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Digital Prescription and Disease Prediction using Machine Learning

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Abstract:- The healthcare industry is increasingly concerned about medical errors, which are the leading cause of death worldwide and also compromise patient safety. This medical error is even more serious in developing countries where healthcare is not supported by technology. Because of the traditional paper-based prescription system, World has an overall 8% – 25% median medication prescribing error rate that could be avoided if an electronic prescription system was in place. Therefore, this study aims to assess physicians' perceptions towards electronic prescription implementation.

Accurate and on-time analysis of any health-related problem is important for the prevention and treatment of theillness. The traditional way of diagnosis may not be sufficientin 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 dataset used had more than 41 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 Naïve Bayes algorithm gave the best results as compared to the other algorithms. The accuracy of the Naïve Bayes algorithm for the prediction was 99%. 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.

Keywords:- *Healthcare, Prescription System, Treatment, Diagnosis, Machine Learning, Symptoms, Naive Bayes.*

I. INTRODUCTION

The health care industry has become increasingly concerned about patient safety, which corresponds to societal trends [1]. Medication safety is one of the most important concerning issues in global health policy [2]. Medical error is a common encounter and represents an important public health problem posing a serious threat to patient safety. A medical error is an error occurred in the prescribing, dispensing, or administration of a drug [4]. It is an avoidable negative impact of medical care, regardless of whether it is a visible or detrimental to the patient [4]. The use of an e-prescriptions has the potential to improve the quality of patient care at the pharmacy [1]. Indeed, a study shows a significant improvements associated with an e-prescription system implementation, including a 86% decrease in serious medication errors, and an increase in Medicare formulary adherence from 14% to 88% [11]. e-Prescription is an alternative to many years old paper-based prescriptions. Electronic prescribing and dispensing processes of drugs whether in medical practice, follow up or research has become an integral partof pharmacy informatics [12]. Despite the fact that the e- Prescription system is an essential tool for the healthcare industry, e-Prescription adoption and utilization remain low in developing countries [13]. Many healthcare organizations around the world have implemented electronic information systems to improve the process of recording information, but only a few have succeeded [14].

Medicine and healthcare are some of the most crucial parts of the economy and human life. There is a tremendous amount of change in the world we are livingin now and the world that existed a few weeks back. Everything has turned gruesome and divergent. In this situation, where everything has turned virtual, the doctors and nurses are putting up maximum efforts to save people's lives even if they have to danger their own. There are also some remote villages which lack medical facilities. Virtual doctors are board-certified doctors who choose to practice online via video and phone appointments, rather than in-person appointments but this is not possible in the case of emergency. Machines are always considered better than humans as, without any human error, they can perform tasks more efficiently and with a consistent level of accuracy. A disease predictor can be called a virtual doctor, which can predict the disease of any patient without any human error. Also, in conditions like COVID-19 and EBOLA, a disease predictor can be a blessing as it can identify a human's disease without any physical contact. Some models of virtual doctors do exist, but they do not comprise the required level of accuracy as all the parameters required are not being considered. The primary goal was to develop numerous models to define which one of them provides the most accurate predictions. While ML projects vary in scale and complexity, their general structure is the same. Several rule-based techniques were drawn from machine learning to recall the development and deployment of the predictive model. Several models were initiated by using various machine learning (ML) algorithms that collected raw data and then bifurcated it according to symptoms.

The data-set was then processed in ML models like Naive Bayes. According to ML models, the accuracy varied. While processing the data, the input parameters data-set was supplied to model, and the disease was received as an output.

II. RELATED WORK

A. General:

A review of literature can be defined as a body of the text that mainly focuses on review of all the crucial data points and/or method that gives us a different approach towards a specific topic. It displays information in a very explicit and subjective field and typically the info in a very explicit subject field among a particular or fundamental quantity. Its final goal is to bring the reader and people up so far with current literature that is on a subject and forms of the idea for one or more goal, like future analysis that will be by required within the space and also precedes a search proposal. There are numerous work that have been done related to disease prediction system using different Machine Learning algorithms and achieved different results for different methods in medical field.

