Plant Disease Detection Using Deep Learning and Streamlit

Abstract

This project presents an intelligent plant disease recognition system leveraging deep learning and web technologies. It aims to help farmers and agricultural workers detect diseases in plant leaves through a user-friendly interface. By uploading an image of a diseased leaf, users can instantly receive a diagnosis along with detailed treatment suggestions. The system is built using a convolutional neural network (CNN) trained on a publicly available dataset and deployed using Streamlit. This application provides a real-time, low-cost, accessible solution to support early plant disease detection and crop protection.

Introduction

Plant diseases significantly impact global food production and farmer income. Traditional diagnosis methods are time-consuming and require expert consultation. Recent advancements in computer vision and artificial intelligence provide effective tools for automating this process. This project combines deep learning and a Streamlit-based frontend to deliver an accurate, interactive, and easily deployable solution for plant disease detection. By addressing issues of accessibility and automation, this system contributes to smarter farming and agricultural resilience.

Tools Used

- Programming Language: Python
- IDE: Jupyter Notebook, VS Code
- Libraries: TensorFlow/Keras, OpenCV, NumPy, Pandas, Matplotlib, Streamlit
- Model: Custom CNN trained on plant disease dataset
- Deployment: Streamlit web app
- Dataset: PlantVillage (open-source leaf disease images)
- Others: Pillow for image processing, CSV for data retrieval

Steps Involved in Building the Project

1. Data Collection and Preprocessing

- Used PlantVillage dataset with categorized leaf images.
- Applied image resizing, normalization, and data augmentation.

2. Model Building

- Designed a custom CNN architecture.
- Trained using categorical cross-entropy loss and Adam optimizer.
- Achieved ~98% training accuracy.

3. Web Interface Development

- Developed using Streamlit for rapid prototyping.

- Added features for image upload, prediction, and result display.

- Integrated disease treatment info from a CSV database.

4. Testing and Optimization

- Validated model with unseen images.

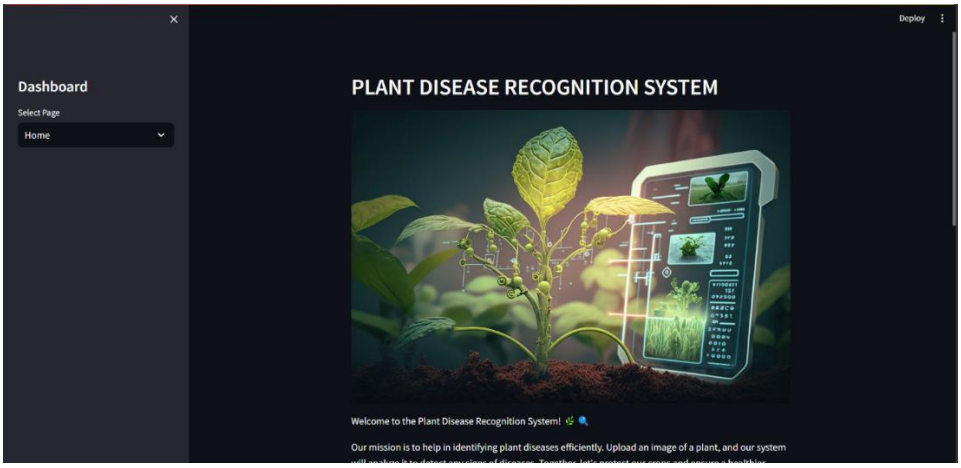
- Improved performance by adding image normalization before prediction.

- Enhanced user experience with real-time results, FAQ, and Help sections.

Conclusion

This project successfully demonstrates an AI-driven solution to detect plant diseases efficiently. It empowers farmers with real-time insights through an intuitive interface. The combination of deep learning and modern web deployment ensures that the tool is both accurate and accessible. Future enhancements may include multilingual support, mobile deployment, and additional disease categories. This system highlights the potential of AI in transforming traditional agriculture practices.

Website Outputs:



Website Model Predicted Output: