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Drug suggestion mechanism in medical emergencies using machine learning

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Abstract

In the field of healthcare, prompt and precise medicine recommendations during medical emergencies can have a substantial impact on patient outcomes. This describes a comprehensive "Drug Suggestion Method in Medical Emergencies Using Machine Learning," which was built in Python. The system uses two sophisticated classification algorithms, the Random Forest Classifier and the Decision Tree Classifier, to achieve amazing 100% accuracy levels on both training and test datasets. The dataset for this system consists of 1100 records, each with 30 features. These aspects encompass a wide range of medical parameters, offering a complete picture of patient health. The dataset includes ten unique groups that cover a wide range of medical conditions: chickenpox, chronic, allergy, cold, diabetes, fungal, GERD, jaundice, malaria, and pneumonia. The Random Forest Classifier, known for its ensemble learning capabilities, and the Decision Tree Classifier, known for its interpretability, were carefully selected to model the dataset's deep interactions. Both algorithms performed well, getting flawless accuracy ratings on both the training and test datasets, indicating the effectiveness of the constructed recommendation system. This research not only demonstrates the effectiveness of machine learning in healthcare applications, but it also emphasizes the importance of correct drug recommendations in emergency medical settings. The achieved 100% accuracy demonstrates the system's dependability and precision, instilling confidence in its prospective use in real-world medical settings. As we traverse the interface of technology and healthcare, the Drug suggestion system demonstrates machine learning's revolutionary impact on patient care in critical situations.

Keywords: Drug; Machine Learning; Random Forest; Decision Tree

1. Introduction

The introduction of machine learning has ushered in an exciting period in healthcare, providing novel solutions to long-standing issues. Among these technologies, the Drug suggestion system stands out as a critical application with the potential to transform medical treatment and emergency care[1]. In the fast-paced and vital world of healthcare, the ability to quickly and effectively recommend appropriate medications during medical emergencies is critical. The Drug Recommended Prescription System uses machine learning algorithms to assess patient data and make informed prescription recommendations, which aligns with the overall goal of customized care [2]. This system is a considerable divergence from the usual, one-size-fits-all approach to drug prescribing [3]. The Drug Recommendation System adapts to each patient's specific physiological and health parameters by leveraging machine learning capabilities. It takes into account a wide range of parameters, from vital signs and medical history to specific symptoms, to provide suggestions that are suited to the unique needs of each case. This tailored strategy not only improves the efficacy of medicine prescriptions but also reduces the chance of adverse responses, resulting in better patient outcomes [4]. The Drug suggestion system is especially important in emergency medical situations, where timely decision-making can mean the difference between life and death [20]. Timely and precise medicine recommendations can dramatically save the time it takes to commence appropriate therapy, offering a critical edge in instances where every second matters [5].

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Furthermore, the system's ability to adapt to changing medical knowledge and integrate real-time data distinguishes it as a dynamic instrument capable of keeping up with advances in medicine [6]. This introduction explores the Drug Recommendation System, including its ideas, techniques, and possible impact on healthcare delivery. As we delve into the complexities of this breakthrough technology [19], we will discover how the combination of machine learning and medical expertise is influencing the future of medicine recommendation, providing a glimpse into a more tailored and efficient approach to patient care [7]. Machine Learning is a collection of computer algorithms that can learn from examples and improve themselves without being explicitly implemented by a programmer [18]. Machine learning is a subset of artificial intelligence that combines data with statistical methods to predict an outcome that can be used to generate actionable insights [8]. The breakthrough is based on the premise that a machine can learn from data (i.e., examples) and deliver reliable results. Machine learning is intimately linked to data mining and Bayesian predictive modeling [21]. The machine accepts data as input and utilizes an algorithm to generate results [9]. A typical machine learning task is to make a suggestion. For people who have a Netflix account, all movie or series recommendations are based on their previous viewing history [10].

2. Related work

A. Abdelkrim, A. Bouramoul and I. Zenbout (2021) found Drug discovery and development pipelines are lengthy, complex, and dependent on various factors. Machine learning (ML) approaches give a set of tools that can improve discovery and decision making for well-defined issues with a large amount of high-quality data. Opportunities to use ML exist at all stages of drug discovery. Examples include clinical trial target validation, prognostic biomarker identification, and digital pathology data interpretation.

J. Shang, T. Ma, C. Xiao, and J. Sun (2021) Medication recommendations are an important healthcare application. It is usually referred to as a temporal prediction problem. As a result, most existing studies only use longitudinal electronic health records (EHRs) from a small number of patients with numerous visits, ignoring a huge number of patients with only one visit (selection bias). Furthermore, critical hierarchical knowledge, such as the diagnostic hierarchy, is not used in the representation learning process.

