Botanic Image Analyzer

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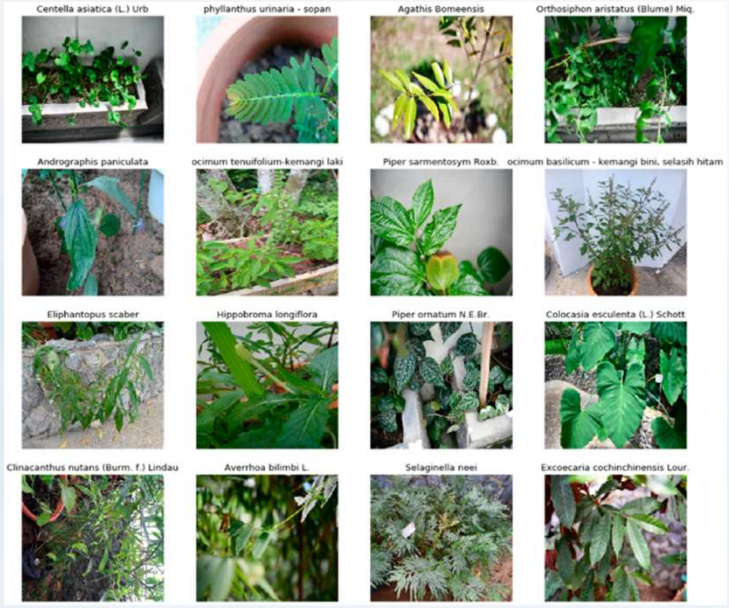
Problem Statement

“To Make a Web Application that helps to identify plant leaf and detect disease in the leaf based on the leaf image uploaded by the user as an input to the app.”



Objectives

1

Develop a user-friendly web application

Create an intuitive interface that allows users users to easily upload, analyze, and manage manage botanical images.

2

Implement robust image recognition recognition capabilities

Employ advanced computer vision techniques to techniques to accurately identify and classify various plant species from uploaded images.

3

Provide detailed plant information

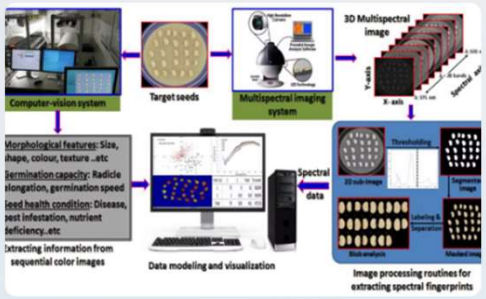
Integrate a comprehensive database to offer offer
users detailed descriptions, care instructions, instructions, and other relevant information information about the identified plant species.

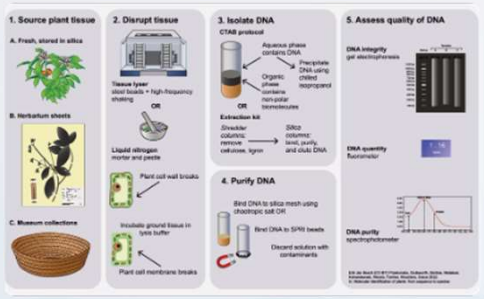
4

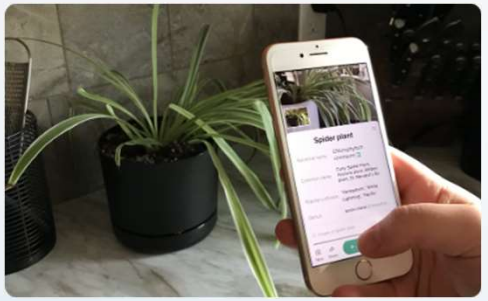
Enhance the user experience

Incorporate features like search, filtering, and and personalization to help users quickly find find the information they need.

Existing System







Current Capabilities

The existing botanical image analysis analysis system provides basic functionality for identifying common common plant species based on on visual characteristics. However, it However, it has limitations in accurately recognizing species.

