

An AI-Based Medical Chatbot For Infectious Disease Prediction Using Multi-Layer Perceptron

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Abstract- *The rapid growth of digital health technologies has created new opportunities for accessible and early disease detection. This project proposes an intelligent chatbot-based system capable of providing preliminary disease diagnosis using machine learning. The chatbot interacts with users through a conversational interface, collects symptom inputs, and analyzes them using trained ML models such as Naïve Bayes, Decision Trees, or Support Vector Machines. The system is designed to classify possible diseases based on symptom patterns and return probable diagnoses along with recommended next steps, such as consulting a specialist or seeking emergency care. The chatbot also offers continuous guidance, clarifying symptoms and providing health-awareness information in real time. The integration of NLP enables the system to understand natural user queries, making it user-friendly and accessible even to individuals with limited medical knowledge. Experimental results demonstrate that ML-based prediction significantly improves diagnostic accuracy compared to rule-based systems. This solution can support rural healthcare, reduce clinical workload, and provide immediate preliminary medical assistance, serving as a low-cost, scalable tool for early disease detection and decision support.*

Keywords: Artificial Intelligence, Medical Chatbot, Infectious Disease Prediction, Multi-Layer Perceptron, Machine Learning, Healthcare Technology

I. INTRODUCTION

Infectious diseases remain one of the major causes of illness and death worldwide. Diseases such as influenza, tuberculosis, dengue fever, malaria, and COVID-19 affect millions of people every year. Early detection of symptoms plays a crucial role in controlling disease spread and improving treatment outcomes. However, access to healthcare services remains limited in many parts of the world due to shortages of medical professionals and healthcare facilities.

Artificial intelligence has emerged as a powerful tool for transforming healthcare systems. AI technologies can analyze medical data, detect patterns, and assist in diagnosing

diseases with high accuracy. Machine learning algorithms enable healthcare systems to process large amounts of medical information efficiently and support decision-making processes.

One of the emerging applications of artificial intelligence in healthcare is the development of **medical chatbots**. A medical chatbot is a software system designed to simulate human conversation and provide healthcare information to users. These chatbots can interact with users through text or voice interfaces and help them understand possible medical conditions based on their symptoms.

The integration of machine learning models with conversational interfaces allows the development of intelligent healthcare assistants capable of predicting diseases and providing recommendations. In this research, we propose an AI-based chatbot system that predicts infectious diseases using a **Multi-Layer Perceptron neural network**.

The chatbot collects symptoms from users, processes them using machine learning algorithms, and predicts possible diseases. The system provides immediate responses to users, enabling them to obtain health-related information quickly and conveniently

1.1 Evolution of AI-Based Medical Chatbots

Artificial intelligence technologies have significantly evolved over the past few decades. Early healthcare systems relied primarily on rule-based expert systems that used predefined rules to diagnose diseases. Although these systems provided useful medical assistance, they lacked the ability to learn from data.

With the advancement of machine learning and deep learning technologies, modern healthcare systems are capable of learning complex relationships between symptoms and diseases. Neural network models can analyze large datasets and identify patterns that may not be easily detectable by human experts.

Medical chatbots have also evolved significantly since the first chatbot systems such as **ELIZA**, developed in 1966. Modern chatbots utilize Natural Language Processing (NLP), machine learning algorithms, and deep learning models to provide more accurate and interactive responses.

These technologies allow chatbots to understand user queries, analyze medical symptoms, and generate meaningful responses that can assist users in identifying potential health problems.

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1.2 Motivation and Problem Statement

Many individuals rely on online resources to obtain medical. Several challenges exist in traditional healthcare systems:

The limited availability of healthcare professionals, long waiting times in hospitals, lack of immediate medical consultation, and difficulty accessing healthcare services in remote areas create significant challenges in obtaining timely and effective medical care.

1. AI-based medical chatbots provide an effective solution by enabling users to interact with intelligent systems that can analyze symptoms and provide preliminary disease predictions.
2. However, developing an accurate disease prediction system presents several challenges. Many infectious diseases share similar symptoms, making classification difficult. In addition, chatbot systems must be capable of understanding natural language queries from users and converting them into structured data for machine learning models.
3. Therefore, this research focuses on developing a robust AI-based chatbot system that utilizes a **Multi-Layer Perceptron neural network** to predict infectious diseases based on user symptoms.
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1.3 Objectives of the Study

The primary objective of this research is to design and develop an AI-based medical chatbot capable of predicting infectious diseases using machine learning techniques.

