##### A Project report on

**AI-Driven Disease Insights, Doctor Referral & Appointment Utility**

###### A Dissertation submitted to JNTU Hyderabad in partial fulfillment of the academic requirements for the award of the degree.

**Bachelor of Technology**

**in**

**Computer Science and Engineering**

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#### CERTIFICATE

This is to certify that the Major Project Phase I report entitled **"AI-Driven Disease Insights, Doctor Referral & Appointment Utility"** being submitted by A.Bhanu Prasad Reddy (20H51A0528), Ruheena Naaz (20H51A0548), A.Bhagya Sree (20H51A0557) in partial fulfillment for the award of **Bachelor of Technology in Computer Science and Engineering** is a record of bonafide work carried out his/her under my guidance and supervision.

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

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# **ABSTRACT**

Many deadly diseases are preventable and can be cured if treated at an early stage. However, people tend to ignore the early symptoms of a disease as they are mild. And till the time they become aware of the disease, the infection has already spread into their body. Hence, it is always advisable to have a regular body check-up to avoid health issues later. The Online Doctor Application proposed here is an android based smart application that will help the users to identify a disease based on the symptoms. When a patient enters his /her symptoms the system will incorporates custom made algorithms like random forest algorithm and KNN classifer to identify the disease. Then based on the disease identified the system will recommend a list of doctors having expertise on that particular disease. The patients can book an appointment with the doctors as per their preferred time & date. The patients can also chat with a doctor to get consultations

The primary goal of this project is to harness the power of AI to transform the healthcare landscape by empowering both patients and healthcare providers with valuable information and resources. The platform leverages machine learning algorithms and data analysis techniques to deliver personalized disease insights to patients based on their medical history, symptoms, and available healthcare data. These insights serve as a valuable resource for patients to better understand their condition, treatment options, and potential risks.

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# **CHAPTER 1**

**INTRODUCTION**

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**CHAPTER 1**

**INTRODUCTION**

**1.1.Problem Statement**

In today's fast-paced world, access to quality healthcare is essential. We're excited to introduce an innovative solution that puts your health in your hands.It is always advisable to have a regular body check-up to avoid health issues later.Introducing the AI-Driven Disease Insights, Doctor Referral & Appointment Utility —an indispensable tool that seamlessly combines cutting-edge AI technology with healthcare access. This application offers users the ability to gain deep insights into their health conditions through symptom analysis, receive tailored doctor referrals, and effortlessly schedule appointments, revolutionizing the way we approach healthcare in a user-friendly, efficient, and accessible manner.

Overall, this project aims to leverage the capabilities of AI to provide patients with meaningful disease insights, simplify the process of finding the right healthcare professional, and enhance the efficiency of appointment scheduling. By empowering patients with knowledge and facilitating seamless access to healthcare services, this platform contributes to the improved quality of care and patient satisfaction, ultimately promoting the overall well-being of individuals within the healthcare ecosystem.

**1.2.Research Objective**

Our objective is to develop and evaluate an AI-driven healthcare application that effectively identifies diseases based on symptoms.Assess the effectiveness of the symptom analysis algorithm in providing reliable disease insights.Based on the disease identified this aims to provide accurate doctor referrals. Create a user-friendly interface for seamless appointment booking with recommended doctors.with the aim of improving healthcare accessibility and patient outcomes.

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**1.3 Project Scope and Limitations**

**Project Scope:**

* Users can select the symptoms which they are suffered and able to identify the disease caused by them.
* The app allows users to search for doctors in their area based on specialty, location, and availability. Users can also read reviews from other patients to help them make informed decisions about their healthcare providers.
* Users can easily book appointments with their chosen healthcare providers directly through the app. The app also offers reminders and notifications to help users stay on top of their appointments and manage their healthcare needs more effectively.