B. Disease Prediction Using Machine Learning (2020): Author – Chauhan Raj H.

Description: This system is used to predict disease according to symptoms. This system uses decision tree classifier for evaluating the model. This system is used by end-users. The system will predict disease based on symptoms. This system uses Machine Learning Technology. For predicting diseases, the decision tree classifier algorithm is used. We have named this system as'AI THERAPIST'. This system is for those people who arealways fretting about their health, for this reason, we provide some features which acknowledge them and enhance their mood too. So, there is a feature for the awareness of health 'Disease Predictor', which recognize disease according to symptoms.

C. Disease Prediction Using Machine Learning (2019): Author – Kedar Pingale.

This system is used to predict most of the chronic diseases. It accepts the structured and textual type of data as input to the machine learning model. This system is used by end users. System will predict disease on the basis of symptoms. This system uses Machine Learning Technology. For predicting diseases Naïve Bayes algorithm, for clustering KNN algorithm, final output will be in the form of 0 or 1 for which Logistic tree is used.

D. Multiple Disease Prediction Using Machine Learning Algorithms Comparetivily (2020):
Author – Smita S. Gunjal

This paper proposing such a system which will flaunt a simple and elegant User Interface and also be time efficient. In order to make it less time consuming we are aiming at a more specific questionnaire which will be followed by the system. Our aim with this system is to be the connecting bridge between doctors and patients. The main feature will be the machine learning, in which we will be using algorithms such as Naïve Bayes Algorithm, K-Nearest Algorithm, Decision Tree Algorithm, Random Forest Algorithm and Support Vector Machine, which willhelp us in getting accurate predictions and also will find which algorithm gives a faster and efficient result by comparatively-comparing. Another feature that our systemwill comprise of is Doctor's Consultation.

III. PROPOSED SYSTEM

Our project is stand on multiple disease prediction in accordance with symptoms entered by patient. We are proposing such a system that will flaunt a simple, cost effective, elegant User Interface and also be time efficient. Our proposed system bridges the gap between doctors and patients which will help both classes of users to achieve their goal. This system is used to predict diseases according to symptoms. In this proposed system we are going to take down five symptoms from the users and evaluate them by applying algorithms such as Naïve bayes. Also, we are going to ask our users to enter their login details that we are going to store in our database so that the user can use this prediction for future use. Lastly, with the input provided by the user, we will predict the disease associated to those symptoms and also provide prescription that could be effective against that disease in the form of a report that would contain the details regarding the symptoms provided by the user, the disease predicted by the algorithms and the required prescription (along with where to get them).

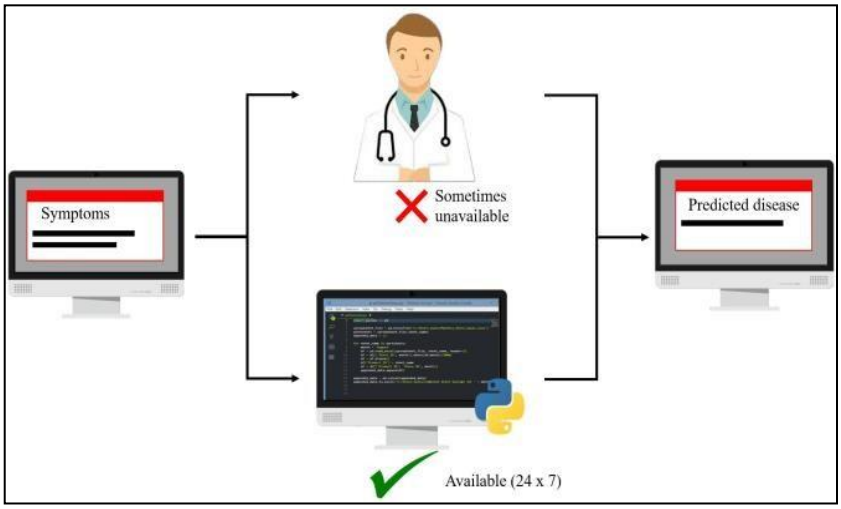

Fig. 1: Proposed System for Disease Prediction

A. System Implementation

➢ *Loading the Dataset:*

- We first load the given dataset
- After that we import the required library packages. Data Pre-processing
- We do reshape and data augmentations. Defining the Model
- We define the model as sequential or Functional.
- Now we decide the number of layers to be used, Number of nodes to be used in the model and also the evaluation metrics. Compiling the Model.
- It defines the loss function, optimizer, and weights. Model Fit
- Training Data, Testing Data.

