Data 606 Capstone in Data Science

Project Proposal

AI-Driven NLP Chatbot for Skin Disease Diagnosis and Medication recommendations

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OBJECTIVE

The objective of this project is to develop an AI-powered chatbot that utilizes natural language processing (NLP) and image recognition to assist users in diagnosing dermatological conditions and providing relevant medication assistance. The chatbot will allow users to upload images of skin conditions for preliminary diagnostic feedback and offer recommendations for over-the-counter medications or treatments, along with dosage information and guidelines.

By integrating resources for both diagnosis and medication, the chatbot simplifies the often-complex process of identifying suitable treatments, helping users avoid unnecessary medical consultations for minor conditions. This approach is aimed at reducing diagnostic delays, improving medication accessibility, and enhancing patient engagement by providing a user-friendly, quick-response solution to skin health issues.

DATA SOURCE

For this project, DermNet NZ is a very valuable and perfect resource for training an AI model for recognizing skin conditions. It provides a rich dataset of high-quality dermatological images, which can be used in the chatbot's image recognition component. This data can improve precision in identifying dermatological issues and provide personalized medication recommendations, enhancing patient engagement and care outcomes.

DermNet. (2024, April 22). *Images A-Z | DermNet*. DermNet®.
https://dermnetnz.org/images

LITERATURE REVIEW

- **Machine Learning and Deep Learning in Dermatology**: Zhang et al. (2023) review recent advancements in machine learning, particularly Convolutional Neural Networks (CNNs), for diagnosing skin diseases. They highlight CNNs' high accuracy in classifying dermatological conditions from images, which is highly relevant to the proposed chatbot. The study's insights will guide the chatbot's model development, ensuring the use of best practices in image recognition to provide reliable diagnostic feedback for users.
- **Image Processing and Machine Learning for Skin Disease Detection**: ALEnezi (2020) introduces a method for skin disease detection using image processing and machine learning, focusing on essential preprocessing steps like resizing and normalizing images to enhance quality before model training. The study emphasizes that effective data preprocessing is crucial for improving model performance, which aligns with the proposed project's methodology of preprocessing image data to optimize AI model accuracy in identifying skin conditions.

- **AI-Powered Diagnostic Systems in Healthcare**: Singh and Sharma (2022) review the growing use of AI-powered diagnostic systems in healthcare, emphasizing how machine learning algorithms can process complex medical data for more accurate and timely diagnoses. They highlight that these systems can improve patient care by reducing diagnostic delays, supporting the proposed chatbot's goal of providing fast preliminary diagnostic feedback for dermatological conditions.
- **Chatbot-Based Disease Prediction and Treatment Recommendation**: Pathak and Ansari (2023) examine the use of AI chatbots in disease prediction and treatment recommendation, highlighting their effectiveness as an initial point of contact in healthcare. The study shows that chatbots can efficiently gather patient information, analyze symptoms, and suggest treatments. This aligns with the proposed chatbot's goal of using image recognition and natural language processing to provide personalized medication assistance and diagnostic support.

METHODOLOGY

This project briefly consists of 5 major steps. Combination of all of these give us the final output of a running ai powered chatbot.

1. **Data Collection and Preprocessing**: Firstly, we perform exploratory data analysis (EDA) on skin disease image datasets to assess quality, relevance, and diversity of the data set. data preprocessing through augmentation and normalization is also done . Additionally, preprocess text data for medication-related queries by cleaning, tokenizing, and lemmatizing to optimize the NLP model.
2. **Model Development**: CNN models are created to analyze and classify skin conditions from user-uploaded images, and a Natural Language Processing (NLP) model to understand user queries, providing personalized medication recommendations along with dosage guidelines based on the diagnosed condition.
3. **Integration of Models**: These models are integrated to form a chatbot experience, allowing users to receive both diagnostic feedback and medication suggestions in one interface without any hassle.
4. **Model Evaluation**: The chatbot's performance is analyzed using metrics like accuracy, precision, and recall ensuring both the image recognition and medication recommendation functionalities meet standards of reliability.
5. **Deployment and User Testing**: After everything is done final deployment is done, then chatbot undergoes user testing to gather feedback, enabling improvements in accuracy, user experience, and the relevance of medication recommendations.

