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Personal Virtual Doctor

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Abstract: The concept of a "personal virtual doctor" refers to an innovative approach in healthcare that utilizes virtual or digital technologies to provide personalized and accessible medical guidance and support. This virtual doctor operates in a digital realm, machine learning, and advanced algorithms to interact with users in a manner like a human healthcare provider. Analyzes data to provide insights into the user's health status and potential areas for improvement. In the realm of technological innovation, the convergence of machine learning and healthcare has led to the development of a groundbreaking solution – the Personal Virtual Doctor. This project harnesses the capabilities of machine learning in Python to create an advanced system capable of predicting diseases based on user-input symptoms. Augmented by a sophisticated healthcare chatbot, the application offers an interactive platform for users to describe their symptoms and receive real time information about potential health issues. With a user-friendly interface and a commitment to privacy and security, this project signifies a transformative leap towards a more informed and proactive approach to personal health. The Personal Virtual Doctor is poised to revolutionize healthcare, empowering individuals to take charge of their well-being through the amalgamation of technology and medical expertise. Challenges faced by many people are looking online for health information regarding diseases, diagnoses, and different treatments. If a recommendation system can be made for doctors and medicine while using review mining will save a lot of time. The idea behind recommender system is to adapt to cope with the special requirements of the health domain related with users. The development and implementation of a personal virtual doctor aim to enhance healthcare accessibility, provide timely information, and empower individuals to take a more proactive role in managing their health and well-being.

Keywords: Personal Virtual Doctor, Disease prediction System, Multiple disease prediction

I. INTRODUCTION

In an era dominated by technological advancements, the fusion of machine learning and healthcare has paved the way for innovative solutions. This project aims to introduce a cutting-edge application – your very own Personal Virtual Doctor. Leveraging the power of machine learning in Python, this virtual doctor is designed to predict diseases based on user-input symptoms, providing valuable insights into one's health. In an era marked by unprecedented technological strides, the synergy of machine learning and healthcare has ushered in a new frontier of personalized well-being. This project introduces a pioneering concept: the Personal Virtual Doctor. Leveraging the potency of machine learning algorithms implemented in Python, this innovative system aims to redefine how individuals engage with their health. At its core, the Personal Virtual Doctor is designed to predict diseases based on user input symptoms, offering an invaluable tool for early detection and informed decision making. Complemented by a healthcare chatbot, the application transcends traditional diagnostics, fostering interactive conversations and delivering tailored recommendations.

Welcome to the future of healthcare—welcome to your Personal Virtual Doctor. With the rise in number of patient and disease every year medical system is overloaded and with time have become overpriced in many countries. Most of the disease involves a consultation with doctors to get treated. With sufficient data prediction of disease by an algorithm can be very easy and cheap. In our project we have tried accurately predict a disease by looking at the symptoms of the patient. We have used 5 different algorithms for this purpose and gained an accuracy of 92-95%. We have also designed an interactive interface to facilitate interaction with the system.

II. PROBLEM STATEMENT

Imagine In contemporary healthcare, there exists a critical need for a comprehensive and personalized approach to disease prediction and prevention. Despite advancements in medical technology, the proactive monitoring of individual health remains fragmented and reactive. Recognizing this gap, the problem at hand is to develop a robust Personal Virtual Doctor Disease Prediction System that utilizes artificial intelligence and machine learning to analyze diverse health data sources, empowering individuals, and healthcare professionals with timely insights for early disease detection and preventive interventions. Additionally, concerns surrounding data privacy, security, and interoperability with existing healthcare infrastructure pose substantial barriers to the seamless deployment and adoption of such systems.

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III. OBJECTIVES

To create an application which performs the following functionalities:

➢ Disease Prediction Accuracy: Develop and fine-tune machine learning algorithms to ensure high accuracy in predicting diseases based on user-input symptoms. Continuously update the model with the latest medical data to enhance prediction capabilities.

➢ Interactive Healthcare Chatbot: Implement a natural language processing (NLP) powered chatbot to facilitate user friendly and interactive conversations. Enable the chatbot to understand and respond to user queries regarding symptoms, potential diseases, and recommended actions.