➢ *Objective*

A framework for multiple disease predication system based on the symptoms using Naïve bayes supervised machine learning algorithms. Also the application interface which will help the patient and the doctor to stay connected.

➢ *Scope of the Project*

The aim of this study is to test the proposed hypothesis that supervised ML algorithms can improve health care by the accurate and early detection of diseases.There is a demand to make such a system that will help end users to predict diseases on the basis of symptoms given in it without visiting hospitals. By doing so, it will decrease the rush at OPD‟s of hospitals and bring down the workload on medical staff.

B. System Architecture

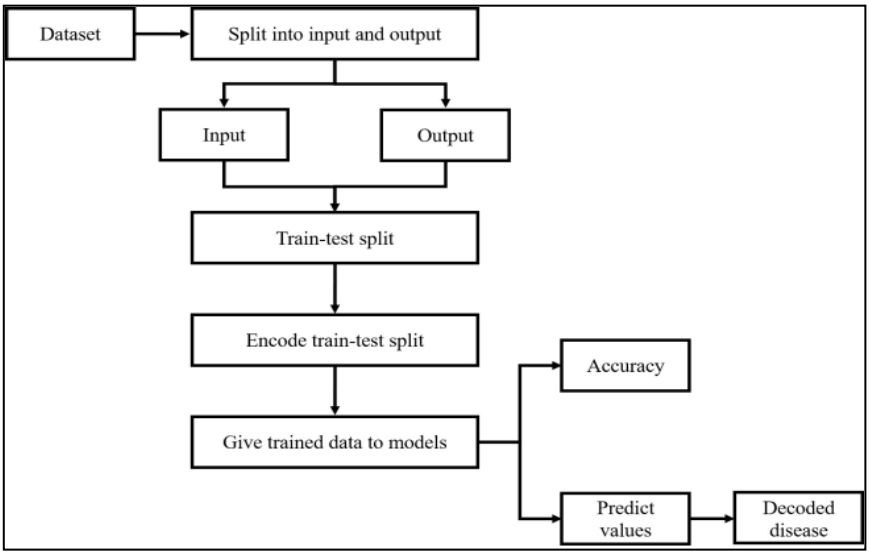

Fig. 2: Architecture of Disease Prediction System.

C. Algorithm

➢ *Naïve Bayes*

Naive Bayes is an easy however amazingly powerful rule for prognosticative modelling. One of the simplest ways that of choosing the foremost probable hypothesis given the info that we've that we are able to use as our previous information regarding the matter. Bayes' Theorem provides how that we are able to calculate the likelihood of a hypothesis given our previous information. Naive Bayes classifier assumes that the presence of a specific feature in an exceedingly class is unrelated to the presence of the other feature

It is a machine learning algorithm for classification problems and is based on Bayes' probability theorem. The primary use of this is to do text classification which involves high dimensional training data sets. We used the Bayes theorem that can be defined as:

P(d|h) is the probability of data d given that the hypothesis h was true. P(h) is the probability of hypothesis h being true (regardless of the data). This is called the prior probability of h. P(d) is the probability of the data (regardless of the hypothesis).

IV. RESULT AND DISCUSSION

Now the working and results of our system is displayed here. Various Screenshots with their explanation can be shown below on how the system will work and helppeople in contacting the doctor in no time and predicting the disease.

These are the screenshots of the Digital Prescription and Disease Prediction Application:

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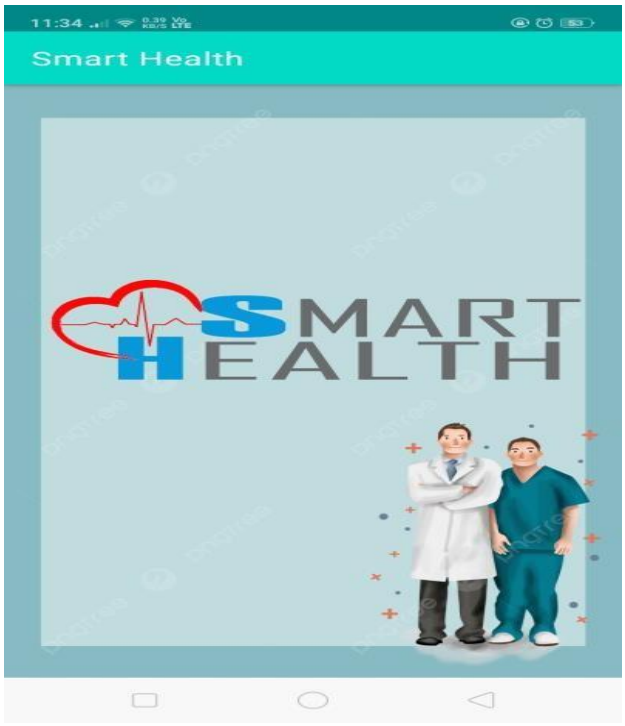

