# Exploring Ayurvedic Medicine Recommendation Using Machine Learning Techniques

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**Abstract**
Ayurveda, a time-tested medical system, traditionally offers personalized healthcare. Recently there has been a growth in medicine recommendation using AI but not much has been explored about Ayurvedic medicines. With our paper we plan to implement and explore Ayurvedic medicine recommendation and how machine learning can enhance this approach by recommending individualized Ayurvedic treatments based on patient data. We propose a system that uses machine learning methods such as decision trees and neural network to first diagnose and then recommend the natural medicines. Furthermore, our main objective is to explore the potential of machine learning principles in medicine recommendation. By integrating machine learning techniques, this research seeks bridge the gap between traditional Ayurvedic wisdom and modern machine learning. The primary methodology employed in this study involves the training of a Neural Network model using patient data and predict medicines. The proposed system has the potential to improve healthcare accessibility and efficacy, particularly within the context of personalized Ayurvedic recommendations.

**Keywords:** Ayurveda, Machine Learning,Recommendation Systems,Decision Trees,Neural Networks

## 1. Introduction

Ayurveda, an ancient system of medicine with roots in the Indian subcontinent, has long been celebrated for its holistic and personalized approach to healthcare. Ayurvedic medicines, rooted in ancient Indian wisdom, offer a holistic and natural approach to healthcare. In this era of personalized medicine, the potential of Ayurveda medicine recommendation using machine learning techniques is immense. By analyzing patient data and considering individual health profiles, these systems aim to bridge the gap between traditional medicinal wisdom, like Ayurveda, and modern healthcare standards

### 1.1 Ayurveda

At its core, Ayurveda perceives health as a harmonious balance between the mind, body, and spirit, reflecting a profound understanding of the interconnectedness of these elements. The foundation of Ayurvedic medicines lies in harnessing the healing properties of nature, drawing from a rich tapestry of herbs, plants, minerals, and other natural sources. These medicinal formulations, deeply embedded in ancient Indian wisdom, emphasize not only the treatment of ailments but also the prevention of diseases by fostering a holistic lifestyle. The holistic philosophy of Ayurveda extends beyond mere symptom relief, aiming to address the root causes of illnesses. It recognizes each individual's unique constitution and tailors treatments accordingly, highlighting the personalized nature of Ayurvedic healthcare.

### 1.2 Medicine Recommendation

Medicine recommendation involves the use of advanced technologies and algorithms to suggest appropriate medications based on individual health conditions and medical history. This process often employs machine learning techniques to analyze large datasets, identifying patterns and correlations that contribute to personalized treatment plans. By considering factors such as medical history, symptoms, and potential side effects, these systems aim to enhance the precision and efficacy of medication recommendations. The goal is to provide patients with tailored and optimized drug prescriptions, ultimately improving healthcare outcomes.

### 1.3 Machine Learning in Medicine Recommendation

Using decision trees which excel at classifying medical conditions by analyzing diverse patient data we predict diseases using the symptoms. This involves the meticulous selection of relevant features, such as medical history and diagnostic results, which guide the creation of a transparent tree-like model. Further on, neural networks play a crucial role in personalized medicine recommendation. Trained on datasets comprising patient data, neural networks decipher intricate patterns and relationships to recommend tailored medication plans. The adaptability of neural networks to individual variations in genetics, treatment response, and potential side effects enhances the precision of medication suggestions. Together, these machine learning approaches contribute to a transformative shift in healthcare. Decision trees provide transparent insights into disease prediction, aiding clinicians in understanding diagnostic outcomes, while neural networks offer personalized medicine recommendations, promising more effective and individualized treatment strategies. The synergy of these techniques holds immense potential for advancing medical practices and improving patient outcomes

## 2. Literature Review

The convergence of machine learning (ML) with Ayurvedic medicine has spurred innovative research in personalized healthcare. Rastogi and Tiwari [1] pioneered the application of ML techniques for diagnosing ailments and recommending treatments in Ayurveda, showcasing the potential of data-driven approaches in leveraging ancient medical knowledge. Similarly, Kulkarni and Kadam [2] contributed to this field by implementing decision trees to facilitate disease diagnosis within the Ayurvedic framework, emphasizing the utility of ML algorithms in capturing complex patterns in patient data. Shukla et al. [3] expanded upon these foundations, developing a sophisticated ML-based treatment recommendation system tailored to Ayurvedic principles, highlighting the feasibility of integrating modern computational techniques with traditional healthcare systems.