**Limitations:**

* **Data Quality:** The accuracy of disease insights and doctor referrals heavily relies on the quality and completeness of patient data. Inaccurate or incomplete data can lead to erroneous recommendations.
* **Privacy Concerns:** The project should adhere to stringent data privacy regulations, which may limit the extent of data sharing and analysis, potentially impacting the quality of insights.
* **AI Algorithm Accuracy:** AI algorithms, while powerful, are not infallible. There may be limitations in the algorithms' ability to accurately diagnose or match patients with doctors, particularly for rare or complex conditions.
* **User Adoption:** The success of the system relies on user adoption. If patients or healthcare providers are reluctant to use the platform, its impact may be limited.
* **Healthcare System Integration:** Integrating with existing EHR systems and databases can be complex and may require cooperation from various healthcare institutions, which could be challenging to achieve.

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**CHAPTER 2**

**BACKGROUND WORK**

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**CHAPTER 2**

**BACKGROUND WORK**

**2.1 Disease Prediction using Machine Learning based on User Symptoms**

**2.1.1 Introduction:**

The healthcare and medical sector are more in need of data mining today. When certain processing methods are used in the right way, valuable information is often extracted from a large database which may help the medical practitioner to wish for early decision and improve health services. Machine Learning helps in prediction by its emerging approach for the diagnosis of a disease. This paper depicts the prediction of diseases by using patient symptoms. Machine Learning algorithms like Naive Bayes, Decision Tree, and Random Forest are used for predicting diseases. Its implementation is completed through the python programming language. Diseases and health-related problems like malaria, Impetigo, Diabetes, Migraine, Jaundice, Chickenpox, etc., cause a significant effect on one’s health and sometimes might also lead to death if ignored. The healthcare industry can make a decent deciding making by, “mining” the large database they possess i.e. by extracting the hidden patterns and relationships within the database. Data processing algorithms like Decision Tree, Random Forest, and Naive Bayes algorithms can provide a remedy to the current situation. Hence, we have developed an automatic system that can discover and extract hidden knowledge associated with the diseases from a historical (diseases-symptoms) database according to the rule set of the algorithms.

**2.1.2 Merits,Demerits and Challenges**

**Merits:**

* Early Detection: Machine learning can aid in the early detection of diseases, allowing for timely intervention and treatment, potentially improving patient outcomes.
* Personalized Healthcare: Machine learning models can provide personalized disease predictions based on individual symptoms, medical history, and other data, resulting in more tailored treatment plans.
* Efficiency: Automation of disease prediction can help healthcare providers streamline the diagnostic process, reducing manual workloads and minimizing errors.

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* Data-Driven Insights: Machine learning models can analyze large datasets to identify patterns and correlations in symptoms, enabling more accurate disease predictions.
* Improved Accuracy: Machine learning algorithms can process and analyze a vast amount of data, leading to potentially more accurate disease predictions compared to traditional methods.

**Demerits:**

* Data Quality: The accuracy of predictions heavily relies on the quality and completeness of input data. Inaccurate or incomplete symptom data can lead to incorrect predictions.
* Lack of Human Expertise: Machine learning models, while powerful, may lack the nuanced understanding and clinical judgment of healthcare professionals. They are not a replacement for doctors but should be used as tools to aid decision-making.
* Privacy Concerns: Handling sensitive healthcare data for prediction purposes requires stringent data privacy measures to protect patient information.
* Algorithm Bias: Machine learning models can inherit biases from the training data, potentially leading to disparities in disease predictions, particularly in underrepresented populations.
* Limited Data: Machine learning models may struggle to provide accurate predictions for rare diseases or conditions with limited historical data.

**Challenges:**

* Ethical Concerns: The ethical use of patient data for disease prediction, consent, and data security are paramount challenges in implementing machine learning in healthcare.
* Regulatory Compliance: Adhering to healthcare regulations and privacy laws, such as HIPAA in the United States, is crucial and can be a significant challenge.
* Education and Acceptance: Educating healthcare professionals and patients about the benefits and limitations of machine learning in healthcare is important for successful adoption and acceptance.