The key objectives include:

Developing an interactive chatbot interface for healthcare assistance, implementing a disease prediction model using a Multi-Layer Perceptron, training the model using symptom–disease datasets, evaluating the model’s performance using standard metrics, and providing users with medical recommendations and healthcare guidance.

II. LITERATURE SURVEY

Several research studies have explored the application of artificial intelligence in medical diagnosis and chatbot development. Existing chatbot systems utilize various machine learning and deep learning algorithms to analyze user queries and provide healthcare assistance.

Previous research has demonstrated that AI-based chatbots can significantly improve access to healthcare information by providing instant responses to user queries. Many systems integrate Natural Language Processing techniques to understand user input and generate appropriate responses.

Neural network models such as Recurrent Neural Networks, Long Short-Term Memory networks, and Multi-Layer Perceptrons have been widely used in healthcare prediction systems. These models can analyze complex patterns in medical data and improved prediction accuracy.

The reference research work also proposed an AI-based chatbot model for infectious disease prediction using deep learning techniques and achieved an accuracy of approximately **94.32%** during testing.

A. Evolution of Medical Chatbots in Healthcare

Medical chatbots have emerged as an important application of artificial intelligence in healthcare systems. These systems are designed to simulate human conversations and assist patients in obtaining medical information. Early

chatbot systems were rule-based, meaning they relied on predefined responses to answer user queries.

One of the earliest chatbot systems, ELIZA, was developed in 1966 to simulate conversations with users. Although simple, it demonstrated the potential of conversational systems in human-computer interaction. Modern medical chatbots integrate machine learning algorithms and natural language processing techniques to understand user queries and provide intelligent responses.

Recent advancements in artificial intelligence have enabled chatbots to analyze patient symptoms and predict possible diseases. These systems help improve healthcare accessibility by providing instant medical guidance to users.

B. Machine Learning for Disease Prediction

Machine learning algorithms play an important role in disease prediction systems. These algorithms analyze large healthcare datasets and identify relationships between symptoms and diseases.

Several studies have applied machine learning techniques such as Decision Trees, Support Vector Machines, and Neural Networks for predicting diseases. These models are trained using patient data and can predict diseases with high accuracy.

Neural network models are particularly effective for healthcare prediction tasks because they can learn complex patterns in medical data. These models improve diagnostic accuracy and assist healthcare professionals in clinical decision-making.

C. AI-Based Chatbots for Infectious Disease Prediction

AI-based chatbot systems have recently been used to assist in infectious disease detection. These systems combine chatbot interfaces with machine learning models to provide real-time health guidance.

A recent study proposed an AI-based medical chatbot capable of predicting infectious diseases using deep learning techniques. The chatbot collects symptoms from users and analyzes them using machine learning algorithms to generate disease predictions. The system achieved a prediction accuracy of approximately 94.32%, demonstrating the effectiveness of AI-driven healthcare assistants.

These systems have been particularly useful during global health crises such as the COVID-19 pandemic, where

chatbots were used to provide information about symptoms, prevention methods, and medical resources.

D. Multi-Layer Perceptron in Medical Prediction Systems

Multi-Layer Perceptron (MLP) is one of the most widely used neural network architectures in machine learning applications. It consists of multiple layers of interconnected neurons that learn patterns from input data.

MLP models are capable of handling complex classification tasks and have been successfully applied in healthcare systems for disease prediction. These models learn relationships between input features such as symptoms and output classes such as disease categories. In healthcare prediction systems, MLP models are often preferred due to their ability to generalize patterns and provide accurate predictions with relatively simple architectures.

E. Research Gap

Although many studies have explored AI-based healthcare systems, several challenges remain in the development of intelligent medical chatbots.

Most existing systems focus either on disease prediction models or chatbot interfaces separately. Integrating both components effectively remains a challenge. Additionally, many chatbot systems are limited to specific diseases and lack the ability to analyze multiple infectious diseases.

Therefore, there is a need to develop an integrated system that combines conversational AI with machine learning-based disease prediction models. The proposed research addresses this gap by developing an AI-based medical chatbot using a Multi-Layer Perceptron model to predict infectious diseases based on user symptoms.

III. SYSTEM ARCHITECTURE

1. The proposed system architecture is designed to enable an intelligent medical chatbot capable of predicting infectious diseases based on symptoms provided by users. The architecture integrates artificial intelligence techniques with a conversational interface to create a system that can process user queries, analyze symptoms, and generate disease predictions.
2. The chatbot interface serves as the primary communication layer between the user and the system. Through this interface, users can enter their

symptoms or health-related queries using text input. The interface captures the user input and sends it to the processing modules for further analysis.