➢ Comprehensive Disease Database: Create a comprehensive database of diseases, symptoms, and associated medical information to support accurate disease prediction. Regularly update the database to incorporate new medical findings and ensure relevance.

➢ Personalized Treatment Recommendations: Develop a recommendation system that provides personalized and actionable advice for users based on predicted diseases. Integrate information on treatment options, lifestyle modifications, and preventive measures.

➢ Security and Privacy Measures: Implement robust security protocols to safeguard user data and maintain confidentiality. Adhere to healthcare data protection standards to instil trust in users regarding the security of their personal health information.

➢ Education and Awareness: Develop educational resources within the application to inform users about common health issues, prevention strategies, and the importance of early detection.

IV. EXPECTED OUTCOMES

The expected outcomes for the Personal Virtual Doctor project encompass a range of positive impacts on healthcare management, user experience, and overall well-being. As per user interest, he/she can predict the disease using different algorithms such as Decision tree algorithm, Random Forest algorithm, Naive bayes algorithm and K-Nearest neighbour. Disease Recommendation will be available Infront of the labels of algorithm of user's choice. Here are the expected outcomes:

- Improved Early Detection and Prevention: Users will benefit from early detection and prevention of potential health issues, leading to better health outcomes and reduced healthcare costs.

- Increased Health Literacy: The integration of educational resources will contribute to increased health literacy, empowering users to make informed decisions about their health.

- Personalized Healthcare Guidance: Users will receive personalized treatment recommendations and lifestyle advice, leading to more effective and targeted health interventions.

- Time-Efficient Healthcare Access: The time-efficient nature of the virtual doctor's analysis will enable users to access healthcare information promptly, fostering timely decision-making.

- Trust in Security and Privacy: The robust security measures will build trust among users regarding the confidentiality and privacy of their health data.

- User Empowerment: Users will feel empowered to take an active role in managing their health, fostering a sense of control and responsibility.

- Continual Improvement: Continuous efforts to improve machine learning models, update the disease database, and gather user feedback will ensure the system's ongoing relevance and accuracy.

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V. LITERATURE SURVEY

[1] RINKAL KENIYA, AMAN KHAKHARIA, VRUDDHI SHAH, VRUSHABH GADA, RUCHI MANJALKAR, TIRTH THAKER, MAHESH WARANG AND NINAD MEHENDALE " DISEASE PREDICTION FROM VARIOUS SYMPTOMS USING MACHINE LEARNING" - ACCURATE AND ON-TIME ANALYSIS OF ANY HEALTH-RELATED PROBLEM IS IMPORTANT FOR THE PREVENTION AND TREATMENT OF THE ILLNESS. THE TRADITIONAL WAY OF DIAGNOSIS MAY NOT BE SUFFICIENT IN THE CASE OF A SERIOUS AILMENT. DEVELOPING A MEDICAL DIAGNOSIS SYSTEM BASED ON MACHINE LEARNING (ML) ALGORITHMS FOR PREDICTION OF ANY DISEASE CAN HELP IN A MORE ACCURATE DIAGNOSIS THAN THE CONVENTIONAL METHOD. WE HAVE DESIGNED A DISEASE PREDICTION SYSTEM USING MULTIPLE ML ALGORITHMS. THE DATA SET USED HAD MORE THAN 230 DISEASES FOR PROCESSING. BASED ON THE SYMPTOMS, AGE, AND GENDER OF AN INDIVIDUAL, THE DIAGNOSIS SYSTEM GIVES THE OUTPUT AS THE DISEASE THAT THE INDIVIDUAL MIGHT BE SUFFERING FROM. THE WEIGHTED KNN ALGORITHM GAVE THE BEST RESULTS AS COMPARED TO THE OTHER ALGORITHMS. THE ACCURACY OF THE WEIGHTED KNN ALGORITHM FOR THE PREDICTION WAS 93.5 %. OUR DIAGNOSIS MODEL CAN ACT AS A DOCTOR FOR THE EARLY DIAGNOSIS OF A DISEASE TO ENSURE THE TREATMENT CAN TAKE PLACE ON TIME AND LIVES CAN BE SAVED.