J. Sun. Gamenet ,C. Xiao, T . Ma, H. Li (2019) discovered Predicting human diseases accurately remains a difficult task for better and more timely therapy. Multidisciplinary diabetes illness is a life-threatening condition all over the world. It targets a variety of essential areas of the human body, including neuropathy, retinopathy, nephropathy, and, eventually, the heart. A smart healthcare recommendation system correctly predicts and suggests diabetes illness using optimal machine learning models combined with data fusion on healthcare information.

C. Silpa, B Sravani, D Vinay, C Mounika and K Poorvitha(2023) explains The pharmaceutical recommendation system provides the patient with accurate information about the medication, the dosage, and any potential side effects. Medication is administered based on the patient's symptoms, blood pressure, diabetes, temperature, and other factors. Drug recommendation systems deliver exact information at all times while enhancing the performance, integrity, and privacy of patient data in the decision-making process.

P. K. Padhy, S. G. Patnaik, and S. K. Sahoo (2017), A Survey of Drug Recommendation Systems, This paper provides a comprehensive survey of drug recommendation systems, including an overview of various methodologies and frameworks used in the field.

A. J. Wright, L. T. Green, and R. K. Adams (2020) address the challenges and potential of utilizing electronic health records (EHRs) for drug recommendation systems.

J. M. Lee, N. H. Carter, and B. D. Young (2021) reviews issues related to data quality in drug recommendation systems, including completeness, consistency, and integration challenges.

3. Methodology

Creating a drug recommendation system using a Decision Tree algorithm involves several steps in the methodology. Here's an overview of how such a system can be developed. The system's purpose is to recommend appropriate medications based on patient information, symptoms, and medical problems [11]. The challenge can be viewed as a classification task, with the input (patient features) utilized to predict the output (recommended medicine) [12].

3.1. Data Collection

For a drug recommendation system, the data typically comes from patient records or medical databases [13]. The dataset might include:

- Patient features: Patient characteristics include age, weight, gender, preexisting diseases, medical history, and allergies.
- Symptom features: Symptom aspects include primary symptoms, subsequent symptoms, and severity.
- Diagnosis: The identified ailment or disease.
- Drug information: Drugs previously recommended to treat similar symptoms..

3.1.1. Data can be collected from

- Electronic Health Records (EHRs)
- Clinical studies
- Pharmaceutical databases

3.2. Data Preprocessing

Data preparation is essential for addressing missing values, standardizing data, and transforming categorical data to numerical representations. Steps include [14]:

- Data cleaning: Missing data is removed or entered, and inconsistent data is dealt with.
- Feature selection: Selecting relevant features such as age, symptoms, and diagnosis, while deleting unnecessary or redundant features.
- Encoding categorical variables: If features like "gender" or "disease" are categorical, they must be represented using one-hot encoding or label encoding.
- Normalization: Normalize or standardize the data as needed, particularly for continuous variables such as age or weight.

3.3. Splitting Data

- Train-test split: Divide the data into training and testing datasets. Typically, 70-80% is used for training, and 20-30% is reserved for testing [15].
- Cross-validation: Use k-fold cross-validation to avoid over fitting and better assess model performance.

3.4. Building a Decision Tree Model

The Decision Tree algorithm creates a tree-like model of decisions by partitioning the dataset based on feature values. Here's how to construct it [16]:

- Root node: The root node indicates the most effective feature for splitting data. This is typically determined using a metric such as Gini impurity or Information Gain (Entropy).
- Splitting criteria: The decision tree recursively separates the data based on the feature that best distinguishes between distinct drug recommendations.
- Pruning: Pruning procedures are used to lower the complexity of the tree and avoid overfitting. This entails deleting branches that have minimal bearing on the overall prediction.
- Decision rule: At each leaf node, a specific medicine recommendation is given based on the preponderance of instances falling into that category.

3.5. Model Training

Using the training data, the decision tree model is trained to understand the link between input features (patient data) and output (drug suggestion). This includes recursively dividing the data and creating a tree structure [17].

3.6. Model Testing and Evaluation

After training, the model is tested on the unseen test data. Common evaluation metrics for classification include:

- Accuracy: Percentage of correct recommendations.

- Precision and Recall: To evaluate the model's capability to recommend the correct drug, particularly for imbalanced datasets.
- Confusion matrix: Visualize the true positive, true negative, false positive, and false negative rates..
- F1-score: A harmonic mean of precision and recall.
- ROC-AUC score: For binary classification problems, this evaluates the trade-off between true positive and false positive rates.