Fig. 3: Start Screen of Digital Prescription

Firstly, When the patient, doctor and pharmacist will open the app they will see this interface. The display isshowing smart health on the screen and then after few seconds the login page will be displayed to the user.

$P(h|d) = P(d|h) \cdot P(h) / P(d)$

Where $P(h|d)$ is the probability of hypothesis hgiven the data d. This is called the posterior probability.

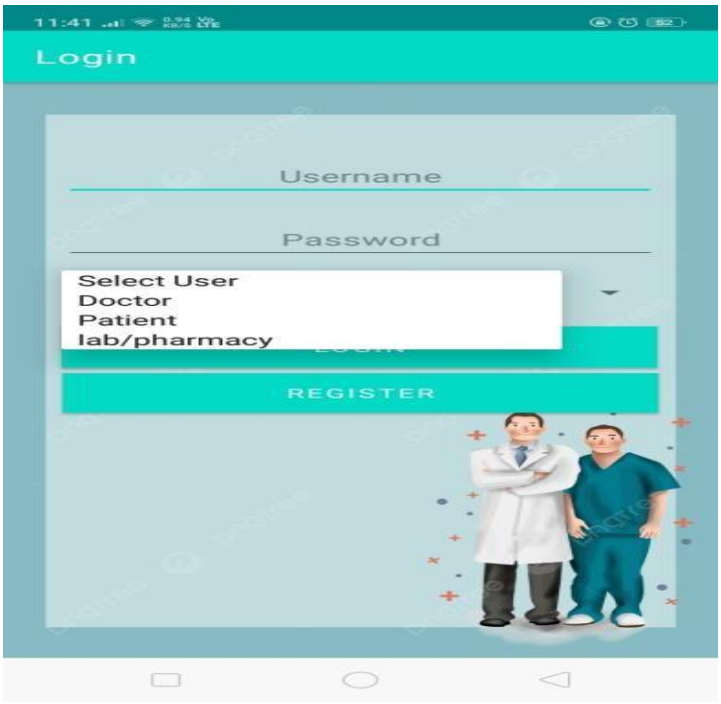

Fig. 4: Registration and Login Page

The register and login page will show the user to select the option from Doctor, Patient and Lab/Pharmacy. Here if the user is new it has to first register and then it canlogin to the system. Else user can login directly.

Now the various dashboards from each user can be shown as given below:

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Fig. 5: Doctor's Dashboard

After login doctor can see this dashboard in front of him/her. Through this doctor can see the history of the patient and add prescription according to the health of the patient. Doctor can create and edit his/her profile accordingto the requirement.

