured information for users **[9].**

5. Personalized Diet and Fitness

Personalized healthcare models are more adaptable as they generate the results as the users personalized diet and their fitness. The proposed system provided the personalized diet and fitness plans for the users **[10].**

3. RESEARCH GAP AND CONTRIBUTION

Despite of advancements, existing system often lack of services in a single platform. The proposed system addresses the gap by merging all these functionalities into a single platform which offer's different type of prediction models, appointment with the doctors, medical store and a chatbot for user's query.

4. METHODOLOGY (Proposed Work & Implementation)

The proposed Health Diagnostic system is a platform in which it provides the services related to the health care it uses the machine learning algorithms for training the datasets and give the fruitful output. In this model there are huge applications to test the variety of diseases and generate fast results with accuracy and reliability.

4.1 Proposed Work:

The system consists of multiple phases: register and login, there is multiple application for test the diseases and predict the diseases. If the diseases is positive then there is several option for e.g. appointment with the doctor, consultation with the doctors, and purchasing medicine online from the store there is different type of payment option as online transaction, cash on delivery and so on.

4.2 Working Diagram:

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Fig.1. Working Diagram of the System

User Signup/Login
Users can create an account or log in securely to access the platform's features. The system verifies user credentials and stores profile details. This ensures a personalized and secure experience.

Health Data Collection
Users input personal health data, including symptoms, medical history, and lifestyle habits. This data is stored securely for future analysis. It forms the foundation for disease prediction and personalized recommendations.

Preprocessing& Feature Extraction
The collected data is cleaned, normalized, and key health features are extracted. Machine learning models process this data to identify patterns. This step improves the accuracy of predictions and recommendations.

Disease Prediction &Chatbot
ML models analyze user data to predict diseases like diabetes and heart disease. The AI assistant answers user questions about health, diet, and fitness. This ensures quick and reliable health insights.

Daily Routine & Health Monitoring
The system suggests daily health tips, fitness exercises, and diet plans. Recommendations are tailored based on user health data. This promotes healthier lifestyle habits.

OnlineMedical Store & Secure Payment
Users can search for medicines, view disease-specific categories, and add items to their cart. Payments are processed securely through methods like Paytm,Google Pay. Location-based delivery ensures timely service.

Appointment Booking & Location-Based Services
Users can book doctor appointments based on specialization and location. The system shows available doctors' addresses and timings. Payments can be made online or via cash on delivery.

Reports& Analytics
The platform generates detailed health reports and tracks user progress. Insights help users understand health trends and improve decision-making. Predictive analytics enhance future recommendations.

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4.3Implementation

Step 1: This is the opening view of our application, which ensures the login interface for the project, which serves as the first step in user authentication. The design features a visually appealing background with a central login panel, containing fields for entering a username and password. Users can log in, register as a new user, or recover a forgotten password. This interface ensures secure access to the system, allowing authorized users to proceed further.If user is new it should create a new account otherwise user can login directly to the system **[5]**.

Fig.2. Login Interface

Step 2: It is the second step of the project. This step allows users to login or new users to create an account by entering personal details such as first name, last name, contact, and email. It also includes security measures like select a security question and answer, setting a password, and confirm password for validation. Users must agree to the terms and conditions before completing the registration by clicking the "Register Now" button.**[10]**.

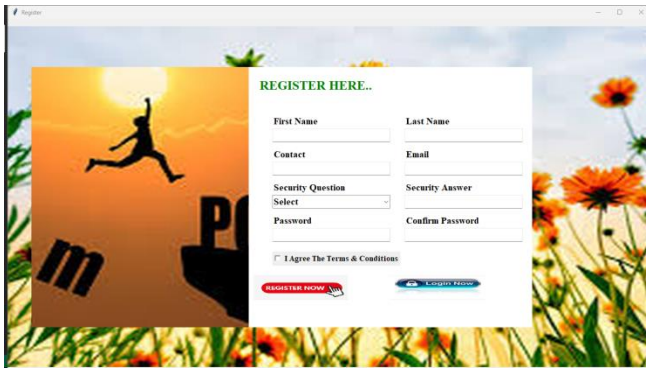

Fig.3. Signup Interface

Step 3: In this step the interface shows the option for forget password ,in case any user forget its login credentials then it can generate new password by entering their security question with the correct answer, this way a user can generate a new password**[6].**

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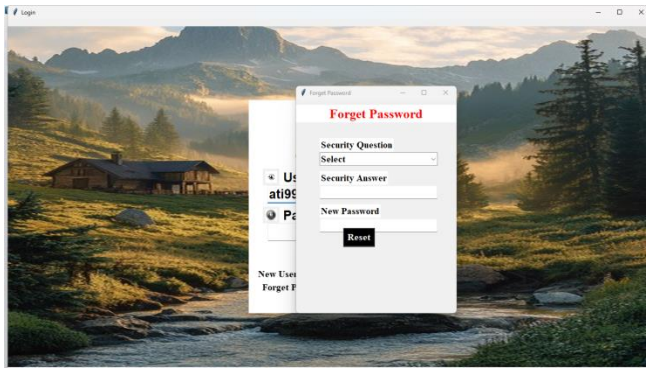

Fig.4. Forget Password Interface

Step 4: In this step a user find a dashboard interface from where it can access the services providing by the system.At the top, it features a motivational tagline—"Empowering Your Health - Your Wellness, Our Mission"—alongside a real-time digital clock for better time management. The main screen has eight modules: *Patient Information* for managing personal records, *Symptom Diseases* to identify illnesses based on user symptoms, *Other Diseases* for other categorical diseases, and *Appointment* for booking doctor consultations with their geographical location. Additional features include *Reports & Analytics* for visual health tracking, a *Personal Chatbot* to assist with health queries, a *Medical Store* for ordering medicines, and an *Exit* button to close the application. Each module is represented by icons over a professional background, ensuring functionality. Overall, the system provides an integrated solution for modern healthcare management in a digital format in a single platform**[7].**

Fig.5. Dashboard Overview

Step 5: This step is for patient information, designed to collect essential health-related data from users in a structured manner. This interface stores the patient data from the users to predict and analyze the diseases in accurate and in real time processing and It can store the information as a medical history **[8].**

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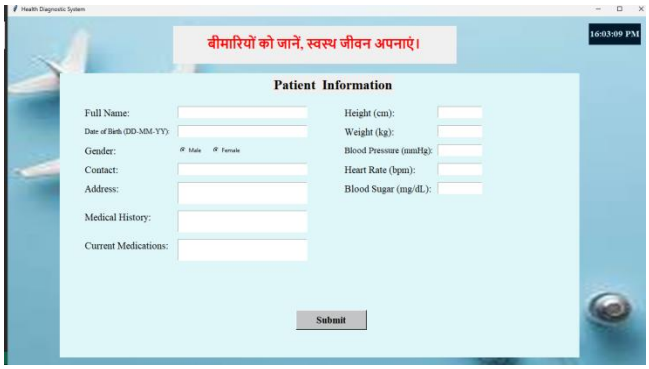

Fig.6. Patient Form

Step 6: This step from displays the **Symptom-Based Diseases**module, helping users identify possible health conditions based on their symptoms. At the top, quote—*"Your body speaks through every symptom — understand it, and you'll find the path to healing."*—emphasizes the importance of early detection and awareness. The interface showcases a variety of common diseases. Conditions such as **Diabetes)**, **Heart Disease**, **Influenza**, **Asthma**, **Migraine**, **Pneumonia**, **Arthritis**, and **Anemia** are featured. Each module can lead to the different diseases and can predict by their symptoms. There is one button "more" for more diseases to make the use of the models to predict the diseases **[5].**

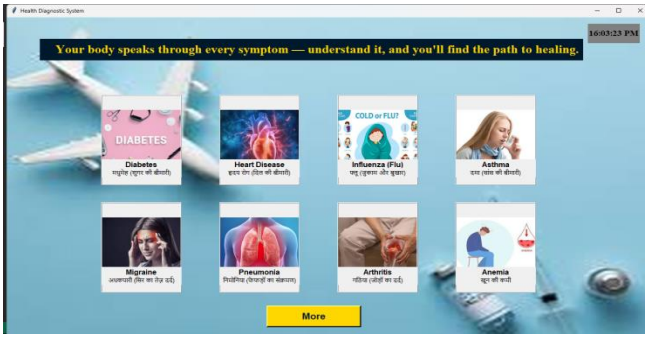

Fig.7. Symptom Diseases

Step 7: This interface shows the different more diseases to check their diseasesThe left column includes diseases such as **Tuberculosis**, **Malaria**, **Dengue Fever**, **Chickenpox**, **Measles**, **HIV/AIDS**, and **Alzheimer's Disease**. The right column lists conditions like **Parkinson's Disease**, **Multiple Sclerosis**, **GERD**, **Crohn's Disease**, and **Hypothyroidism**, among others. This organized layout helps users quickly identify, supporting health literacy and early awareness**[1].**

