Clinical Interaction-Based Drug Guidance System

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***Abstract*—Online recommender systems are being used increasingly often for hospitals, medical professionals, and drugs. Today, the great majority of consumers look online before asking their doctors for prescription suggestions for a range of health conditions. The medical suggestion system can be valuable when pandemics, floods, or cyclones hit. In the age of Machine Learning (ML), recommender systems give more accurate, precise, and reliable clinical predictions while using less resources. The medicine recommendation system gives the patient reliable information about the medication, the dosage, and any possible adverse effects. Medication is given based on the patient's symptoms, blood pressure, diabetes, temperature, and other parameters. Drug recommendation systems provide precise information at any time while improving the performance, integrity, and privacy of patient data in the decision-making process. Recommender system, the decision tree produces the most accurate results. In times of medical emergency, a drug recommendation system is helpful for giving patients recommendations for safe medications.**

***Index Terms*—Machine learning, Decision tree, Recommender systems, Medicines**

I. INTRODUCTION

These computer-assisted computational methods, which were initially studied in the 1950s, have already been used in drug development, bioinformatics, and cheminformatics. With an emphasis on all-encompassing care, a conventional method to medication discovery has been adopted. The growing accumulation of Electronic Health Records (EHRs) offers medical researchers strong assistance. The current state of affairs in the globe, people are becoming increasingly concerned about their health and medical diagnosis challenges. According to a survey, 55% of those with Internet access use it to search for health-related information. By examining the search phrases used in well-known search engines, a study was carried out to ascertain the real frequency of health-related online searches. Additionally, early work on describing and categorizing these queries should be done. The NCBI article states that about 99,000 individuals each year pass away because they don't receive prompt medical attention. Based on a patient's current state of health, the drug recommendation job proposes the best medicine combinations for them. The association between medications and patients' health state may be deduced from a variety of case data using deep learning drug recommendation models, which can map medical concepts into implicit vector representations. Early drug discovery often entails the identification and characterization of targets, lead discovery, and lead optimization. ML and DL have become popular methods for finding new drugs. The entire process of finding new drugs uses ML and DL algorithms, rather than just a single stage.

II. LITERATURE SURVEY

Yan Chao Tan et al. [1] proposed a Prescription help for clinicians using a symptom set-based drug recommendation framework with patient privacy protection. They specifically proposed a symptom-based Set-to-Set Small and Safe medication suggestion, which includes a unique set-to-set comparison module, symptom set module, and drug set module (4SDrug). This study has some flaws, such as the failure of the proposed approach to forecast diseases. There are no dose recommendations in the proposed approach.

S. Mutagen et al. [2], Pipelines for drug research and development are large, intricate, and dependent on various factors. Machine learning (M L) techniques provide a collection of tools that help improve discovery and decision-making for well-defined issues with a large amount of excellent data. Opportunities to employ machine learning occur at many phases of drug development. Target validation, the discovery of prognostic biomarkers, and the analysis of digital pathology data in drug trials are some examples. The contexts and methodologies of applications have varied, with some methods producing precise forecasts

and insights.

S. Garg, Anjum Unisa et al. [3], proposed a medicine recommendation system that uses cutting-edge methods such as machine learning, data mining, and others to uncover interesting information buried in medical data and reduce mistakes made by doctors while prescription medications. System is comprised of the database module and the data preparation module.

A. Abdelkrim et al. [4], A new feature selection strategy based on random forests is suggested for an efficient classification problem. They compare our feature selection strategy to base-line support vector machine and artificial neural network classifiers. The prediction of Drug-Target Interaction Using Weisfeiler-Lehman Neural Machine is another machine learning application given in the paper.M. D. Hossain et al. [5], a system that recommends medications and can greatly lessen the workload of specialists. Researchers developed a system for suggesting drugs in this study that uses patient evaluations to anticipate sentiment using several vectorization approaches, such as Bow, TF-IDF, Word2Vec, and manual feature analysis. The system can assist various classification algorithms in suggesting the best treatment for a particular disease. To evaluate predicted sentiments, precision, recall, score, accuracy, and AUC score were utilised.

J. Shang, M ong li le, et al. [6], Graphs are used to depict the proposed system, drug interactions from an external drug database, and drug co-occurrences from the EHR. PREMIER surpasses material removal medicine recommendation algorithms in tests using M IM IC-III and a sensitive outpatient dataset, achieving the best balance of accuracy and drug-drug interaction.