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**2.1.3 Implementation:**

Nowadays, we live in a world where people suffer from various diseases due to conditions like environmental changes and various dangerous experiments like Covid19. So the prediction of disease at an earlier stage became the most important task and correct prediction of disease is the most challenging task. Here we proposed a system that can identify diseases based on symptoms. There are many applications like online consultation with a doctor but there is less number of application that predict diseases. There are systems where only one disease can be predicted by using the symptoms but in our system, we can predict forty-one common diseases. For prediction purpose, we required some symptom’s dataset. With the help of the disease symptom dataset from the Kaggle platform, we find a huge amount of information to process in this system for accurate prediction. For the prediction purpose, we use three algorithms of machine learning which are Naïve Bayes, Random Forest, and Decision Trees. After prediction of disease, the system will provide detail information about diseases and provide the option to book an appointment for a required doctor which is also a part of our system where patient selects doctor for his/her treatment and book their appointments accordingly.

**2.2 Practo App**

**2.2.1 Introduction:**

Practo is a widely recognized and popular healthcare technology platform that offers a variety of services aimed at improving patient care, enhancing healthcare provider efficiency, and enabling easier access to healthcare services. Founded in 2008, Practo has since expanded its presence to several countries and provides a wide range of features, including doctor discovery, appointment booking, telemedicine consultations, and health information resources.

**2.2.2 Merits,Demerits and Challenges**

**Merits:**

1. Doctor Discovery: Practo simplifies the process of finding healthcare professionals by offering an extensive database of doctors, clinics, and hospitals. Patients can search based on specialties, locations, user ratings, and other filters.
2. Appointment Booking: Patients can easily book, reschedule, or cancel appointments through Practo's platform, reducing the need for lengthy phone calls or in-person visits. This convenience enhances the overall patient experience

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1. Telemedicine: Practo offers telemedicine services, enabling patients to consult with healthcare providers remotely. This feature is particularly valuable in situations where in-person visits are challenging, as seen during the COVID-19 pandemic.
2. Health Information: Practo provides users with access to health information, articles, and tools to better understand their medical conditions and symptoms. This empowers patients to be more informed about their health.

**Demerits:**

1. Data Privacy Concerns: Like any healthcare technology platform, Practo must handle sensitive patient data. Privacy and security concerns can arise, especially given the increasing importance of data protection regulations.
2. Accuracy of Information: The quality of information, such as user reviews and doctor profiles, may vary. Users must exercise caution and verify information to ensure they receive accurate and reliable healthcare services
3. Limited Geographical Availability: The availability and comprehensiveness of Practo's services can vary by location. In some regions, the platform may not offer the same extensive database of healthcare providers.
4. User Adoption: Encouraging patients and healthcare providers to adopt the platform can be a challenge. Some individuals, particularly in less technologically advanced regions, may be resistant to adopting digital healthcare services.

**Challenges:**

1. Regulatory Compliance: Practo operates in a highly regulated industry with strict data privacy and healthcare regulations. Complying with these regulations, which can vary by country, can be a significant challenge.
2. Quality Control: Maintaining the quality and accuracy of information on the platform, including doctor profiles and user reviews, is an ongoing challenge.
3. Competition: The healthcare technology industry is highly competitive, with numerous other platforms vying for market share and user attention.
4. User Trust and Data Security: Earning and maintaining user trust in handling their sensitive healthcare data is crucial, as any security breach or data mishandling can have severe consequences.

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**2.2.3 Implementation:**

The implementation of a healthcare platform like Practo involves a systematic approach. It begins with identifying specific needs and regulatory requirements, selecting the right technology stack, and designing user-friendly interfaces. Integration with healthcare providers and institutions is crucial, allowing patients to find doctors, book appointments, and access telemedicine services. Robust security measures are implemented, and mobile apps are developed for accessibility. Testing and continuous user feedback drive improvements, and marketing strategies aim to attract users and healthcare providers. Regional adaptation is important to meet local healthcare practices and regulations. This multifaceted process requires meticulous planning and a commitment to user privacy and data security.

