Leaf Detection

Mr. Pushkar R. Bagane[1], Mr. Nikhil S. Chavan[2],
Mr. Harshvardhan V. Patil[3],
Mr. Nikhil K. Patil[4], Mrs. P. S. Bodake [5]

Computer Engineering Department, Sharad Institute of Technology Polytechnic, Yadrav, India

Abstract:

Agriculture is the backbone of Indian government. Every human being has a requirement of a lot of production of crops to fulfill the needs of Indian government. Because of some diseases that we observe in this day-to-day life, a large amount of crop production is being decreased. There are various types of diseases on plant leaves and as well as for the crop, that causes problems in development of crops. Human eyes don't have the capacity to identify so strongly with our naked eye. It is too difficult to identify the plant diseases on leaves. The automatic disease detection system is used to automatically detect and identify the diseased part of the leaf images and it classifies plant leaf disease using image processing techniques. By gathering some of the leaves and training those leaves. We use this training data to train our data and then output will be predicted with optimum accuracy. For this we use the Django framework. We upload the image into the website we have developed. Now the patterns of the uploaded image are compared with patterns available in the dataset, which is almost accurate, resulting in identification of the plant disease. At the starting stage, the disease can be easily identified. Proposed model helps to reduce efforts or hard work of farmers for monitoring big farms and related diseases to farms and crops.

Keywords:

VGG16, VGG19, Django, Image Processing, Data Augmentation, Tensorflow, Keras.

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Introduction:

In India, Farmers have a great diversity of crops. Various pathogens are present in the environment which severely affect the crops and the soil in which the plant is planted, thereby affecting the production of crops. Various diseases are observed on the plants and crops the main identification of the affected plant or crop are its leaves. The various colored spots and patterns on the leaf are very useful in detecting the disease. The past situation for plant leaf disease detection taken direct eye observation, recall the particular set of disease as per the climate, season etc. India is a cultivated country and about 80% of the population depends upon agriculture. Plant leaf disease leads to the reduction in both the quality and quantity of agricultural products. The diseased plant leaf refers to the studies of visually observable patterns on the plants. Health of plant leaf and disease on plant leaf plays an important role in successful cultivation of crops in the farm. In early days, analysis of plant leaf diseases were done manually by the proficiency person in that field only. This requires a huge amount of work and also requires excessive processing time. Diseases on the plant leaf have turned into a significant problem as it can cause serious reduction and losses in both quality and quantity of agricultural products. A vast majority of the growing national population depends on agriculture yields. But the cultivation of these crops for optimum yield and quality product is highly technical & challenging.

Methodology:

The methodology for leaf disease detection using Django involves several key steps:

1. **Data Collection and Preprocessing**: Collect images of plant leaves with different diseases, preprocess them by resizing, normalizing, and augmenting the dataset.
2. **Model Development**: Use machine learning, specifically Convolutional Neural Networks (CNN), to train a model that classifies leaf diseases based on the pre-processed images.
3. **Django Application Setup**: Build a Django web application where users can upload leaf images. Django handles backend logic, image storage, and user interactions.
4. **Model Integration**: Integrate the trained machine learning model into the Django application. When a user uploads an image, it is processed and passed through the model to predict the disease.
5. **Prediction and Result Display**: Display the predicted disease along with suggested preventive measures on the frontend. Results are stored in a database for future reference.
6. **Deployment**: Deploy the Django application to a cloud platform like Heroku or AWS, making the system accessible to users for real-time disease detection.
7. **User Interaction**: Provide users with an intuitive interface to upload images, view predictions, and track their plant's health history.

This methodology combines machine learning with Django web development to create an effective system for detecting and managing plant diseases.

System Analysis:

The **Leaf Disease Detection System** using Django allows users to upload leaf images, which are processed by a machine learning model (CNN) to predict diseases. It includes user registration, history tracking, and disease prediction results with treatment suggestions. Built with Django for backend functionality, the system stores data in a database. It needs to be scalable, secure, and fast, and may require future enhancements like mobile support and IoT integration.

Software Requirements:

The software requirements for the Leaf Disease Detection System using Django include the following:

1. Operating System:

- Windows

2. Programming Languages:

- Python: For backend development (Django) and machine learning model integration.
- HTML/CSS/JavaScript: For frontend development.