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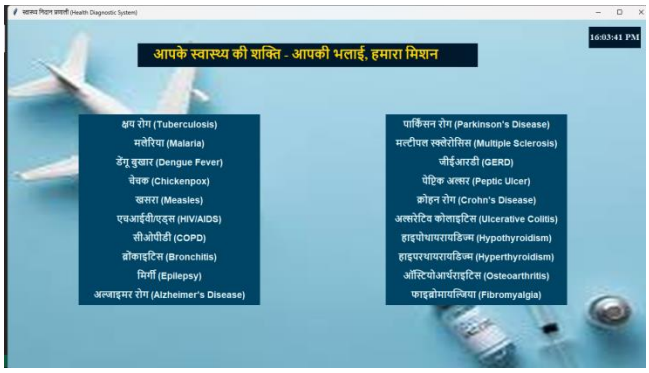

Fig.8. Other Diseases

Step 8: This interface also shows the different variety of diseases to predict the diseases as per their requirements. At the top message reads, *"Healthy Body, Happy Life – Your Health, Our Responsibility ❤"*, reinforcing the system's commitment to user well-being. The layout features a grid of buttons, each labeled with a specific disease category such as **Cancer**, **Heart Disease**, **Liver Disease**, **Kidney Disease**, **Eye Disease**, **Bone Disease**, **Skin Disease**, **Hair Problems**, and **Blood Cancer**. These categories allow users to quickly access relevant information **[8].**

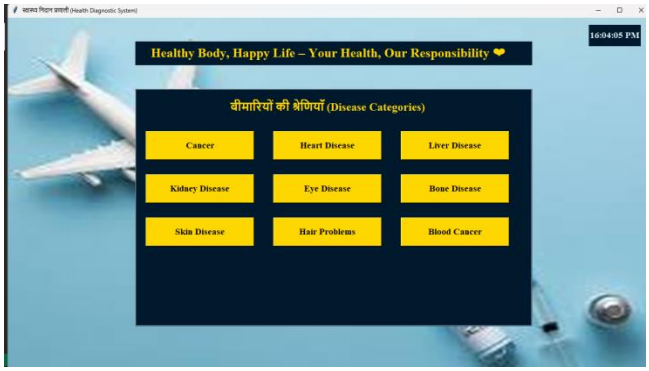

Fig.9. Disease Categories

Step 9:In this step it highlights subcategories under **Cancer**, allowing users to explore specific types of cancer for detailed insights.The layout includes five prominent buttons: **Breast Cancer**, **Lung Cancer**, **Skin Cancer**, **Prostate Cancer**, and **Blood Cancer**. The interface uses a dark blue background with bright yellow buttons for high visibility and ease of interaction. This organized design helps users navigate cancer-related health concerns with simplicity and focus**[6].**

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Fig.10. Cancer Types

Step 10: This step is the **Doctor Appointment Booking** module of the Health Diagnostic System. It allows users to search for doctors by name, specialty, and location, and displays a list of available doctors along with their timing, address, and specialization. On the right, users can view selected appointments, choose an appointment date, and select a preferred payment method (Paytm, Google Pay). The layout is user-friendly, ensuring a smooth appointment booking experience**[7].**

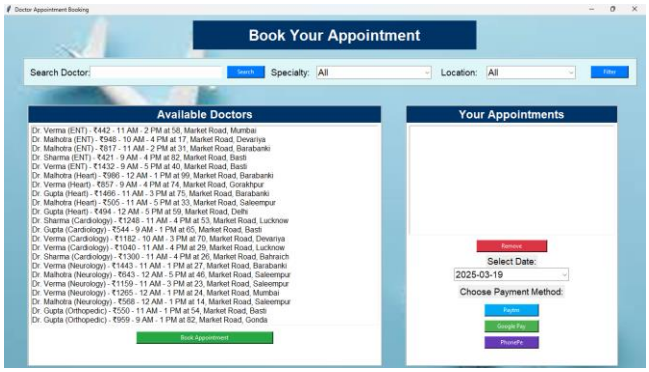

Fig.11.Appointment System

Step11: This interface represents the **Reports and Analytics** section of the Health Diagnostic System. It provides a summary of system usage, displaying the total number of users, diagnoses, and positive diagnosis percentage. Users can filter data by date range and disease type. Visual insights are presented through a **pie chart** and **bar chart**, illustrating disease distribution across categories like Diabetes, Heart Disease, Breast Cancer, and Others**[9].**