In parallel Abhishek, Amit & Bindal, Dharminder & Yadav, & Abhishek, & Bindal, Dr. Amit & Yadav, Dharminder. [4] offered a comprehensive review of the emerging field of machine learning use in Ayurvedic medicine recommendation, shedding light on the transformative potential of machine learning methods. Their work underscores the unique capabilities of ML algorithms in handling vast datasets and uncovering intricate relationships inherent in Ayurvedic practices. Furthermore, Egba, Anwaitu & Okonkwo, Obikwelu & R, Obikwelu [5] delved into the realm of ML for recommendation analysis using neural networks, signaling a paradigm shift towards harnessing machine learning methodologies to deepen our understanding and enhance the efficacy of Ayurvedic diagnostics.

Collectively, these studies exemplify the interdisciplinary synergy between computational sciences and traditional medicine, driving advancements towards more accurate and personalized healthcare solutions rooted in Ayurvedic principles. As research in this domain progresses, the integration of ML methodologies promises to revolutionize healthcare delivery, offering insights and recommendations tailored to individual constitutions and holistic well-being

## 3. Architecture of Ayurvedic Medicine Recommendation

The architectural diagram for a ayurvedic medicine recommendation system with data collection, model training is designed to provide a comprehensive view of how these key elements interact to enhance medicine recommendation. First, we predict the disease by training a decision tree model. Then, we use the drug dataset to train our neural network model. Finally, we take the output of decision tree and use it as input to predict the drug using neural network.

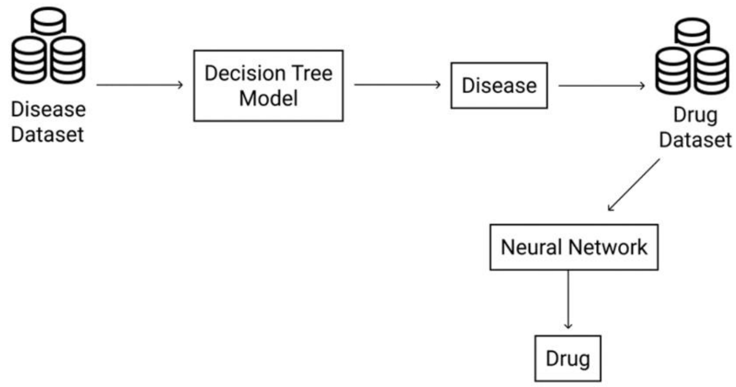


**Fig. 1 Architecture Diagram**

## 4. Design and Implementation of Ayurvedic Medicine Recommendation

### 4.1 Dataset

We have used 2 datasets for this process. First dataset contains the disease dataset with columns such as acidity,headache,stomach pain etc which act as the feature variables. Our target variable "disease" is the predicted disease. We have another dataset which contains features such as disease,age,gender which is trained to predict the suitable ayurvedic medicine.

### 4.2 Data Preprocessing

The data cleaning process involved changing all columns' data types to suitable numeric types, removing duplicate headers, and substituting occurrences of "infinity" with "inf" to align with Pandas' format. Column names were transformed to lowercase with non-word characters removed for easier access. In the data pre-processing phase, missing and infinity values were addressed, and new labels were created as needed. Finally, the model was trained using a 70/30 split for the training and testing datasets, respectively.

### 4.3 Decision Trees

Decision Trees play a crucial role in disease prediction, particularly in the field of personalized treatment plans. In the context of medicine recommendation, we have used decision trees as the first part to predict disease based on symptoms. They work by recursively partitioning the data based on various features, creating a tree-like structure where each node represents a decision based on a specific attribute. The tree structure allows for the identification of key factors influencing the recommendation process.