Sun, J., Gamenet, et al. [7], proposed system will apply data fusion to reduce the needless strain on the system's processing resources and enhance the effectiveness of the suggested system in anticipating and advising this potentially fatal condition. To forecast disease, an ensemble machine learning model is trained. Utilizing a well-known disease dataset, this adaptive method is evaluated, and the results are contrasted with the most current advances in the field.

A. Sedik, Constanze Knahl, et al. [8], Authors undertake a study of the literature on current medical recommender system solutions, characterise and contrast them according to different aspects, and suggest potential future research areas.

Himanshu Gupta et al. [9], propose a strategy for determining the condition based on the patient's symptoms and then recommending the appropriate treatment. To accomplish the goal, a Decision Tree Map, Naive Bayes model, and Random Forest algorithm are used. This work investigates the development of a system that performs the twin duties of sickness prediction and pharmaceutical suggestion in order to improve the performance of the current system.

S. Dongre, Mahima; Nayak, et al. [10], Drug recommendation systems are created to help users choose the best medication for a specific health problem based on reviews made by other users on various medications for various specific conditions. The purpose of this recommendation system is to examine the dataset using data mining concepts, sentiment analysis, and visualisation, and to recommend drugs based on each patient's health condition, ratings, and reviews using machine learning techniques, content, and collaborative filtering methods.

Paula Carracedo-Reboredo et al. [11], The purpose of the drug disclosure is to monitor new medicines with clear treatments. The approaches employed in this study have recently attracted significant attention in software engineering, as has the majority rules system's fast progress of AI techniques. In order to meet both the new problems and the objectives of the Advanced Medicine Initiative, a reliable, efficient, and fundamental computing approach must be established. Predictive models based on AI have been helpful up until this point in the pre-clinical stage. The price and amount of time needed to produce new medicines are considerably reduced by this process. This audit focuses on the most recent instances of research using this new technique. An industry-wide inquiry will provide light on the best outcomes, where chemo medicines will be produced in the future, and where they will end up. The focus of this audit will be on atomic data visualisation as well as biological problems investigated by machine learning algorithms that have recently been used to identify medications.

Rohan Gupta et al. [12], Medication readiness and advancement is an important aspect of drug organisations' and drug researchers' research. Nonetheless, incompetence, item delivery, efficient use of time, and significant costs create impediments and difficulties that affect science and disclosure.

Furthermore, genomic, proteomic, microarray data, and solid, massive clinical medication data interfere with the medication recognition organization. AI and ability knowledge play a significant role in revelation and improvement. Finally, neural organisations and top-down learning calculations have shifted areas. Peptide blend, analytic-based, variation-based ligand, harmfulness expectation, drug control and discharge, drug screening, pharmacological activity, useful connections - drug, polypharmacology, physicochemical movement. In this segment, historical evidence emphasises the use of specialised insight and in-depth research. Similarly, the ability to extract, group, and manage new data has significantly improved the calculation plan. As a result, innovation and significant progress consider better medication planning and disclosure, which will eventually influence individuals.

III. METHODOLOGY

The BNN model is currently being used to recommend the drug. BNN represents all of the random variables in the problem, as well as the conditional dependencies between them. However, neural networks are extremely complex, and their accuracy is low. Using BNN, the correct dosage was not suggested. The time complexity of this type of drug recommender system is high.

Proposed Solution

Many health issues occur because of a lack of immediate health consultancy and the right amount of drug dosage intake. Identifying the right disease based on the symptoms is only possible with offline doctor consultation. Identifying the right drug for the combination of diseases is needed to avoid side effects. The proposed online drug recommender system provides immediate health consultancy, and it also suggests the right amount of drug dosage, identifies the disease based on symptoms, and suggests a drug for the combination of diseases. This recommender system fulfills the basic first aid needs of patients. Users can use the web for basic emergency first aid.

A large number of medications used in clinics and health centres in our daily lives are difficult to distinguish. It can also be unpleasant to realise every day unless you know exactly what you are doing. Drug is possibly the most important way to improve your well-being and prosperity. Standards are initially used to define a certain model. With the use of structured data, machines may now learn to illustrate and perform simple estimations. They developed models that may forecast the usage of drugs and their behaviours using SVM. The model can also suggest medications for a particular patient. Random forest and decision tree algorithms are also implemented in this test and trial of the data set, and the algorithm performs the drug interaction.