**2.3 Disease Predictor Based on Symptoms Using Machine Learning**

**2.3.1 Introduction:**

A well-functioning healthcare system is critical to the economy and the well-being of humanity. Between the world, we live in now and the world we lived in a few decades ago, there has been a substantial amount of change. Everything has gotten more disorderly and unattractive. In this situation, doctors and nurses are doing everything they can to save people's lives, even if it means putting their own lives in danger. Virtual doctors are board-certified doctors who choose to practice online using video and phone consultations rather than in-person consultations, albeit this is not always practicable in an emergency. In the absence of human error, machines are thought to be superior to humans because they can do jobs faster while maintaining a consistent level of precision. A disease predictor, often known as a virtual doctor, A disease predictor can save a person's life in extreme instances, such as COVID-19 and EBOLA, by recognizing their health without requiring physical touch. There are virtual doctors on the market now, but they lack the capacity to provide the kind of precision that is required. This Condition's Prognosis To forecast sickness, we'll use hospital data and Machine Learning methods based on the Python programming language and the Tkinter interface. Doctors may make errors when diagnosing a patient's disease, however, disease prediction systems with machine learning algorithms can help produce accurate results in these situations.

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**2.3.2Merits,Demerits and Challenges**

**Merits:**

1. High Accuracy:The 97% accuracy rate is a significant merit of the project. It indicates that the machine learning models have been trained effectively and can make accurate predictions based on symptoms.

2. Early Detection: The project can help in early detection of diseases based on symptoms, which can be crucial in preventing and treating diseases at an early stage, potentially saving lives.

3. Ease of Use: Such a system can be user-friendly and accessible to the general public. Patients can input their symptoms easily, and the system can provide quick predictions, which can be especially helpful for individuals in remote areas or those who do not have immediate access to healthcare professionals.

4. Cost-Efficiency: This project can help reduce healthcare costs by efficiently allocating resources and avoiding unnecessary medical tests or appointments.

**Demerits:**

1.Data Quality: The accuracy of the predictions is highly dependent on the quality of the training data. If the data used for training is not representative or contains biases, the model's performance can be compromised.

2. Overfitting: There's a risk of overfitting, where the models perform well on the training data but fail to generalize to unseen data. This can lead to inaccurate predictions in real-world scenarios.

3.Limited Scope: The project might be limited to a specific set of diseases or symptoms. Expanding it to cover a broader range of conditions can be challenging.

4. Privacy Concerns: Gathering and storing patient symptom data can raise privacy concerns, and it's important to ensure that data is handled securely and in compliance with relevant regulations like GDPR or HIPAA.

**Challenges:**

1.Maintenance:Machine learning models require regular updates and maintenance to stay accurate as medical knowledge evolves. Incorporating new data and adjusting the models can be an ongoing challenge.

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2. Scalability: As the system gains popularity, it may need to handle a large volume of symptom data. Scalability can be a challenge in terms of computing resources and response times.

3. Interpretability:Some machine learning models, such as decision trees or random forests, can be complex and lack interpretability. This can be a challenge when it comes to explaining the predictions to patients or healthcare professionals.

4. Regulatory Approval: Depending on the region, the system may need regulatory approval, especially if it is used for medical diagnosis or treatment recommendations.