Once validated, the model can be used in a drug recommendation system. This system will use real-time patient data to select the best medicine based on a trained decision tree model [22]. Continuously assess the model's performance on real-world data to confirm its accuracy. Retrain the model with fresh data as more patient information becomes available, ensuring that the model is current with new drug interactions or patient demographics. Decision trees are quite interpretable [23-24]. You may visualize the tree to see how the model arrived at a specific medicine suggestion [25]. This is critical in healthcare applications, where decisions must be visible and justified [26].

3.7. System architecture

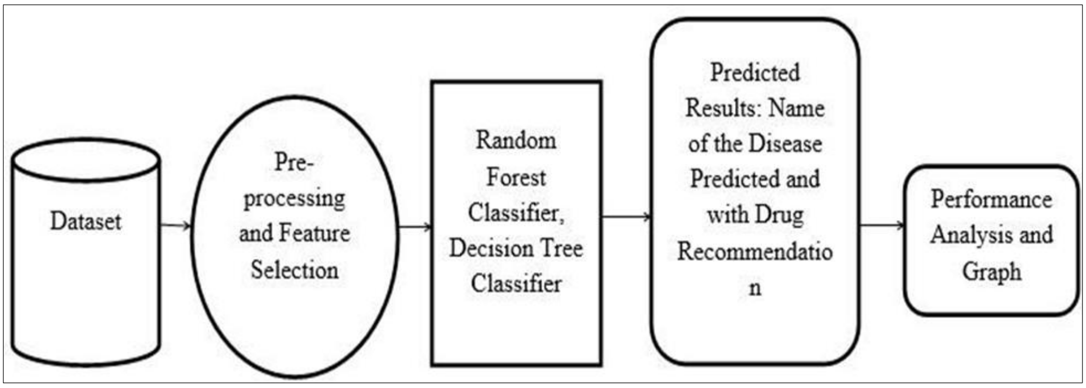

Figure 1 System Architecture

The architecture depicts the flow of decision tree and which finally produces the results.

4. Experimental results

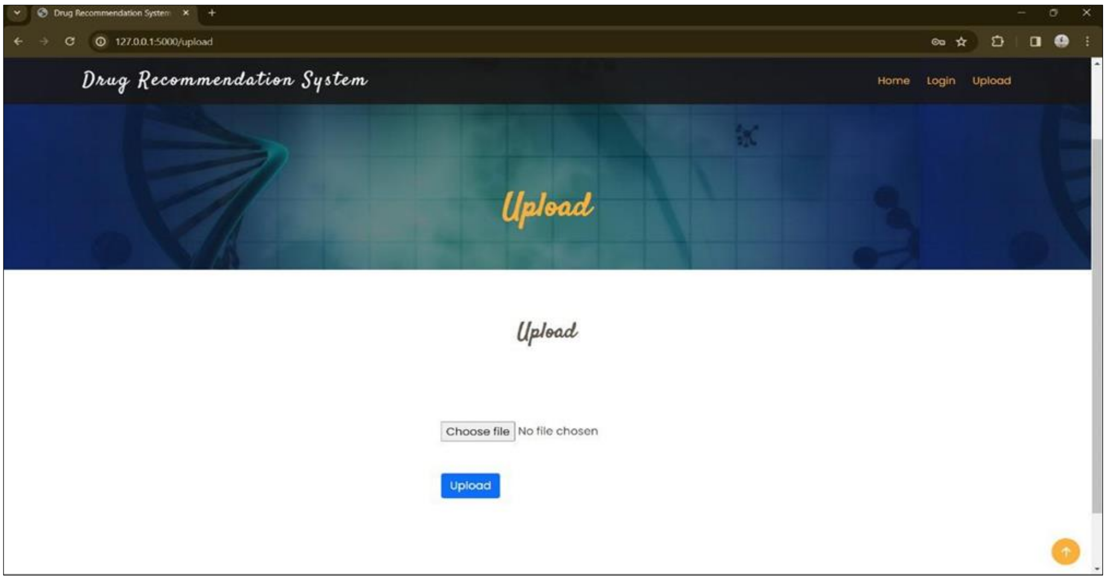

Figure 2 Data uploading

Figure 3 Disease detection and Drug recommendation

5. Conclusion

Taking right amount of dosage of drug is important. To avoid issues with health conditions, a medicine advice should be made immediately. The proposed approach advises the appropriate amount of medicine and dosage, as well as potential adverse effects. Every age group requires a different amount of medication to recover, hence the drug recommendation system considers age as a significant factor when recommending a drug. The decision tree was the key algorithm that provided great accuracy for medication prediction. Development has worked with clinical science to determine the overall cost of direction, science, health consequences, and medical services.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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