**HEALTHCARE CHATBOT**

**Submitted for**

**CSET211 - Statistical Machine Learning**

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A close-up of a logo

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**Abstract**

This project presents a healthcare chatbot application designed to assist users in diagnosing diseases based on reported symptoms. By leveraging Artificial Intelligence (AI) and Machine Learning (ML), the chatbot provides real-time diagnostic support, actionable guidance, and suggestions for healthcare professionals. The system integrates a Decision Tree Classifier, dimensionality reduction techniques, and a user-friendly GUI for interaction. The AI-driven system ensures efficiency and accuracy in healthcare recommendations.  
GitHub repository: https://github.com/AyushMishra-02/AI\_chatbot

1. **Introduction**

Healthcare chatbots powered by AI are revolutionizing patient interactions with healthcare systems. They offer preliminary diagnostic support and bridge the gap between users and healthcare professionals. This project implements a Machine Learning-based chatbot for symptom analysis and disease prediction. The goal is to democratize access to basic diagnostic tools and provide recommendations for appropriate healthcare interventions.

**2. Related Survey**

Extensive research highlights the potential of AI technologies in healthcare. Previous studies demonstrate the effectiveness of Decision Tree models in identifying patterns within healthcare data due to their interpretability. AI-powered chatbots have been found to improve user engagement, reduce diagnostic delays, and offer accurate disease prediction. This project builds upon these findings to create a comprehensive diagnostic tool.

* **Patient Triage and Symptom Analysis**: AI chatbots streamline triage processes, reducing wait times and prioritizing urgent cases efficiently.
* **NLP for Chronic Disease Management**: Chatbots using NLP engage patients, enhance treatment adherence, and improve chronic disease management outcomes.
* **Personalized Medication Recommendations**: AI chatbots minimize medication errors and optimize patient safety through personalized regimens.
* **Mental Health Support**: Chatbots offer accessible therapeutic interventions and emotional support, addressing mental health barriers like stigma.
* **Patient Education and Engagement**: AI chatbots empower patients with personalized health education, fostering better engagement in care.
* **Ethical Considerations in AI Chatbots**: Ethical frameworks are essential to address privacy, bias, and responsibility in healthcare chatbots.
* **Future of AI Chatbots in Healthcare**: Integration of AI chatbots promises improved patient outcomes and healthcare system efficiency but requires addressing ongoing challenges.

**3. Datasets**

* Training Dataset: Used to train the ML model. It includes 132 symptoms and disease labels.
* Testing Dataset: Validates the model's accuracy and reliability.
* Doctor Dataset: Maps diseases to healthcare professionals, including names and contact links.

**Data Preprocessing**

Feature Extraction

* Extracted features (X) represent symptoms.
* Labels (Y) represent the diseases to be predicted.

Label Encoding

* Encoded disease names into numerical values using LabelEncoder.

Data Splitting

* Divided the dataset into training (75%) and testing (25%) sets using train\_test\_split.

Dimensionality Reduction

* Grouped symptoms by diseases to eliminate redundant data and enhance efficiency.

**4. Methodology**

Machine Learning Model

* Model Selection: Decision Tree Classifier for its ability to handle categorical data and its interpretability.
* Training: Features and labels were used to train the classifier, identifying significant predictors using feature importance.

Chatbot Workflow

Symptom-Based Questioning:

* + Dynamically generates yes/no questions based on decision tree traversal.

Disease Prediction:

* + Provides a diagnosis based on user responses.

Confidence Scoring:

* + Calculates confidence levels based on symptom matches.

Recommendations:

* + Suggests doctors and links to additional resources.

Graphical Interface

* Developed using Tkinter, the GUI includes login/registration, symptom questioning, and diagnosis display.

**5. Usage of AI Technologies**

Machine Learning Integration:

* + The Decision Tree Classifier serves as the core of the chatbot, using supervised learning to predict diseases based on symptoms.

Natural Language Processing (NLP):

* + Though basic, the system processes user inputs (e.g., yes/no) to tailor responses dynamically.

1. Data Science Techniques:
   * Dimensionality reduction is applied to improve model performance.
   * Data preprocessing ensures accurate and efficient training.

**Hyperlink Management with Python:**

* + Provides direct links to relevant healthcare resources, leveraging AI-driven recommendations.

**Future Scope of AI in This Project:**

* + Incorporating deep learning models for improved predictions.
  + Expanding into conversational AI for better natural language understanding.

**. Hardware and Software Requirements**

Hardware

* Minimum: 16 GB RAM, 2.5 GHz Processor.

Software

* Python 3.10 or later.
* Libraries: pandas, numpy, sklearn, tkinter.

**Performance Metrics**

Accuracy:

* + Evaluated on test data to measure the model's reliability.

Confidence Level:

* + Reflects the proportion of user-validated symptoms in the predicted diagnosis.

1. **Results and Analysis**

* Model Performance:
  + Achieved high accuracy in disease prediction.
* User Interaction:
  + The GUI successfully guided users through symptom-based diagnosis.

Recommendations:

* + Users received actionable advice, including doctor consultations.

1. **Conclusions and Future Works**

**Conclusions**

This project demonstrates the practicality of integrating AI and ML with user-centric tools like chatbots. It provides accurate diagnoses, empowering users with preliminary healthcare insights.

**Future Works**

Enhanced AI Models:

* + Utilize ensemble models (e.g., Random Forest, XGBoost) for improved accuracy.

Conversational AI:

* + Incorporate advanced NLP for voice-based interactions.

Mobile Application:

* + Extend the project to Android/iOS platforms for wider accessibility.

Expanded Dataset:

* + Add more diseases and symptoms for comprehensive coverage.