**2.3.3 Implementation:**

To construct a disease prediction based on symptoms, we applied four machine learning algorithms: Decision Tree, Random Forest, KNN, and Naive Bayes. We can get an accurate forecast for our model using these tactics. The Prognosis of the Illness Currently, the effort is in full swing. Machine Learning is being used to diagnose and prevent disease in its infancy. As we all know, humanity has become so engrossed in the competitive environment of economic advancement that it has lost sight of its own well-being. Studies show that 40% of people ignore small symptoms, which might lead to more serious problems in the future. The project's interface is also built with Tkinter, a Python library interface. The user must first enter their name, then select symptoms from a drop-down menu; alternatively, the user must enter all symptoms, after which the system will return an exact result. Four machine learning approaches were used to create this forecast: Decision Tree, Random Forest, KNN, and Naive Bayes. When the user enters all of the symptoms and simply presses the Random Forest button, the result is computed using that method; similarly, we've utilized four ways to provide a more thorough perspective of the data, and the user must be satisfied with the anticipated conclusion.

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**CHAPTER 3**

**RESULTS AND DISCUSSION**

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**CHAPTER 3**

**RESULTS AND DISCUSSION**

The "AI-Driven Disease Insights, Doctor Referral & Appointment Utility" project has yielded several significant results and prompted valuable discussions in the realm of healthcare technology. Here are the key results and discussions stemming from this project:

A. Experimentation

To conduct all of the experiments in the Jupyter notebook, we used the python3 programming language with the Tkinter interface, as well as NumPy and pandas.

B. Metrics for Assessment

We get accurate disease prediction because we supply symptoms as input to the system.

C. Disease Prediction Dataset

A CSV data file from New York-Presbyterian Hospital was provided by the University of Columbia. The training data file has 4920 rows and 133 columns, while the testing data file has 5 rows and 133 columns.Itching, skin rash, shivering, chills, joint stiffness, and other symptoms are some of the most prevalent attributes.

D. Data Preprocessing

This step will remove any punctuation, HTML markups, hashtags, URLs, @names, and whitespace, as well as stop words,

lemmatizing, and stemming text.

E. Training

The system will compare the user's symptoms to the dataset as they are entered, the dataset is made up of binary 0s and 1s, and once

the model has assessed all of the user's symptoms, it will accurately forecast the disease associated with that manifestation.

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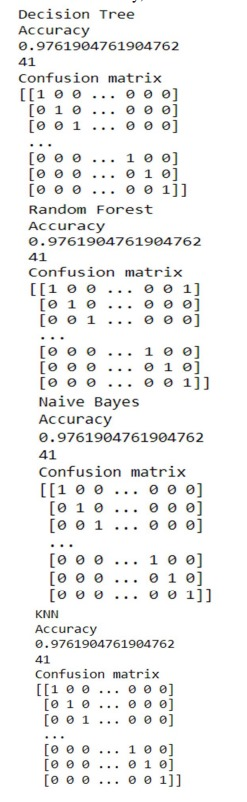


Fig 3.1

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CHAPTER 4

**CONCLUSION**

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**CHAPTER 4**

**CONCLUSION**

In conclusion, the project revolving around the development and implementation of an AI-Driven Disease Insights, Doctor Referral & Appointment Utility platform holds great promise for revolutionizing the healthcare landscape. By leveraging artificial intelligence, this platform aims to empower patients with valuable disease insights, streamline the process of finding healthcare providers, and simplify appointment scheduling, ultimately enhancing the patient experience and improving healthcare efficiency.

While there are merits to such a project, including improved patient convenience, access to healthcare, and data-driven insights, there are also important challenges and limitations to consider. These encompass issues related to data privacy, the accuracy of AI algorithms, regulatory compliance, and the need for user trust and adoption. Addressing these challenges is essential for the successful implementation of such a project.In a rapidly evolving healthcare technology landscape, the ability to adapt to regulatory changes, maintain data security, and continually improve the platform's features and user experience will be key to its long-term success. Overall, the AI-Driven Disease Insights, Doctor Referral & Appointment Utility project represents a significant step towards the future of healthcare, where technology plays a pivotal role in enhancing patient care and making healthcare services more accessible and efficient.

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**GitHub Link**

1.