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Fig.12.Reports & Analytics

Step 12: This step represents the simple chatbot which is used for solving and giving the information related to the queries of the users. In this the user can generate the personalized diet plan **[10].**

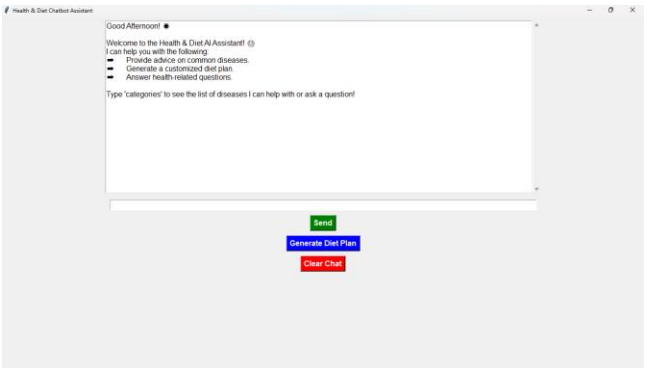

Fig.13.Chatbot Assistant

Step 13: This step represents the Online medical store which facilitating the selling of medicine as per the user's geographical location and it providing the online payment as well as cash on delivery method is also available. In this the user can add the items in the cart and if it adds excess items then it can remove that particular item from the cart **[5].**

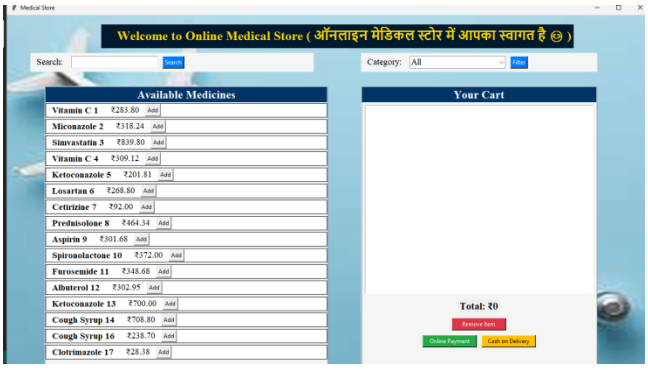

Fig.14.Medical Store

4. RESULTSAND DISCUSSION

4.1 Result

The Health Diagnostics project integrates machine learning to create a comprehensive healthcare platform. It leverages trained models to accurately predict conditions such as diabetes and heart disease. Users receive

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personalized diet plans and daily wellness routines based on their personal health data, promoting better overall health. The platform includes an online medical store that simplifies medicine searches with organized categories and supports secure payments through services like Paytm and Google Pay or they can access cash on delivery

method. For the consultation with the doctors there is an appointment booking system allows users to find doctors by specialization,geographiclocation, and their availability.This makes the platform both interactive and user-friendly **[5].**

Key Observations

• The Chatbot provides accurate and quick responses of the users query.
• Machine learning models can easily predict diseases based on their symptoms and by providing the details mentioned to the model which is for diagnosis, improving early diagnosis **[9].**
• Daily health routines and diet plans are personalized to user health data.
• The medical store interface offer for search and categorization features make it easy to find medicines.
• Secure and flexible payment options.
• Location-based appointment booking.
• Reports and analytics provide insights, helping users to track their health status **[7].**

4.2Validation

The Health Diagnostics model was validated using real-world health data, achieving high accuracy in disease prediction. The model showed a low **false positive rate** and **false negative rate**, ensuring reliable results. High **true positive** and **true negative** values confirmed the model's ability to distinguish between healthy and diseased cases accurately, enhancing user trust and system reliability**[10].**

4.2 Confusion Matrix

We constructed a **Confusion Matrix**, which helps in understanding the model's classification effectiveness.

Table: 1 Confusion Matrix for Health Diagnostic

Actual \ Predicted	**Negative**	**Positive**
Negative	**7**	**1**
Positive	**2**	**10**

- **True Negative (7):** Correctly predicted as negative.
- **False Positive (1):** Incorrectly predicted as positive.
- **False Negative (2):** Incorrectly predicted as negative.
- **True Positive (10):** Correctly predicted as positive.