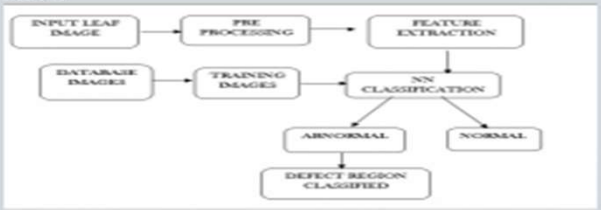
Manual Processes

Currently, botanists and horticulturists must manually inspect plant samples and cross-reference field guides to identify unfamiliar species, which is time-consuming and error-prone.

Limited Accuracy

Existing automated plant identification identification software often struggles struggles with complex or nuanced nuanced visual features, leading to misclassifications that undermine its its practical usefulness for professional professional botanists.

Literature Survey

Sr. No	Paper Title	Journal Name	Authors & Publication Date	Methodology
1	Plant Leaf Disease Classification and Detection System Using Machine Learning	ICCPET 2020	G. Geetha, S.Samundeswari, G.Saranya ,K.Meenakshi and M. Nithya 17/12/2020	Look at the raw data available to us and study it in-order to identify suitable attributes for the prediction of our selected label.  KNN algorithm we first start with the loading of the data and then initializing K to the selected number of neighbours, then for each example in the data we find the distance between the query example and the given current example from the given data. Then the data collected is sorted orderly from smallest to largest according to the distances, later we pick the first k entries from the sorted collection and take the labels of the selected k entries
2	A Dataset of Field Plant Images for Plant Disease Detection and Classification With Deep Learning	IEEE ACCESS	Emmanual Moupojou Appolinair Tagne 29/03/2023	To identify diseases on raw field images we used Convolutional neural network. As expected, when the training and test sets are the same, the noise backgrounds and the multiplicity of leaves on the raw images reduce the models validation accuracies. These accuracies are further reduced when the models are trained on PlantVillage and tested on PlantDoc or FieldPlant. CNNs are made up of layers of neurons, each of which learns to detect different features of an image. For example, the first layer of a CNN might learn to detect edges, the second layer might learn to detect patterns of edges, and the third layer might learn to detect specific objects, such as plant. The results show that the existing models are not sufficiently accurate for plant disease detection and classification of images collected directly from the field, although the classification task results for FieldPlant are better than those for PlantDoc

Literature Survey

3	Detection of Apple Plant Diseases Using Leaf Images Through Convolutional NeuralNetwork	IEEE ACCESS	Arfat Ahmad Khan 28/12/2023	Authors proposed a general framework that CNN for heavy training to make high-Disease prone apple plant. The convolutional layer is responsible to perform convolution a filter (kernel) on an input image. The convolutional layer produces feature maps by finding the local conjunction that appears in the previous layers. CNNs work by applying a series of filters to an image. Each filter is a small matrix of weights that is applied to a small region of the image. The output of the filter is a new pixel value, which is calculated by multiplying the filter weights with the pixel values in the input region. The filters are applied to the image in a sliding window fashion, meaning that the filter is applied to each region of the image, one by one. The output of the filters is then fed into the next layer of neurons, which learns to detect more complex features.
4	A Deep Learning-Based Recognition Technique for Plant Leaf Classification	IEEE ACCESS	Kewen Xia 30/11/2021	A deep Convolutional Neural Network (CNN) can extract higher-level features progressively from the input images given to it by the multiple layers used in a model. The utilization of a conditional Generative Adversarial Network to tackle the problem of a lack of sufficient training data or uneven class balance that could be found within datasets in performing Deep Learning tasks. This serves to augment leaf image datasets, which have not been large enough, as this field still lacks a large number of datasets for adequate training of Deep Neural Net-works for better generalization  

Disadvantages of Existing System

Limited Functionality

The existing image analysis systems have limited capabilities, capabilities, often restricted to to basic object recognition or color analysis. They lack advanced advanced features for in-depth depth botanical analysis.

Time-Consuming

The existing tools require manual manual input and analysis, making the process time-consuming and labor-intensive. intensive. This hinders the ability ability to quickly analyze large large volumes of botanical images.

