

AgroHealth

Intelligent Plant Disease Diagnosis with Chatbot Assistance

Abstract

AgroHealth is an artificial intelligence-based disease diagnostic and advisory platform intended for farmers and gardeners to diagnose plant disease and obtain actionable management advice. Based on the integration of a PlantVillage-trained Convolutional Neural Network model and a Large Language Model-based chatbot implemented with the Groq API, AgroHealth provides both image-based and conversational management of plant disease support. The system is deployed using Streamlit, giving a clear and interactive web-based interface. System architecture, model architecture, implementation strategy, and the importance of the system in precision agriculture are discussed in this report.

Introduction

Timely and accurate detection of plant disease is critical for agricultural crop yields and food security. Manually based traditional methods are unreliable and time-consuming. Computer vision and artificial intelligence technology now make automatic plant disease detection a realizable possibility. AgroHealth will fill this technological gap with a holistic approach towards disease detection as well as treatment consulting.

Problem Statement

Farmers frequently face issues in identifying plant diseases in a timely manner, and as a result, poor crop management and financial losses are incurred. Low-cost, simple-to-use devices that both diagnose and offer expert guidance are not present. AgroHealth fills this gap with a simple-to-use web interface with image-based plant disease diagnosis functionality and offering expert guidance through an AI-based chatbot.

Proposed Solution

1. A CNN model that has learned from images of plant leaves for accurate disease prediction.
 2. A Groq LLM-driven chatbot to process user input and offer treatment recommendations for diagnosed conditions.
 3. Users can upload an image of a diseased plant leaf, receive a prediction, and ask follow-up questions for guidance—all within the same interface.
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4. System Architecture

- **Frontend:**
 - Streamlit (Python)
 - **Backend:**
 - TensorFlow (for CNN)
 - OpenAI-compatible Groq API
 - **Model:**
 - Pretrained PyTorch model converted to TensorFlow .h5
 - **API:**
 - Groq's LLaMA 3 API for chatbot responses
 - **Tools:**
 - OpenCV
 - NumPy
 - Pillow
 - Requests
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5. Dataset and Model Design

5.1 Dataset

- Utilizing the PlantVillage dataset of 50,000+ labeled images.
- Contains 38 crop disease classes across a number of crops.

5.2 CNN Architecture

- Taken from a PyTorch Kaggle notebook and ported with TensorFlow.
 - Layers: Convolution → ReLU → MaxPooling → Dropout → Fully Connected → Softmax.
 - Image dimension: 224x224.
 - Achieved >90% validation accuracy
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6. Large Language Model (Chatbot)

6.1 Technology

- Uses Groq's API with Meta's LLaMA 3 (8B) model.
- Pre-configured system prompt: "You are an expert botanist and plant care advisor."

6.2 Features

- Understands user queries.
 - Provides natural treatment solutions.
 - Suggests chemical and organic remedies.
 - Provides prevention strategies.
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7. Use Case Flow

1. User uploads a leaf image.
 2. Model predicts the disease.
 3. Bot suggests possible follow-up queries (e.g., treatment, symptoms, prevention).
 4. User asks questions in chat.
 5. Bot responds in real time using Groq LLM.
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Results and Evaluation

- **Model Accuracy:** >90% on test set.
 - **Response Time:** ~2s per inference.
 - **Chatbot Quality:** Accurate and context-aware responses.
 - **User Experience:** Smooth and intuitive via Streamlit.
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Advantages and Limitations

Advantages

- Real-time, accessible plant diagnosis.
- Integrated expert advice via chatbot.
- Open-source and scalable.

Limitations

- Accuracy may drop with poor-quality images.
- LLM responses depend on Groq API uptime and latency.
- Currently limited to diseases covered in the dataset.

Conclusion

AgroHealth is the best example of the power of AI to create magic in farming using computer vision and natural language processing for end-to-end health care of crops. It provides actionable recommendations and customized advice that ultimately optimize the health of crops and reduce loss. Incorporating additional dataset augmentation by multilingual inputs will make AgroHealth the ideal online personal assistant to farmers worldwide.

Future Work

- A mobile app version for farmers in remote areas.
 - Adding voice support and regional languages for better accessibility.
 - Expanding detection to include pest attacks, nutrient deficiencies, and soil-related problems.
 - Real-time weather-based disease prediction integration.
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References

1. <https://www.kaggle.com/datasets/emmarex/plantdisease>
 2. <https://www.groq.com/>
 3. Streamlit documentation: <https://docs.streamlit.io/>
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