[2] **RITIKA CHADHA, AAYUSH SHARMA "CHATBOT FOR DISEASE PREDICTION USING CLASSIFICATION BASED MACHINE LEARNING ALGORITHMS"** - IN TODAY'S WORLD, THERE IS A PLETHORA OF MEDICAL DATA WHICH IF PROCESSED INTO INFORMATION COULD ALLEVIATE THE BURDEN ON THE HEALTH-CARE SYSTEMS AND PREVENT READMISSIONS TO THE HOSPITALS. ON ANOTHER PERSPECTIVE, IT COULD ALSO MAKE THE PATIENTS AWARE OF THE CRITICALITY OF THEIR HEALTH CONDITIONS TO TAKE THE REQUIRED ACTION. THAT WARRANTS EMPLOYING MACHINE LEARNING AND DATA MINING TECHNIQUES TO PROVIDE RESOLUTIONS TO SYSTEM'S SHORTCOMINGS AND REDUCING OVERHEAD. PRECISE AND PROMPT DISEASE DIAGNOSIS BASED ON THE SYMPTOMS OF THE PATIENTS HAS BECOME IMPERATIVE. THE PROPOSED RESEARCH IS TO CREATE AN AUTOMATED CONVERSATIONAL CHATBOT SOLUTION WHICH TAKES IN SYMPTOMS AND SUGGESTS PROBABLE SYMPTOMS TO THE USERS FOR A COMPLETE AND HOLISTIC UNDERSTANDING OF THEIR CONDITION. FOLLOWING THE AGGREGATION OF SYMPTOMS, THE SYSTEM PREDICTS THE DISEASE BASED ON THE PRE-LABELLED DATASET USING VARIOUS CLASSIFICATION-BASED MACHINE LEARNING TECHNIQUES. THE AIM OF THE PROPOSED SYSTEM IS FOR PEOPLE TO BE AWARE OF THEIR HEALTH CONDITIONS AND BE ABLE TO DETERMINE WHEN A DOCTOR'S VISIT IS NECESSARY.

[3] **POTHANA HEMA, N.SUNNY, RAAVI VENKATA NAGANJANI, ARUNARKAVALLI DARBHA "DISEASE PREDICTION USING SYMPTOMS BASED ON MACHINE LEARNING ALGORITHMS"** - PEOPLE ARE CURRENTLY SUFFERING FROM A VARIETY OF DISEASES. MANY PEOPLE ARE UNSURE IF THE SYMPTOMS THEY ARE EXPERIENCING ARE INDICATIVE OF A CERTAIN DISEASE, AND HENCE THEY ARE UNABLE TO TAKE THE REQUIRED SAFEGUARDS. ANTICIPATING THE DISEASE DURING PRODROMAL STAGE LOWERS THE LIKELIHOOD OF COMPLICATIONS. PEOPLE WILL NOT BE ABLE TO VISIT A DOCTOR EVERY TIME THEY EXPERIENCE A SYMPTOM. IT MAY SOMETIMES BECOME A SERIOUS AILMENT IF NOT TREATED. A MODEL IS SUGGESTED THAT USES A VARIETY OF SYMPTOMS AS INPUT TO PREDICT THE ILLNESS. FOR DISEASE PREDICTION, THE SUGGESTED METHOD UTILIZES DECISION TREES, NAIVE BAYES, AND RANDOM FOREST CLASSIFIERS. THE ULTIMATE RESULT WILL BE THE MODE OF ALL THESE MACHINE LEARNING MODELS. USERS WILL BE GIVEN A GRAPHICAL USER INTERFACE (GUI) TO CHOOSE THEIR SYMPTOMS. THE RESULT WILL BE SHOWN ON THE INTERFACE USING ALL THREE MACHINE LEARNING TECHNIQUES, AND FEATURE EXTRACTION WILL BE DONE DEPENDING ON THEIR SYMPTOMS.