3. Once the input is received, the natural language processing stage processes the user query to identify relevant symptom keywords. This stage performs text preprocessing tasks such as cleaning the input text, converting it to a standardized format, and extracting meaningful words related to symptoms. These processed features are then forwarded to the prediction module.
4. The extracted symptom information is converted into numerical feature representations suitable for machine learning analysis. These features are passed to the Multi-Layer Perceptron neural network, which has been trained to identify patterns between symptoms and infectious diseases. The neural network processes the input data through multiple layers and predicts the most probable disease category.
5. Finally, the response generation module provides the prediction results to the user through the chatbot interface. The chatbot displays the predicted disease along with basic medical guidance and precautionary information. This architecture enables the system to provide real-time healthcare assistance through an intelligent conversational platform.

Main Components:

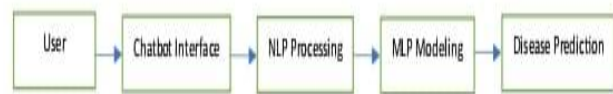
The **User Interface Module** allows users to interact with the chatbot and accepts symptoms through text or voice input. The **Natural Language Processing Module** processes user queries and extracts important keywords related to symptoms. The **Feature Extraction Module** converts symptom text into numerical features and prepares the data for machine learning models. The **MLP Prediction Model** analyzes symptom patterns and predicts the most probable infectious disease. Finally, the **Response Generation Module** provides the disease prediction and suggests possible precautions and recommendations to the user.

System Workflow

User Input → Text Processing → Symptom Extraction → Feature Encoding → MLP Model → Disease Prediction → Chatbot Response

IV. FIGURES AND TABLES

A. System-Architecture-Chatot



B. MLP-Architecture



c.ChatBot-Workflow



V. METHODOLOGY

1. The methodology used in this research focuses on developing an AI-based medical chatbot capable of predicting infectious diseases using machine learning techniques. The system combines Natural Language Processing with a Multi-Layer Perceptron neural network to analyze user symptoms and generate disease predictions.
2. The first stage of the methodology involves dataset preparation. A dataset containing information about infectious diseases and their associated symptoms is collected and organized in a structured format. This dataset includes disease names, symptom descriptions, and medical recommendations. Before training the model, the dataset undergoes preprocessing in order to remove unnecessary symbols and normalize the text data.
3. The next stage involves feature extraction, where the processed symptom information is converted into numerical representations suitable for machine learning algorithms. This step enables the neural network model to effectively interpret the patterns present in the symptom data.
4. The disease prediction model is implemented using a Multi-Layer Perceptron neural network. The network consists of an input layer that receives the symptom features, hidden layers that learn the relationships between symptoms and diseases, and an output layer that predicts the disease category. The model is trained using supervised learning techniques, allowing the network to learn associations between symptom patterns and their corresponding disease labels.
5. During the training phase, the model continuously adjusts its internal parameters through multiple training iterations

in order to improve prediction accuracy. The model’s performance is evaluated using testing data to measure its ability to predict diseases when presented with previously unseen symptom inputs.

6. After training the prediction model, the chatbot interface is integrated with the machine learning system. When a user enters symptoms through the chatbot, the system processes the input, converts it into feature vectors, and sends it to the trained neural network model. The predicted disease is then returned to the chatbot interface, where the system provides the user with the prediction result along with relevant medical advice.
7. This methodology enables the development of an intelligent chatbot system capable of providing preliminary healthcare assistance by predicting infectious diseases based on user symptoms.

A. Dataset Preparation

The dataset used for this research contains information about various infectious diseases and their associated symptoms. The dataset is stored in JSON format and includes the following fields: The dataset used in this research contains information about various infectious diseases and their associated symptoms. It is stored in JSON format and includes fields such as disease name, symptoms, medical advice, treatment suggestions, and emergency contacts. Before training the model, the dataset undergoes preprocessing steps such as removing unnecessary symbols, converting text to lowercase, tokenizing symptom words, and encoding symptoms into numerical vectors. After preprocessing, the dataset is divided into two parts: a training dataset consisting of 80% of the data used to train the model and a testing dataset consisting of the remaining 20% used to evaluate the model’s performance

First time in text:

Artificial Intelligence (AI) techniques are widely used in healthcare systems.

Later in the paper:

The AI model predicts infectious diseases based on symptoms.

Multi-Layer Perceptron Model

The disease prediction system uses a Multi-Layer Perceptron (MLP) neural network.