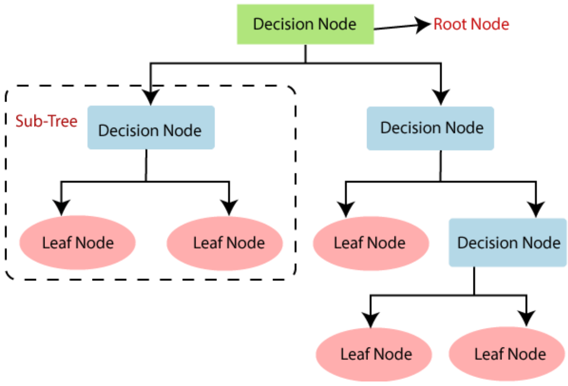


**Fig. 2 Decision Trees**

### 4.4 Neural Networks

Neural Networks, a subset of artificial intelligence, have become a transformative tool in medicine, particularly in the domain of medicine recommendation. These sophisticated algorithms are designed to simulate the human brain's neural structure, enabling them to learn patterns and make complex decisions based on vast datasets. In medicine recommendation, Neural Networks excel at processing diverse patient information, including medical histories, genetic data, and diagnostic results. Their ability to recognize intricate relationships within this data allows for more accurate and personalized recommendations for treatments, medications, and interventions. Neural Networks can predict which drugs are likely to be most effective for an individual. This personalized approach minimizes the risk of adverse reactions and enhances treatment outcomes.

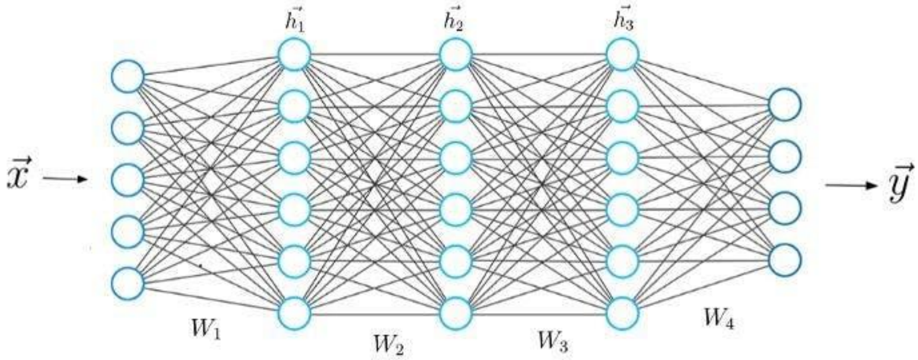


**Fig. 3 Neural Networks**

## 5. Results and Discussion

### 5.1 Metrics

Precision measures the accuracy of positive predictions, Recall assesses the model's ability to identify all relevant instances, and the F1 Score combines both precision and recall to provide a single metric for model evaluation. Precision is calculated as TP/(TP + FP), Recall as TP/(TP + FN), and the F1 Score as 2 * (Precision * Recall) / (Precision + Recall) [10]. These metrics are crucial for evaluating a classification model's performance, especially in scenarios with imbalanced datasets, as they collectively provide insights into the model's ability to make accurate positive predictions, capture relevant instances, and balance precision and recall effectively.

### 5.2 Final Result

With a precision of 0.82, we achieved a commendable level of accuracy in predicting the diseases based on the given input symptoms when tested on the test dataset. This means that out of the total medicines predicted, around 82% were actually matching with their actual values, demonstrating a low rate of false positives.

## 6. Conclusions

Neural Networks show promise in enhancing Ayurvedic Medicine Recommendation by improving accuracy, robustness, and efficiency in detecting complex cyber threats. Machine learning algorithms demonstrate notable performance gains with minimal datasets, hinting at potential advancements in the medicinal field. However, challenges such as limited data, lack of knowledge etc. may persist in future applications

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