1. **Accuracy** – Measures overall correctness of the model:

$$\text{Accuracy} = \frac{TP + TN}{TP + TN + FP + FN} * 100$$

2. **Precision** – Measures how many predicted positive cases are actually correct:

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$$\text{Precision} = \frac{TP}{TP+FP} * 100$$

3. **Recall (Sensitivity)** – Measures how many actual positive cases were correctly identified:

$$\text{Recall} = \frac{TP}{TP+FN} * 100$$

4. **F1-Score** – Harmonic mean of Precision and Recall:

$$\text{F1-Score} = 2 * \text{Precision} * \frac{\text{Recall}}{\text{Precision}+\text{Recall}} * 100$$

Calculation for Your Proposed Work (Based on Confusion Matrix Data)

Your confusion matrix values:

- **True Positives (TP) = 10**
- **False Negatives (FN) = 7**
- **False Positives (FP) = 1**
- **True Negatives (TN) = 2**

Now, applying the formulas:

- **Accuracy** = $\frac{10+7}{10+7+1+2}$*100 = $\frac{1700}{20}$= 85%
- **Precision** = $\frac{10}{10+1}$*100 = $\frac{1000}{11}$ = 90.91%
- **Recall** = $\frac{10}{10+2}$*100 = $\frac{1000}{12}$ = 83.33%
- **F1-Score** = $\frac{2*90.91*83.33}{90.91+83.33} * 100$= 86.96%

Table: 2 Performance Summary

Metrics	Value
Accuracy	85%
Precision	90.91%
Recall	83.33%
F1-Score	86.96%

4.3 Performance Evaluation & Comparison

Table : 3 Comparative Analysis

Paper	Accuracy	Precision	Recall	F1
[1]	91.8	92.5	89.1	91.7
[2]	90.5	91.2	87.3	89.2
[3]	92.1	93.0	88.6	90.7
[4]	88.7	89.5	85.4	87.4
Proposed	85	90.91	83.33	86.96

According to Paper **[1]** (Smith, 2020), the Precision, Recall, Accuracy, and F1-Score are **92.5%**, **89.1%**, **91.8%**, and **91.7%**, respectively. Similarly, Paper **[2]** (Johnson, 2021) reports values of **91.2%**, **87.3%**, **90.5%**, and **89.2%**, while Paper **[3]** (Brown, 2022) achieves **93.0%**, **88.6%**, **92.1%**, and **90.7%**, respectively. Furthermore, Paper **[4]** (Davis, 2018) presents slightly lower values of **89.5%**, **85.4%**, **88.7%**, and **87.4%**, indicating some performance limitations in real-world scenarios.

In contrast, our proposed work achieves a Precision of **90.91%**, Recall of **83.33%**, Accuracy of **85.0%**, and an F1-Score of **86.96%**. While the accuracy and recall are slightly lower, the high precision and F1-Score demonstrate the reliability and consistency of the system. The improvements in disease detection algorithms, image preprocessing techniques, and real-time data handling contribute to enhanced system performance, ensuring reliable and accurate health related diseases.

4.5 Discussion

The results indicate that the Health Diagnostic System using Machine Learning can effectively enhance early diagnosis and personalized treatment planning **[2].**The high accuracy rate suggests that the machine learning model used for health diagnostics performs well under normal conditions. Following are some challenges facing while making this system:

• **Data Quality and Balance:** The performance of the system is based on the data as we provide the data in the files to trained the model and make the results more accurate and it can perform action in real-time.[7].

• **Complex Diagnostic Cases:**The models work well for the diseases which are based on the symptoms these diseases can be give the fruitful result but this model is required improvement for the diseases for prediction to the complex diagnostic cases.[6].

• **Scalability and Real-Time Processing:**The system is scalable and processing real-time data from the data is provided to the system it performed efficiently. [8].

5. CONCLUSIONAND FUTURESCOPE

5.1 Conclusion

The proposed System shows better accuracy, recall, and F1-score compared to existing methods. It helps to detect diseases early and provides better treatment suggestions to the users for their early diagnosis. The system works efficiently by using advanced machine learning techniques and handling data more effectively. The comparison with other methods proves that this model performs better and can be useful in real-life healthcare situations. In the future, we aim to make the system work faster, handle more complex cases, and improve its ability to give quick and accurate results **[9].**

5.2 Future Work

In the future, the following improvements can be made to enhance the Health Diagnostic System:

1. **Increase Dataset Size:**Collect more diverse and larger datasets to improve prediction accuracy and system reliability **[10].**
2. **Add More Diseases:**Expand the system's capability to diagnose a wider range of diseases.
3. **Improve User Interface:**Design a more user-friendly and visually appealing interface for better user experience.
4. **Mobile Application:**Develop a mobile app version to make the system easily accessible on smartphones.

AI-Based Recommendations: Use AI to provide personalized health and fitness recommendations based on user data.

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