Medical Recommendation System

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Abstract

Medical Recommendation System is an AI-
based model designed to give appropriate recommendations for workouts, diets, and medication based on symptoms provided by the users. Acting similarly to a medical practitioner, the system checks a patient's
symptoms and predicts possible conditions and recommends the corresponding pharma ceutical treatments. With the aid of machine learning algorithms, the
system learns independently and improves its predictive ability, thus making accessible and easy healthcare options available for a broader population.

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1. Introduction

This project proposes a Medical Recommendation System intended to support initial health screening and give first-level recommendations depending on the user-inputted symptoms. The system seeks to cover the gap between patients and healthcare information, especially in situations where there is restricted access to health professionals in an immediate way. Through machine learning, the system is capable of giving personalized advice, which makes individuals take more proactive care for their own well-being.

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2. Problem Background

- The medical field is plagued by many challenges, such as:
- Inadequate access to medical experts in remote or underprivileged regions.
- Rising healthcare expenses.
- The challenge of processing and interpreting enormous volumes of medical data.
- The requirement for individualized and timely medical advice.

This project aims to tackle some of these challenges by creating a system that can offer preliminary medical advice based on patient-reported symptoms.**2.1 Relevant Articles**

The following articles provide context and highlight the growing role of AI in healthcare:

- AI in Medical Diagnosis - arXiv
- AI's Role in Health Care - Wired
- AI Blood Test for Parkinson's - The Guardian
- AI Cough Monitoring - CACM
- PMC Article on Cough Diagnosis
- AI and Health - Time Magazine
- AI in Medicine - Time
- AI in Healthcare - Wikipedia
- Personalized Medicine - Wikipedia
- Imaging Informatics - Wikipedia
- AI for Cure Discovery - Wired
- AI in Africa - Human Progress
- AI for Development - FT
- AI in Africa NGOs - Funds for NGOs

Table for Literature Review:

The following table summarizes key articles reviewed for the Medical Recommendation System, highlighting their focus, findings, and relevance to our project.

Article/Source	Key Focus	Findings	Relevance to Project
AI in Medical Diagnosis (arXiv, 2023)	Machine Learning to predict based on symptoms	Decision trees work well (80–85% accurate) but need lots of data.	Tell us to use decision trees or random forests in our app
AI's Role in Health Care (Wired, 2022)	A.I-powered health advice	It works well but needs fast computers.	Reminds us to use light tools like scikit-learn
AI in Medicine (Time Magazine, 2023)	AI gives personal health tips	AI can help, but online use (telemedicine) is still hard.	Helps us build a friendly system for remote users
Personalized Medicine (Wikipedia, 2024)	Matches symptoms to diseases	AI can do this well but needs easy interfaces for people.	Supports our plan to make a simple user interface
AI Blood Test for Parkinson's (The Guardian, 2023)	AI uses blood to detect diseases	Biomarkers can help in the future (Predictions).	Shows we can add more smart features later

3. System Overview

The Medical Recommendation System is intended to give users initial diagnoses and treatment recommendations based on their self-reported symptoms. The system uses machine learning algorithms to examine patterns of symptoms and forecast the most probable disease. It then gives a list of suggested medicines and general wellness tips.

Workflow Summary:

- **Symptom Input:** User enters symptoms via an interface.
- **Symptom Processing:** Input symptoms are transformed for the model.
- **Disease Prediction:** ML model predicts a potential disease.
- **Recommendation Generation:** Associated medicines and advice are retrieved.
- **Output:** Predicted disease and recommendations are shown to the user.

3.1 Suitability of AI

AI, particularly ML, is ideal for this task due to its ability to:

- Identify complex, non-linear patterns.
- Continuously improve through learning.
- Handle variability and vast medical data.

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4. Technologies and Libraries Used

Language & Environment: Python (Jupyter Notebook)

Library	**Purpose**
pandas	Data loading and manipulation
numpy	Numerical computations
scikit-learn	Model building & evaluation (DecisionTree, RandomForest)
matplotlib / seaborn	Visualization (feature importance, confusion matrix)
LabelEncoder	Categorical data preprocessing
train_test_split	Data partitioning

5. Importance in the Real-World

- **Telemedicine:** Supports healthcare access in remote regions.
- **Chatbots:** Can power AI health chat assistants.
- **Professional Aid:** Filters simple cases for doctors.
- **Health Awareness:** Educates users on conditions.
- **Cost Savings:** Reduces visits for minor illnesses.

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6. Group Members and Role Distribution

Member	Role
Tauha Amir	Data Scientist - Preprocessing, Feature Encoding
Muhammad Tayyab Extreme	ML Engineer - Model training, validation
Assadullah Bhatti	Backend Developer - Logic and mapping integration
Abrar Hussain	Analyst & Documentation - Metrics, visuals, reporting

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7. Dataset Information

- **Symptom Columns:** Represent presence/absence of symptoms.
- **Target Column:** Disease (label for prediction).
- **Medicine Mapping:** Associates diseases with treatments.
- **Preprocessing:** Label Encoding for ML compatibility.
- **Train-Test Split:** 80-20 split.
- **Evaluation Metric:** Accuracy for performance validation.

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8. Final Output: The System (Program)

Functional Workflow:

1. User inputs symptoms.
2. ML model predicts disease.
3. System fetches medicine.
4. Output is displayed.

Example Python Code:

```python
from sklearn.datasets import make_classification
from sklearn.model_selection import train_test_split
from sklearn.svm import SVC
from sklearn.ensemble import RandomForestClassifier, GradientBoostingClassifier
from sklearn.neighbors import KNeighborsClassifier
from sklearn.naive_bayes import MultinomialNB
from sklearn.metrics import accuracy_score, confusion_matrix
import numpy as np


# Create a dictionary to store models
models = {
    'SVC': SVC(kernel='linear'),
    'RandomForest': RandomForestClassifier(n_estimators=100, random_state=42),
    'GradientBoosting': GradientBoostingClassifier(n_estimators=100, random_state=42),
    'KNeighbors': KNeighborsClassifier(n_neighbors=5),
    'MultinomialNB': MultinomialNB()
}

# Loop through the models, train, test, and print results
for model_name, model in models.items():
    # Train the model
    model.fit(X_train, y_train)

    # Test the model
    predictions = model.predict(X_test)

    # Calculate accuracy
    accuracy = accuracy_score(y_test, predictions)
    print(f"{model_name} Accuracy: {accuracy}")

    # Calculate confusion matrix
    cm = confusion_matrix(y_test, predictions)
    print(f"{model_name} Confusion Matrix:")
    print(np.array2string(cm, separator=', '))

    print("\n" + "="*40 + "\n")

```

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9. Conclusion and Future Work

Conclusion: This system leverages AI to deliver preliminary healthcare recommendations based on symptoms, improving accessibility and empowering patients.