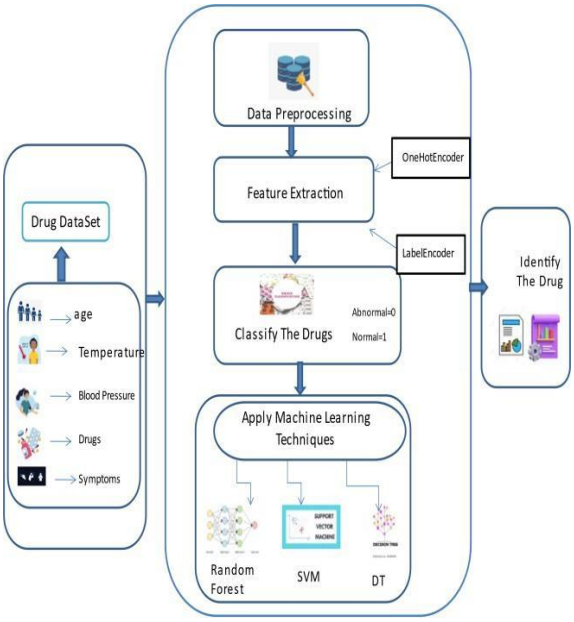


Fig 1. Process Workflow

The Three stages make up the medication recommender system's process. The data set must be uploaded first. The data collection includes characteristics like age, medication, dose, and conditions. Pre-processing of data happens after the data set has been submitted. Data pre-processing is the cleaning and filtering of data. It identifies and rejects null values, empty values, and repetitive rows from the decision-making process, resulting in high accuracy. The feature extraction approach converts unprocessed raw data into numerical features that may be handled while retaining the original data set's content. Following that, the medicine is categorised according to blood pressure and sugar levels. There are two divisions in the categorization of medications. Different medications are administered to individuals with normal and abnormal illnesses. We employ machine learning methods to choose the best medication and dose.

Algorithm:
data <- preProcessing(data)

//Loading pickle files drug <- drug.pkl dosage <- dosage.pkl side <-side.pkl
for x in request.form.values()

feature <- [np.array(x)]

drug_pred <- drug.predict(features) dosage_pred <- dosage.predict(features) side_pred <- side.predict(features)
return drug_pred+dosage_pred+side_pred

IV. RESULTS

A. Generating accuracy for the trained and test results

Table 1. Accuracy of 4 algorithms

Model Type	Acurracy
Decision Tree classification	99.3
Logistic regression	73.23
Random Forest	97.2
Navie Bayas	96.73

Table 1 can predict the accuracy values for the four algorithms, with Decision Tree classification having the highest accuracy when compared to the other models.

B. Classification report

The classification report of 4 algorithms models based on the review dataset.

Table 2. Classification report of precision and recall

s.no	Model	Precision	recall
1	Decision Tree	1.00	1.00
2	Random Forest	0.95	0.96
3	Logistic regression	0.66	0.73
4	Navie Bayes	0.96	0.97

Table 2 can give the classification report of the 4 models with the respective metrics as precision and recall values. In which Decision Tree has higher precision and recall metrics can obtained.

Table 3. Classification report of F1-score and support

S.no	Model	F1-score	support
1	Decision Tree	0.98	195
2	Naive Bayes	0.97	192
3	Logistic regression	0.97	192
4	Random forest	0.94	194

Table 3 gives the classification report of the 4 models with the respective metrics as F1-score and support values. In which decision tree can higher precision and recall metrics be obtained.

C. Confusion Matrix

The Decision tree classification algorithm performed better that the remaining models when the vales is set to the Drug and the Dosage.

End for

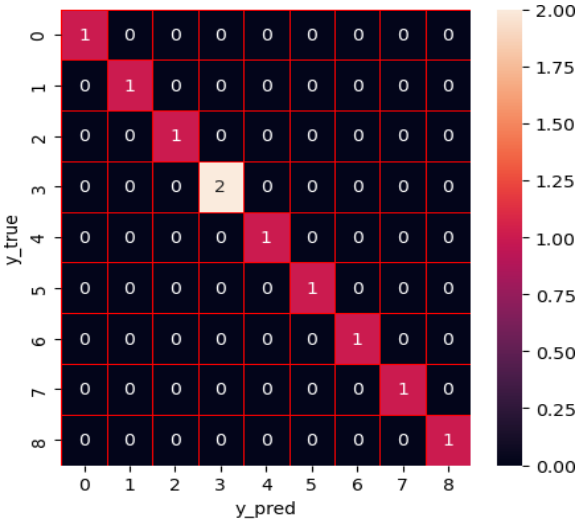


Fig 2. Confusion Matrix

D. Classification Metrics

	precision	recall	f1-score	support
Aubra	1.00	1.00	1.00	1
Bactrim	1.00	1.00	1.00	1
Campral	1.00	1.00	1.00	1
Clonazepam	1.00	1.00	1.00	2
Ethinyl estradiol / etonogestrel	1.00	1.00	1.00	1
Ivermectin	1.00	1.00	1.00	1
NuvaRing	1.00	1.00	1.00	1
Oxybutynin	1.00	1.00	1.00	1
Suprep Bowel Prep Kit	1.00	1.00	1.00	1
accuracy			1.00	10
macro avg	1.00	1.00	1.00	10
weighted avg	1.00	1.00	1.00	10