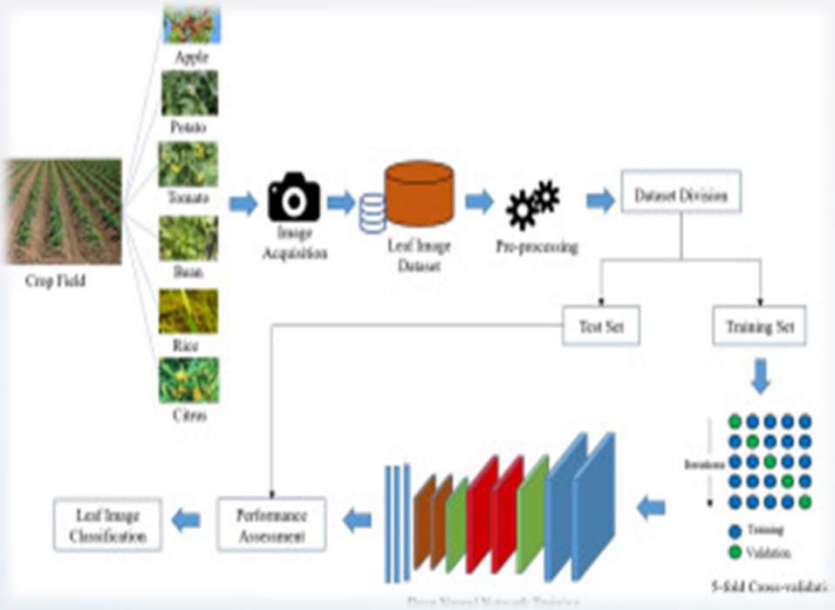
Accuracy Issues

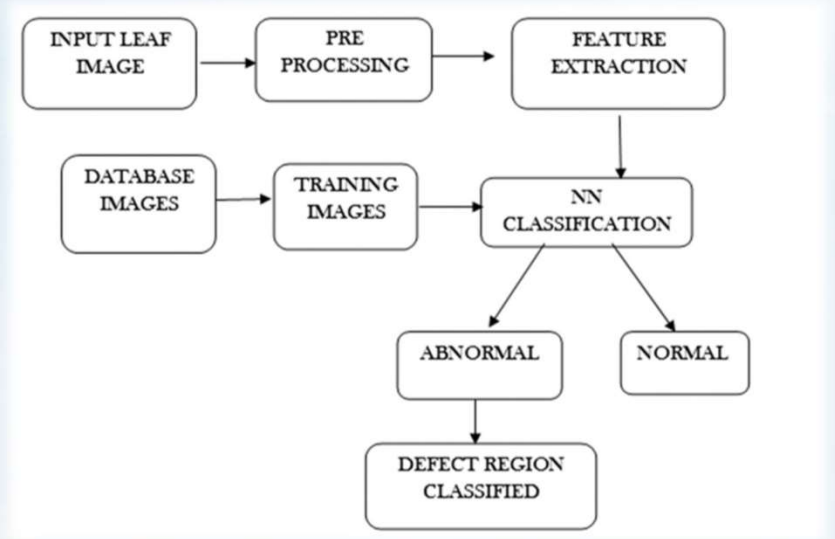
The accuracy of existing systems systems is often inconsistent, particularly when dealing with with complex or niche botanical botanical specimens. This can lead to unreliable results, undermining the usefulness of the of the analysis.

Proposed System

The proposed system is a web-based application that utilizes CNN image recognition recognition algorithms to analyze and classify botanical images. This innovative innovative solution aims to revolutionize the way users interact with and understand understand the natural world around them.

By leveraging cutting-edge machine learning techniques, the application will be able will be able to accurately identify various plant species, provide detailed information information about their characteristics, and offer insights into their ecological ecological significance. This empowers users to explore the rich diversity of the of the botanical realm with greater ease and understanding.





Advantages of Proposed System

Improved Accuracy

The proposed Botanic Image Analyzer leverages advanced machine learning algorithms to provide highly accurate plant identification, surpassing the capabilities of traditional manual methods.

Enhanced Accessibility

By offering a user-friendly web application, the system makes botanic identification accessible to a wider audience, including hobbyists, students, and professionals alike.