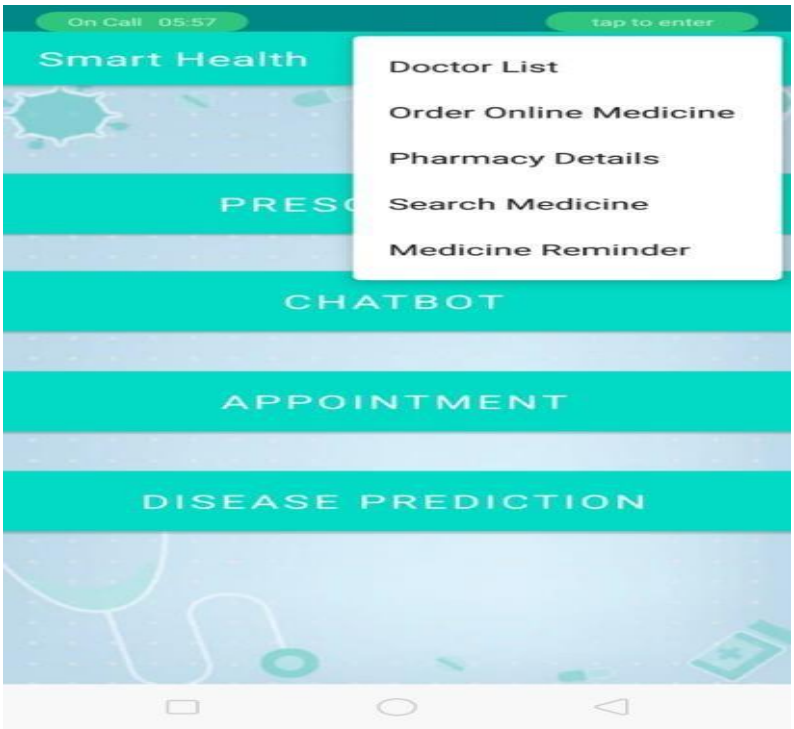

Fig. 6: Patient's Dashboard

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Patient can see the prescription added by the doctor on his /her dashboard. Various functions such as Chatbot, Appointment, Disease Prediction, Doctor list, Order Online Medicine, Pharmacy Details, Search Medicine and Medicine Remainder.

Fig. 7: Pharmacist's Dashboard

Pharmacist can add the details of the medicine, description about the medicine and price rate. The report ofthe test can be generated and send to the user through mailof the user.

Fig. 8: Chid's Profile on CareTracker

This is the chatbot which patient can use to get suggestions on some common doubts and medicines.

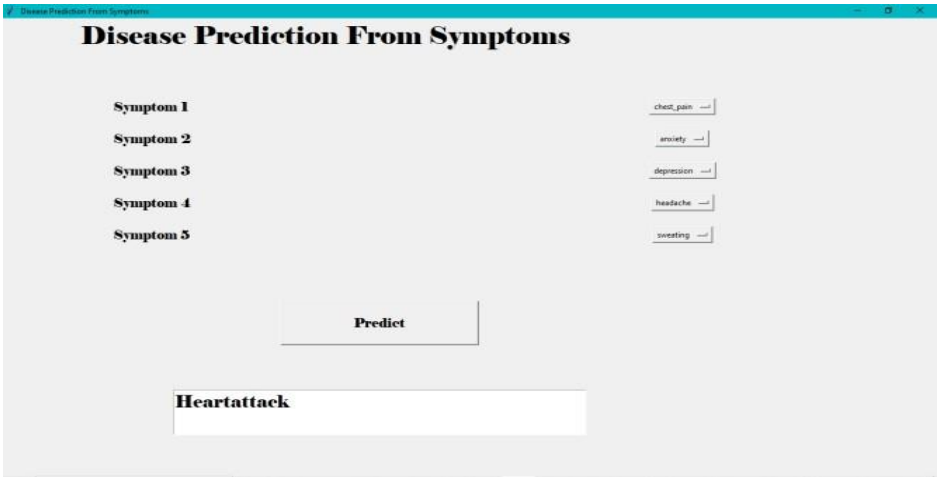

Fig. 9: Disease Prediction from Symptoms

Here the patient will get the option to input 5 symptoms and according to the input the model will predict the output as it is trained from the dataset. Theoutput will be shown in the output box and accordingly the patient can decide what he wanted to do. Whether to go to the doctor or do the normal medications.

V. CONCLUSION

Thus through this application, patient can get information about his or her health in no time without visiting the doctor in person. It will save both patient and doctor time. Patient can treat the common disease on its own. Also, the perception of the user has a significant impact on the successful implementation of an e- prescription system. To be successful in e-prescription system implementation, health care organizations should improve the computer technical skill of physicians' providing training on digital device usage, and improve internet connectivity. As a limitation, the study was a cross-sectional which has inherited limitation of a cross- section study. In addition to this the sample size of the study was a little bit smaller.

The manuscript presented the technique of predicting the disease based on the symptoms of an individual patient. The Naïve Bayes model gave the highest accuracy of 99% for the prediction of diseases using the above-mentioned factors. Once the disease is predicted, we could easily manage the medicine resources required for the treatment. This model would help in lowering the cost required in dealing with the disease and would also improve the recovery process.

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