Fig 3. Classification Metrics for Decision tree

E. Trained and Test accuracy results in Bar chart:

The plots of bar graphs show the accuracy of trained and test values for the four algorithms models.
Here Fig 4 displays the results of training and test data from the dataset, allowing for visualisation of the accuracy outcomes. The Naviebayes, Random Forest, Logistic regression, and decision tree classifier algorithms produced the following findings.

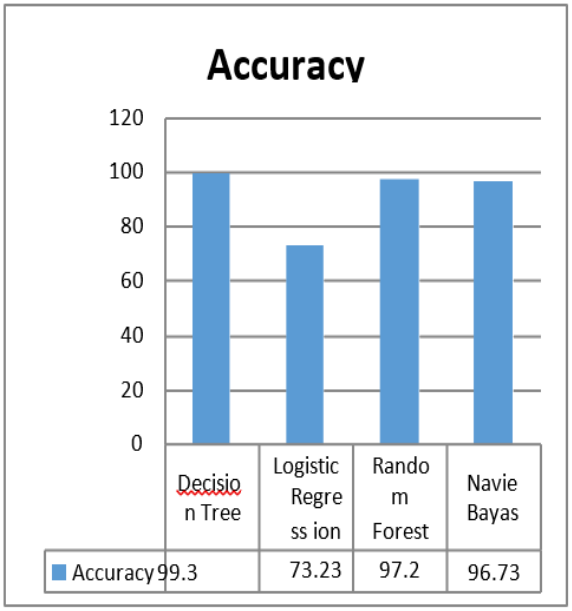
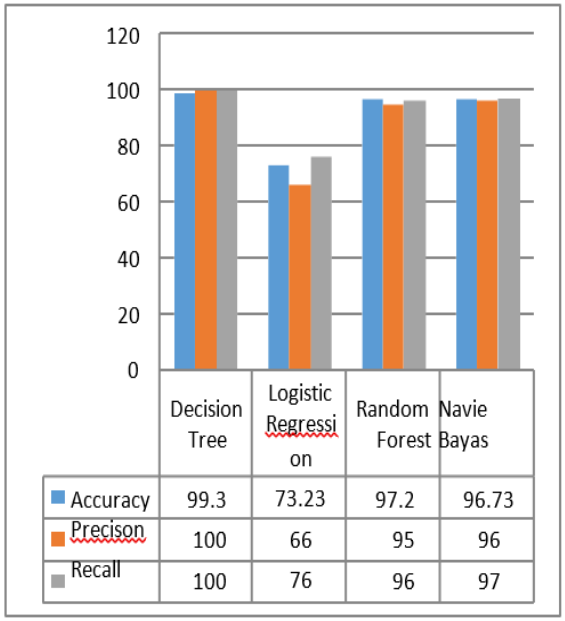


Fig 4. Trained and Test accuracy results

F. Viewing Train and test accuracy results:
The line chart shows the accuracy results of the 4 models and its ranging from 94 to 96.

G. Comparison of algorithms with metrics
For certain values Decision Tree classifier range accuracy of 99.5 than other algorithms, and those algorithms have a range of 90- 95%. collaborated with clinical science to calculate the total cost of direction, science, wellbeing impacts, and medical services. We anticipate that in the future, drug discovery and development will incorporate all aspects of AI innovation. We intend to make our work more user-friendly by implementing it as a mobile application and to add many more features to the application.



V. CONCLUSION AND FUTURE WORK

Taking the right amount of a drug dosage is crucial for effective treatment and to avoid adverse health complications. Timely and accurate drug recommendations can significantly improve patient outcomes, especially in critical medical situations. The proposed system is designed to recommend the appropriate drug along with its correct dosage and possible side effects based on the patient's profile. One of the key factors considered in this system is the patient's age, as dosage requirements can vary greatly across different age groups. Administering the correct dosage according to age is essential for quick and safe recovery. The drug recommendation system utilizes a machine learning approach, where age acts as a primary input feature. Among various algorithms evaluated, the Decision Tree algorithm demonstrated the highest accuracy in predicting the most suitable drug. Its interpretability and performance make it an ideal choice for this healthcare application. The development of this system aims to support medical professionals by offering intelligent, data-driven suggestions that enhance the quality of care provided to patients.

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