[4] **SIDDEGOWDA C. J, A. JAYANTHILA DEVI. (2022). "A LITERATURE REVIEW ON PREDICTION OF CHRONIC DISEASES USING MACHINE LEARNING TECHNIQUES"** SUMMARY: REVIEWING OF THE VARIOUS WORK AND LITERATURE IN THE PROPOSED AREAS WILL HELP IN DEVELOPING A STRONG FOUNDATION OF THE DOMAIN ON WHICH THE RESEARCH IS PLANNED. THE REASON FORTH FOR THE LITERATURE REVIEW IS TO BECOME FAMILIAR IN THE HEALTH CARE DOMAIN. SINCE THE AREA SELECTED IS THE HEALTH CARE DOMAIN, THE RECENT LITERATURE REVIEW IS CARRIED OUT AS IT IS VERY IMPORTANT, HTTPS://DOI.ORG/10.5281/ZENODO.6823291.

[5] **ANISH GUPTA , MANISH KUMAR GUPTA "PREDICTION OF DISEASES USING DIFFERENT MACHINE LEARNING APPROACHES"** - EVERY YEAR, AS THE NUMBER OF PATIENTS AND DISEASES INCREASES, THE MEDICAL SYSTEM BECOMES OVERBURDENED AND, IN MANY NATIONS, EXPENSIVE. WITH ENOUGH DATA, DISEASE PREDICTION USING AN ALGORITHM CAN BE SIMPLE AND INEXPENSIVE. PREDICTING DISEASE BASED ON SYMPTOMS IS AN IMPORTANT ELEMENT OF TREATMENT. IN OUR PROJECT, WE ATTEMPTED TO ACCURATELY FORECAST AN ILLNESS BASED ON THE PATIENT'S SYMPTOMS. FOR THIS, WE UTILIZED FOUR DIFFERENT ALGORITHMS AND ACHIEVED 92-95 PERCENT ACCURACY. A SYSTEM LIKE THIS HAS A LOT OF POTENTIAL IN FUTURE MEDICAL THERAPY. WE HAVE ALSO CREATED AN INTERACTIVE INTERFACE TO HELP YOU INTERACT WITH THE DATA.

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[6] **DR. P.HAMSAGAYATHRI,MR .S. VIGNESHWARAN. (2021)"SYMPTOMS BASED DISEASE PREDICTION USING MACHINE LEARNING TECHNIQUES"** SUMMARY: COMPUTER AIDED DIAGNOSIS (CAD) IS QUICKLY EVOLVING, DIVERSE FIELD OF STUDY IN MEDICAL ANALYSIS. SIGNIFICANT EFFORTS HAVE BEEN MADE IN RECENT YEARS TO DEVELOP COMPUTER-AIDED DIAGNOSTIC APPLICATIONS, AS FAILURES IN MEDICAL DIAGNOSING PROCESSES CAN RESULT IN MEDICAL THERAPIES THAT ARE SEVERELY DECEPTIVE. MACHINE LEARNING (ML) IS IMPORTANT IN COMPUTER AIDED DIAGNOSTIC TEST. OBJECT SUCH AS BODY-ORGANS CANNOT BE IDENTIFIED CORRECTLY AFTER USING AN EASY EQUATION. THEREFORE, PATTERN RECOGNITION ESSENTIALLY REQUIRES TRAINING FROM INSTANCES. ML PROVIDES A RESPECTABLE APPROACH TO MAKE SUPERIOR AND AUTOMATED ALGORITHM FOR THE STUDY OF HIGH DIMENSION AND MULTI - MODAL BIO MEDICALS DATA. THE RELATIVE STUDY OF VARIOUS ML ALGORITHM FOR THE DETECTION OF VARIOUS DISEASE SUCH AS HEART DISEASE, DIABETES DISEASE IS GIVEN IN THIS SURVEY PAPER. IT CALLS FOCUS ON THE COLLECTION OF ALGORITHMS AND TECHNIQUES PROCESSES,10.1109/ICICV50876.2021.9388603.