3. Frameworks and Libraries:

- Django: For backend web development and database management.
- OpenCV: For image processing and preprocessing.
- NumPy: For numerical operations (used during data preprocessing and model evaluation).
- Pandas: For handling and processing data .

4. **Database**:

- SQLite: For storing user data, uploaded images, and prediction results.

5. Model Development Tools:

- Jupyter Notebook: For prototyping and training the machine learning model.

These are the core software requirements to develop, deploy, and maintain the Leaf Disease Detection System using Django.

Block Diagram of the Proposed Model:

1. The model is trained with vgg16 architecture with 16 layers.
2. First the image is uploaded.
3. The website is created using django. So the uploaded image is sent to the server using the post method.
4. The sent image is then given input to the pretrained model.
5. After the prediction, it gives back to the user as a result.

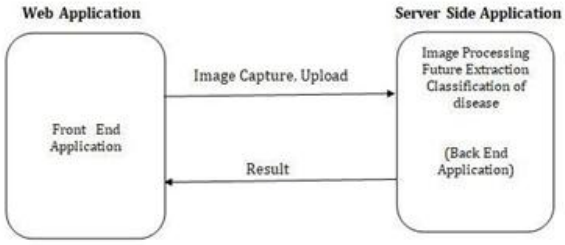
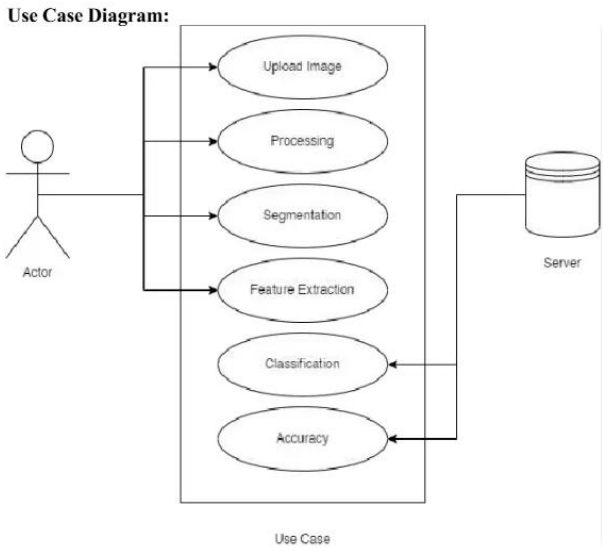


Fig: Structure of Proposed System

Use Case diagram of the proposed system:



System Testing:

System Testing of Leaf Disease Detection using Django includes:

1. **Functional Testing**: Ensure users can register, upload leaf images, receive disease predictions, and view historical data.
2. **Integration Testing**: Verify seamless interaction between the frontend, backend, machine learning model, and database.
3. **Usability Testing**: Ensure the system is user-friendly and easy to navigate.
4. **Performance Testing**: Test the system's response time and ability to handle multiple users.

Objectives:

The **objectives of the Leaf Disease Detection System using Django** are:

1. **Automated Disease Detection**: To develop an automated system that accurately detects and classifies plant leaf diseases from uploaded images using machine learning models.
2. **User-Friendly Interface**: To provide an easy-to-use web interface where users can upload leaf images and receive disease predictions with suggested treatments.
3. **Fast and Accurate Predictions**: To ensure that the machine learning model processes leaf images quickly and provides reliable disease predictions.
4. **History Tracking**: To allow users to track their past image uploads and disease predictions, helping them monitor plant health over time.
5. **Scalability**: To design a system that can handle an increasing number of users and image uploads without performance degradation.
6. **Educational Resource**: To offer users valuable information about common plant diseases, helping them take preventive measures and manage crop health effectively.
7. **Real-time Access**: To provide real-time disease detection, enabling users to take immediate action to protect their plants.

Working:

The working of the Leaf Disease Detection system using Django can be broken down into the following key steps:

1. **User Interaction (Frontend):**
   The user accesses the web application built with Django. They can register, log in, and upload an image of a plant leaf through an easy-to-use interface built with HTML, CSS, and JavaScript.
2. **Image Upload:**

After login, the user uploads a leaf image through the web interface. The image is sent to the Django backend for processing.