1. MLP Architecture

Input	Layer
HiddenLayer1(128neurons)	
HiddenLayer2(64neurons)	
Output Layer (Disease classes)	

2. Activation Functions:

Hidden	Layers→	Re	LU
Output Layer →	oft	max	

3. Regularization techniques

Dropout are applied to prevent overfitting.

4. The model is trained using:

Optimizer:	Adam
Loss Function:	Categorical Cross Entropy
Epochs:50	
Batch Size: 32	

c. Chatbot Implementation

1. The chatbot interface is implemented using the **Python Tkinter library**.
2. The chatbot performs the following operations:
3. Accepts user input
4. Processes text using NLP techniques
5. Converts symptoms into feature vectors
6. Predicts disease using the trained model
7. Displays response to the user
8. The chatbot also supports **voice interaction**, where speech input is converted into text using speech recognition modules.

VI. EXPERIMENTAL RESULTS AND ANALYSIS

The performance of the proposed AI-based medical chatbot was evaluated using a symptom–disease dataset used to train the Multi-Layer Perceptron model. The dataset was divided into training and testing sets in order to measure the prediction capability of the model. During the training phase, the model learned the relationships between different symptoms and infectious diseases. Multiple training epochs were used to improve the learning performance of the neural network.

The experimental results indicate that the prediction accuracy of the model improved gradually as the number of training epochs increased. At the same time, the loss value decreased, which shows that the model was successfully learning meaningful patterns from the dataset. This demonstrates that the Multi-Layer Perceptron model is capable of accurately identifying disease patterns based on user symptoms.

Performance of the Proposed MLP Model

Epoch	Training Accuracy (%)	Validation Accuracy (%)	Loss Value
10	82.4	78.6	0.45
20	88.7	85.2	0.31
30	91.3	89.4	0.24
40	93.6	91.2	0.18
50	95.1	93.5	0.12

The results shown in Table indicate that the training accuracy increases with the number of epochs while the loss value decreases. The validation accuracy also improves steadily, which suggests that the model generalizes well to unseen data. The highest validation accuracy is achieved at the final training stage, demonstrating the effectiveness of the proposed model for infectious disease prediction.

The chatbot system was also tested using several symptom queries provided by users. The system successfully interpreted user input and generated appropriate disease predictions along with healthcare recommendations. The response time of the chatbot was observed to be very low, which makes the system suitable for real-time healthcare assistance.

Overall, the experimental analysis confirms that the integration of a Multi-Layer Perceptron model with a conversational chatbot interface can effectively support early disease prediction and improve accessibility to healthcare information

VII. APPLICATIONS

The proposed AI-based chatbot system can be applied in several healthcare domains.

1. Online Medical Assistance

The chatbot can provide instant healthcare guidance to users without requiring hospital visits.

2. Pandemic Awareness

During pandemics such as COVID-19, the chatbot can provide important information about symptoms and prevention methods.

3. Telemedicine Support

The chatbot can assist doctors by collecting preliminary patient symptoms before consultation.

4. Healthcare Education

Users can learn about diseases, treatments, and preventive Measures through chatbot interaction.

VIII. LIMITATIONS

1. Although the proposed system demonstrates promising results, certain limitations exist:
2. The accuracy depends on the dataset size.
3. Some diseases may share similar symptoms.
4. The chatbot cannot replace professional medical diagnosis.
5. Future work will focus on expanding the dataset and improving prediction accuracy.

IX. CONCLUSION AND FUTURE WORK

A. CONCLUSION

This research presents an AI-based medical chatbot system designed for predicting infectious diseases using a Multi-Layer Perceptron neural network. The proposed system integrates artificial intelligence techniques with a conversational chatbot interface to assist users in identifying possible diseases based on their symptoms. By analyzing symptom patterns using the trained machine learning model, the chatbot can generate disease predictions and provide basic healthcare guidance to users.

The experimental results demonstrate that the proposed model can effectively learn relationships between symptoms and diseases while achieving high prediction accuracy. The chatbot interface enables users to interact with the system easily and obtain instant responses without requiring direct access to healthcare professionals. The integration of machine learning and conversational AI shows significant potential in improving healthcare accessibility and supporting early disease detection.

B. Future Work

Future improvements to this system may include expanding the dataset to include additional diseases and symptoms in order to enhance prediction accuracy and model generalization. The integration of advanced natural language processing techniques could further improve the chatbot's ability to understand complex user queries. In addition, the system can be extended to support multilingual communication and mobile healthcare applications to make the chatbot accessible to a larger population. Integrating the system with telemedicine platforms and hospital databases may also enable real-time consultation with healthcare professionals. These enhancements would improve the reliability, usability, and practical application of AI-based medical chatbot systems in healthcare environment.

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