[7] **DR C K GOMATHY, MR. A. ROHITH NAIDU. (2021). "THE PREDICTION OF DISEASE USING MACHINE LEARNING"** SUMMARY: THE SYSTEM PROCESSES THE SYMPTOMS PROVIDED BY THE USER AS INPUT AND GIVES THE OUTPUT AS THE PROBABILITY OF THE DISEASE. NAÏVE BAYES CLASSIFIER IS USED IN THE PREDICTION OF THE DISEASE WHICH IS A SUPERVISED MACHINE LEARNING ALGORITHM. THE PROBABILITY OF THE DISEASE IS CALCULATED BY THE NAÏVE BAYES ALGORITHM. BY USING LINEAR REGRESSION AND DECISION TREE WE ARE PREDICTING DISEASES LIKE DIABETES, MALARIA, JAUNDICE, DENGUE, AND TUBERCULOSIS.

[8] **PALLE PRAMOD REDDY, DIRISINALA MADHU BABU, HARDEEP KUMAR AND DR.SHIVI SHARMA. "DISEASE PREDICTION USING MACHINE LEARNING"** SUMMARY: THE "DISEASE PREDICTION" METHOD, WHICH IS CONCENTRATED ON PREDICTIVE MODELING, IT PREDICTS THE USER'S DISEASE BASED ON THE SYMPTOMS THAT THE USER PROVIDES AS INPUT. THE METHOD EXAMINES THE USER'S SYMPTOMS AS INPUT AND RETURNS THE DISEASE'S LIKELIHOOD AS AN OUTPUT. DISEASE PREDICTION IS ACCOMPLISHED USING THE RANDOM FOREST CLASSIFIER.

[9] **K. GAURAV, A. KUMAR, P. SINGH, A. KUMARI, M. KASAR*, T. SURYAWANSHI. " HUMAN DISEASE PREDICTION USING MACHINE LEARNING TECHNIQUES AND REAL-LIFE PARAMETERS"** SUMMARY: DISEASE PREDICTION OF A HUMAN MEANS PREDICTING THE PROBABILITY OF A PATIENT'S DISEASE AFTER EXAMINING THE COMBINATIONS OF THE PATIENT'S SYMPTOMS. MONITORING A PATIENT'S CONDITION AND HEALTH INFORMATION AT THE INITIAL EXAMINATION CAN HELP DOCTORS TO TREAT A PATIENT'S CONDITION EFFECTIVELY. THE PREVIOUS RESEARCHERS HAVE PRIMARILY EMPHASIZED MACHINE LEARNING MODELS MAINLY SUPPORT VECTOR MACHINE (SVM), K-NEAREST NEIGHBORS (KNN), AND RUS BOOST FOR THE DETECTION OF DISEASES WITH THE SYMPTOMS AS PARAMETERS. THIS DATASET IS THEN TRAINED USING A COMBINATION OF MACHINE LEARNING ALGORITHMS: RANDOM FOREST, LONG SHORT-TERM MEMORY (LSTM), AND SVM. PARALLEL TO THIS, THE HISTORY OF THE PATIENT CAN BE ANALYSED USING LSTM ALGORITHM. SVM IS THEN USED TO CONCLUDE, THE POSSIBLE DISEASE. THE PROPOSED MODEL HAS ACHIEVED BETTER ACCURACY AND RELIABILITY AS COMPARED TO STATE-OF THE-ART METHODS. THE PROPOSED MODEL IS USEFUL TO CONTRIBUTE TOWARDS DEVELOPMENT IN THE AUTOMATION OF THE HEALTHCARE INDUSTRIES.

VI. PROPOSED WORK

Personal Virtual Doctor using symptoms involves designing a comprehensive framework to predict and identify potential illnesses based on observed symptoms. A well-d Gather a diverse and comprehensive dataset containing information on various diseases and their associated symptoms. Clean the dataset by handling missing values, outliers, and inconsistencies. Encode categorical variables and convert textual information into a format suitable for machine learning algorithms. Identify relevant features that contribute to disease prediction. Extract key information from symptoms and convert them into a format suitable for machine learning models.