PROJECT PROGRESS

Our project has completed initial crucial stage such as loading and preprocessing a dataset of skin disease images, developing an image classification model , training the model to provide high accuracy results etc. The process results are given below:

1.

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/drive", force_remount=Tr
ue).
Total data shape: (1711, 224, 224, 3)
Training data shape: (1368, 224, 224, 3)
Testing data shape: (343, 224, 224, 3)
Training labels shape: (1368,)
Testing labels shape: (343,)
```

2.

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Epoch 1/10
486/486 ━━━━━━━━━━━━━━━━━━━━ 2024s 4s/step - accuracy: 0.5470 - loss: 0.8983
Epoch 2/10
486/486 ━━━━━━━━━━━━━━━━━━━━ 1965s 4s/step - accuracy: 0.6229 - loss: 0.6896
Epoch 3/10
486/486 ━━━━━━━━━━━━━━━━━━━━ 1902s 4s/step - accuracy: 0.6172 - loss: 0.6829
Epoch 4/10
486/486 ━━━━━━━━━━━━━━━━━━━━ 2004s 4s/step - accuracy: 0.5834 - loss: 0.6841
Epoch 5/10
486/486 ━━━━━━━━━━━━━━━━━━━━ 1977s 4s/step - accuracy: 0.6229 - loss: 0.6788
Epoch 6/10
486/486 ━━━━━━━━━━━━━━━━━━━━ 1941s 4s/step - accuracy: 0.6142 - loss: 0.6767
Epoch 7/10
486/486 ━━━━━━━━━━━━━━━━━━━━ 2035s 4s/step - accuracy: 0.5975 - loss: 0.6773
Epoch 8/10
486/486 ━━━━━━━━━━━━━━━━━━━━ 1984s 4s/step - accuracy: 0.5787 - loss: 0.6841
Epoch 9/10
249/486 ━━━━━━━━━━━━━━━━━━━━ 15:36 4s/step - accuracy: 0.6693 - loss: 0.6704
```

3.

```
1/1 ━━━━━━━━━━━━━━━━━━━━ 5s 5s/step - accuracy: 0.9375 - loss: 0.2788
Test Accuracy: 93.75%
1/1 ━━━━━━━━━━━━━━━━━━━━ 2s 2s/step
Predicted label: 1
```

Here we developed an image classification model using skin disease images. This model was trained over ten epochs, reaching 62.29% accuracy during training. However, on a test batch, it achieved 93.75% accuracy, demonstrating its ability to classify new data and show potential for real-world skin disease recognition.

CONCLUSION

Our project aims to create an AI-powered chatbot that integrates natural language processing (NLP) and image recognition to offer users quick and accurate diagnoses of dermatological conditions, along with personalized medication recommendations. By leveraging high-quality dermatological datasets and advanced machine learning techniques, the chatbot simplifies the treatment process, improving medication accessibility and reducing unnecessary doctor visits for minor conditions. Ultimately, this solution enhances patient engagement, streamlines the diagnosis and treatment process, and provides a user-friendly, efficient tool for managing skin health issues.

In our development phase, we created an image classification model using a comprehensive dataset of skin disease images. The model was trained over ten epochs, achieving an accuracy of 62.29% during training. When evaluated on a test batch, it demonstrated a significant improvement, reaching an impressive accuracy of 93.75%. This high level of accuracy indicates the model's strong potential for effectively classifying new data and highlights its capability for real-world skin disease recognition. With these promising results, we can further develop the AI-powered chatbot I which provide reliable diagnostic feedback and personalized treatment recommendations, paving the way for more accessible and efficient dermatological care.

REFERENCES

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