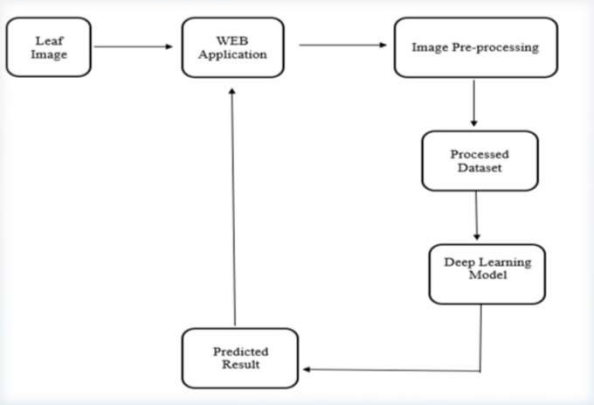
Scalability and Efficiency

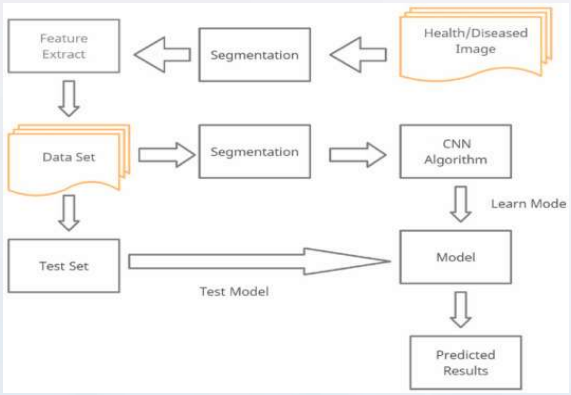
The system's scalable architecture allows it to handle a large volume of image submissions, ensuring rapid and efficient processing even as the user base grows.

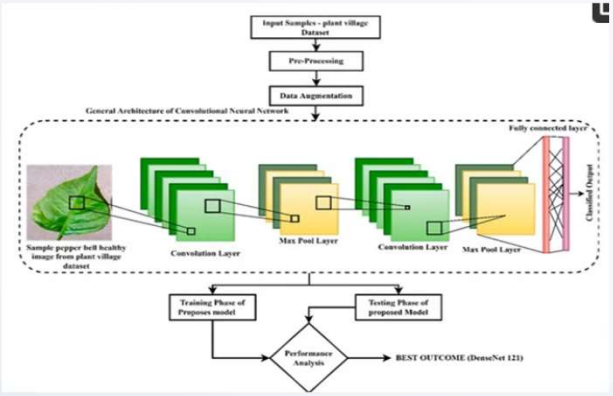
Educational Benefits

The application enables enables students, professors to learn about about different plant species an diseases. It also also helps in agriculture agriculture fields.

System Architecture/Design







System Architecture

The botanic image analyzer system utilizes a a modular, scalable architecture that integrates integrates computer vision, machine learning, learning, and a user-friendly web interface. The The core components include an image processing module, a plant classification model, model, and a dynamic visualization dashboard. dashboard.