3. **Image Preprocessing:**
   The backend processes the uploaded image using libraries like OpenCV or Pillow to resize, normalize, and prepare the image for prediction.
4. **Displaying Results:**
   Once the disease is identified, the system displays the results to the user, including the name of the disease and suggested treatment options.
5. **Data Storage:**
   The uploaded image, prediction result, and user information are stored in a database (such as SQLite) to keep track of users' activities, image history, and predictions.
6. **User History:**
   Users can view their past uploaded images and predictions in their account history, helping them track plant health over time.
7. **Scalability and Deployment:**
   The Django application can be deployed on cloud platforms like Heroku, AWS, or

Interface of Application:

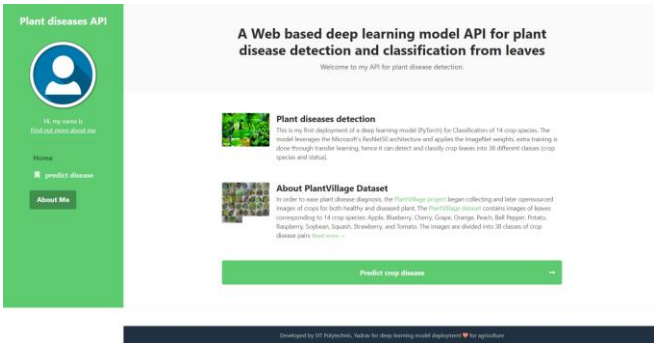


Fig. Main Interface

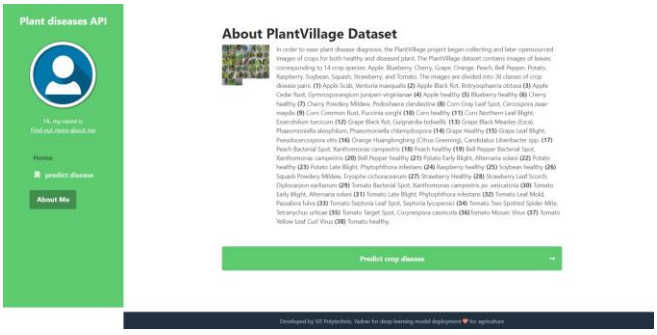


Fig. Dataset Information Interface

Fig. Prediction Interface

Fig. Prediction Interface

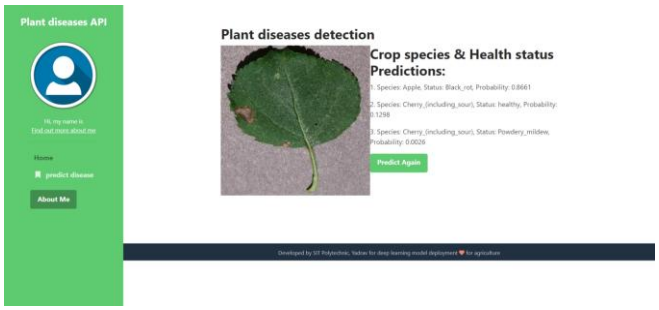


Fig. Predicted Interface

Future Scope:

The developed model was able to detect leaves between healthy leaves and different diseases, which can be visually diagnosed. The model is able to detect only a few diseases. In future we will extend to this model to detect more number of diseases. As this is a small a website containing a server with trained model and frontend for the users. In future we will extend this with APIs and in further we can use drones which will captures the leaves and send those images to the server where it predicts where they are healthy or not and will maintain a record of statistical data (percentage of healthy leaves and defected leaves at a particular location). This application will serve as an aid to farmers (regardless of the level of experience), enabling fast and efficient recognition of plant diseases and facilitating the decision-making process when it comes to the use of chemical pesticides.

Conclusion:

There are many methods in automated or computer vision plant disease detection and classification processes, but still, this research field is lacking. In addition, there are still no commercial solutions on the market, except those dealing with plant species recognition based on the leaves images. Here a new approach of using deep learning methods was explored in order to automatically classify and detect plant diseases from leaf images.

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