Choose appropriate machine learning algorithms based on the nature of the problem (classification in this case).Experiment with different algorithms such as Decision Trees, Random Forest, Support Vector Machines, and Neural Networks to identify the most suitable model. Train the selected model using the training data, adjusting hyperparameters for optimal performance.

Convert user input into a format compatible with the model for predicting diseases. Monitor the model's performance over time and make improvements to enhance its accuracy and reliability. By following this methodology, the Personal Virtual Doctor can provide accurate and timely predictions of diseases based on user-input symptoms, offering a valuable tool for healthcare assistance and early detection.

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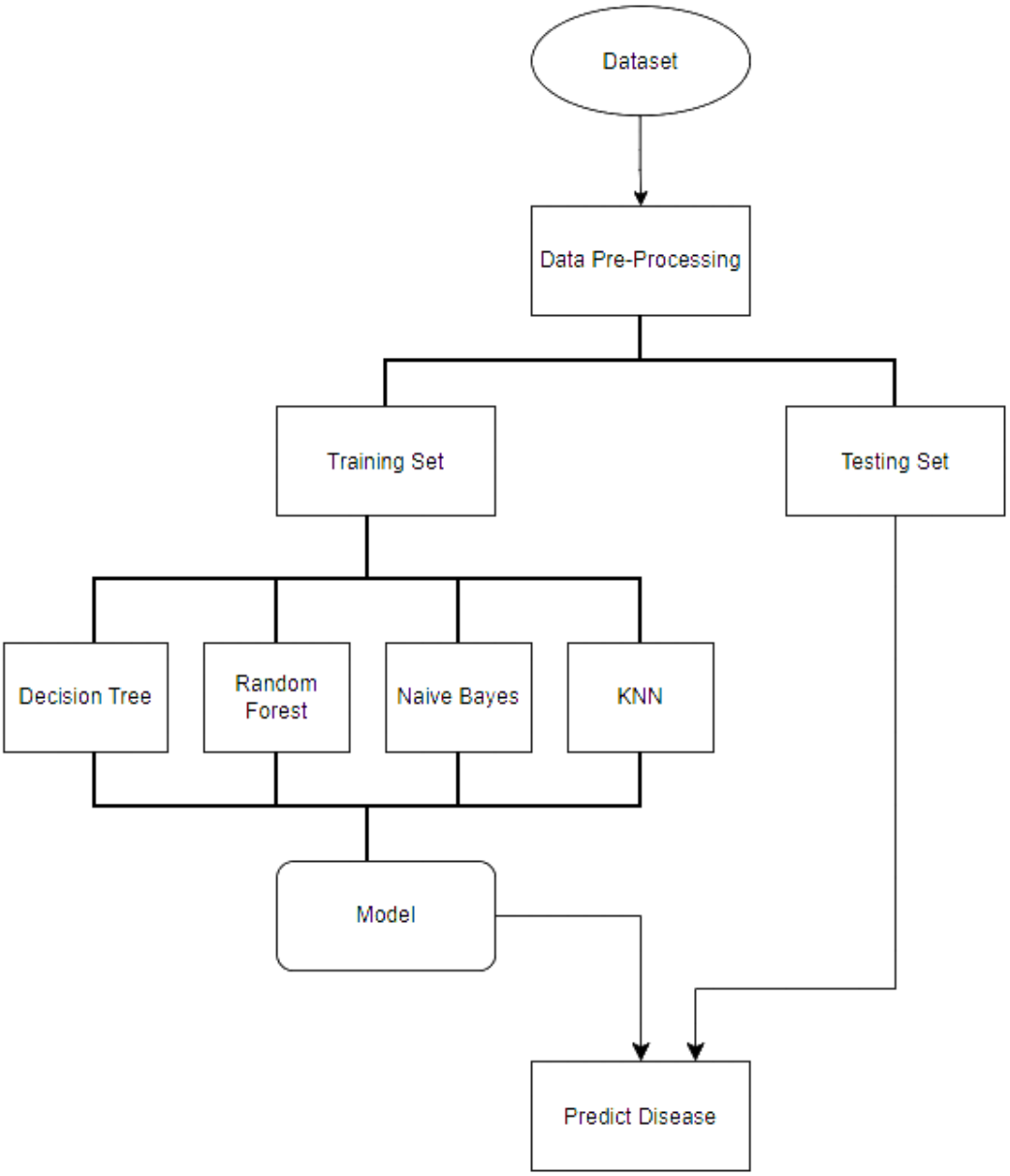