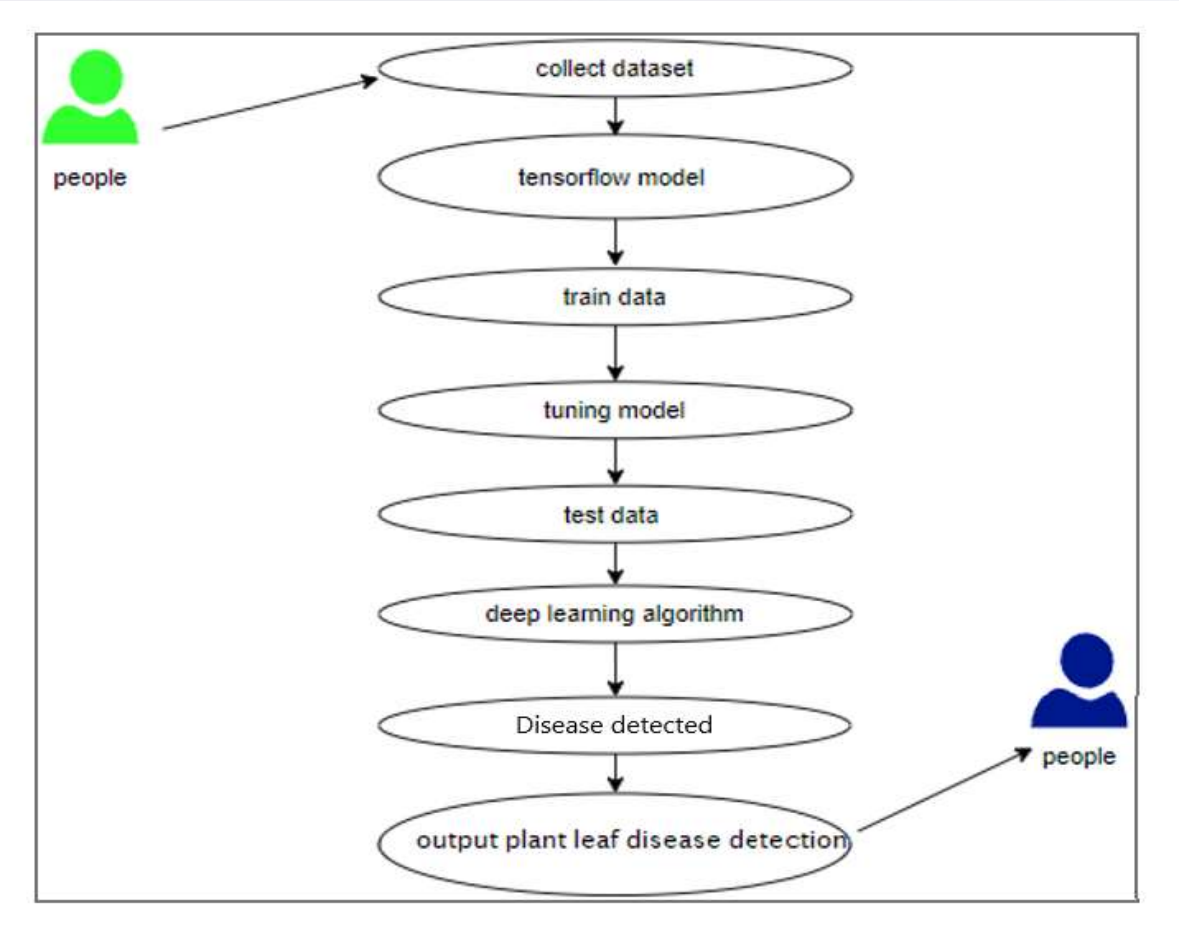
Data Flow

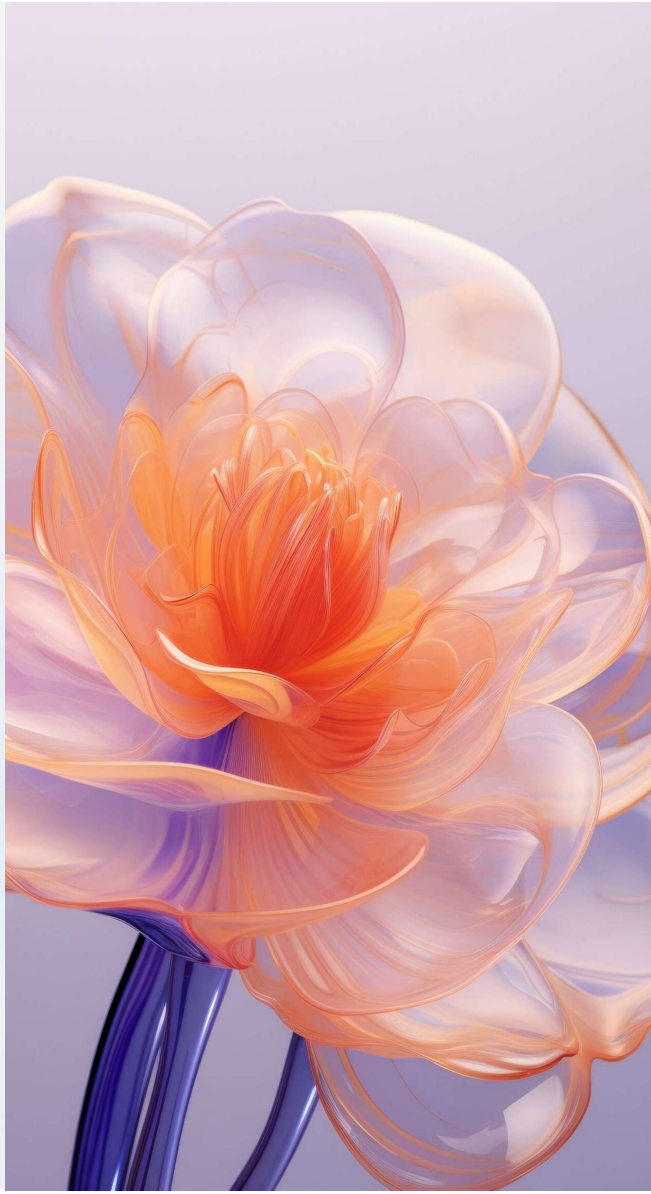
Users upload plant images through the the web application, which are then analyzed by the computer vision algorithms. The classified plant species species information is displayed on an an interactive dashboard, providing insights and recommendations to the the user.