Fig:5.1:Personal Virtual Doctor Work Flow

➢ **Training Set:** The training set is a crucial component of the model development process. The training set consists of a dataset containing examples of individuals with known health conditions and corresponding symptoms.

➢ **Testing Set:** A testing set plays a crucial role in evaluating the performance of the developed model. The testing set is used to assess the generalization ability of the machine learning model. It helps determine how well the model can predict disease outcomes on unseen data, providing insights into its real-world applicability.

➢ **Decision tree:** A decision tree is a visual representation of decision-making processes, commonly used in machine learning for classification and regression tasks. The tree structure consists of nodes representing decisions based on specific features, branches indicating the possible outcomes of those decisions, and leaf nodes denoting the final classifications or values. Popular algorithms such as CART and ID3 are employed to build these trees, and ensemble methods like Random Forests use multiple decision trees for enhanced predictive performance.

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➢ **Random Forest tree:** In this project we have used random forest classifier with 100 random samples and the result given is ~95% accuracy. As the name suggests, "Random Forest is a classifier that contains a number of decision trees on various subsets of the given dataset and takes the average to improve the predictive accuracy of that dataset, the random forest takes the prediction from each tree and based on the majority votes of predictions, and it predicts the final output.

➢ **Gaussian Naïve bayes:** Naive Bayes is an easy however amazingly powerful rule for prognosticative modeling. It is very easy to build and useful for large datasets. Naive Bayes is a supervised learning model. Bayes theorem provides some way of calculative posterior chance P(b|a) from P(b), P(a) and P(a|b). In our project we have used naïve bayes algorithm to gain a ~95% accurate prediction.

➢ **KNN:** K Nearest Neighbour is a supervised learning algorithm. It finds extensive use in pattern finding and data mining. It works by finding a pattern in data which links data to results and it improves upon the pattern recognition with every iteration. We have used K Nearest Neighbour to classify our dataset and achieved ~92% accuracy. It belongs to the family of instance-based, lazy learning algorithms. However, its computational cost can be a limitation in large-scale applications.

➢ **Model:** The primary goal is to develop a predictive model that can analyze patient symptoms and accurately predict the likelihood of a specific disease. Gather a comprehensive dataset containing information on patient symptoms and corresponding diagnoses. The dataset should cover a diverse range of cases to ensure the model's robustness.

VII. CONCLUSION

Predicting diseases using symptoms is a complex and challenging task that involves the integration of various factors, including medical knowledge, data analysis, and technological advancements. However, challenges remain, including the need for large, diverse datasets, interpretability of complex models, and ethical considerations related to data privacy and bias. In conclusion, while disease prediction using symptoms holds great potential for improving early detection and intervention, it is important to approach this field with a cautious and comprehensive mindset. Continued research, collaboration, and ethical considerations are essential to overcoming challenges and harnessing the full benefits of predictive models in healthcare, leveraging symptom-based disease prediction holds immense potential in revolutionizing healthcare by enabling early detection and intervention. The integration of advanced technologies, such as machine learning, facilitates more accurate and timely diagnoses.

This approach not only enhances the efficiency of healthcare systems but also empowers individuals to proactively manage their health. We were successful in creating such a system and use 4 different algorithms to do so. On an average we achieved accuracy of ~95%. Such a system can be largely reliable to do the job. Creating this system, we also added a way to store the data entered by the user in the database which can be used in future to help in creating better version of such system. Our system also has an easy-to-use interface. It also has various visual representation of data collected and results achieved. The ability to predict diseases at an early stage facilitates timely intervention, personalized treatment plans, and ultimately improves patient outcomes.

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