Algorithm Design

The plant classification model is built built upon a deep learning neural network, trained on a comprehensive comprehensive dataset of botanical botanical specimens. The algorithm algorithm follows a multi-stage process process to accurately identify the plant plant species and provide detailed information to the user.

UML Diagram


people
collect dataset
tensorflow model
train data
tuning model
test data
deep learning algorithm
Disease detected
output plant leaf disease detection
people

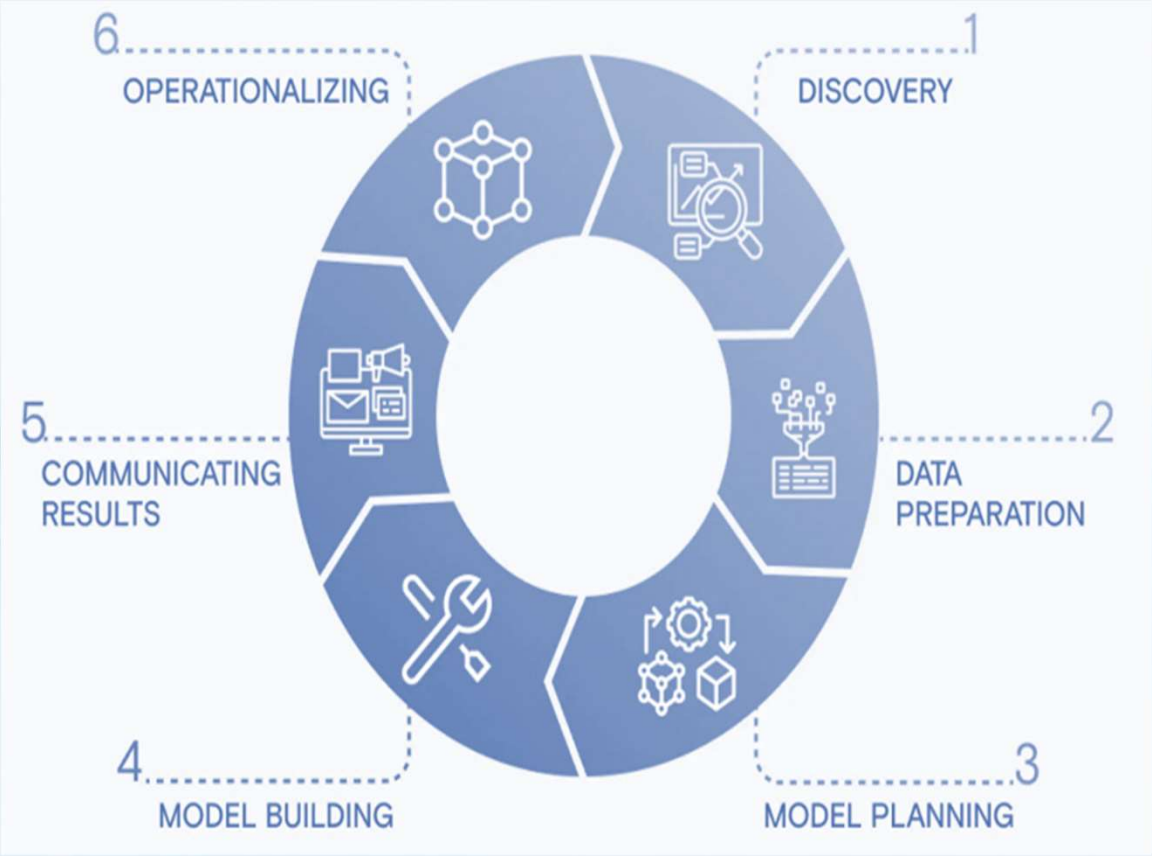


Software and Hardware Requirements

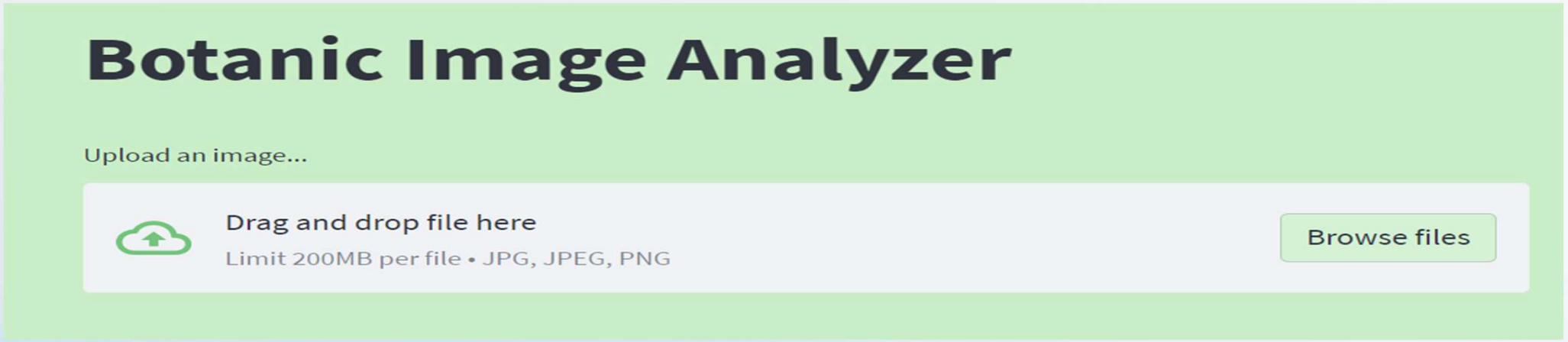
- Programming language - Python
- Python libraries – Tensorflow, Keras, Numpy, Pandas, Matplotlib etc.
- Web development framework – Streamlit (for DS,ML)
- Image Processing – OpenCV
- Deep Neural Network Algorithm - CNN
- Development platforms - Jupyter Notebook/Google Colab Workbook

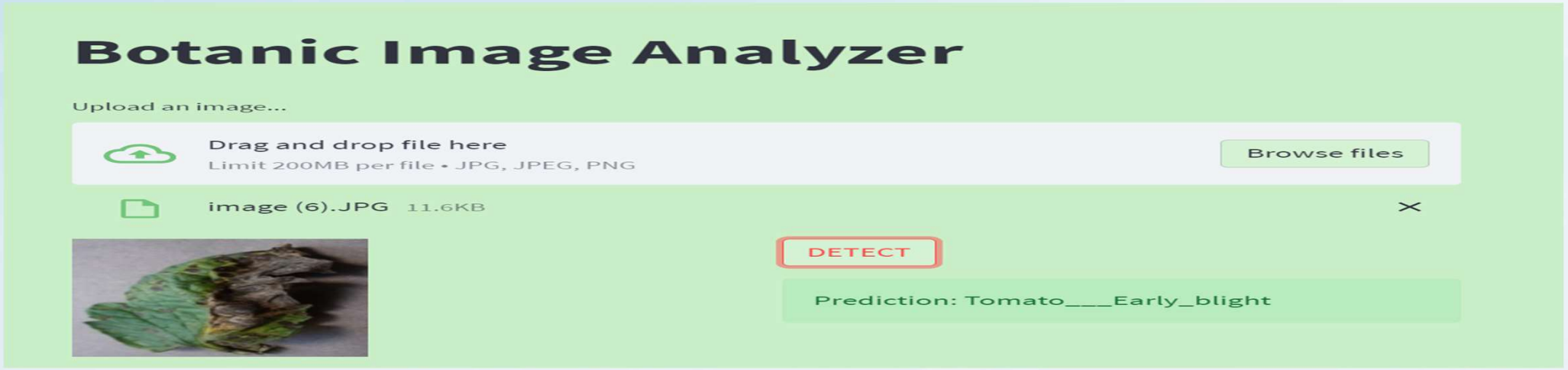
Implementation Diagram

Implementation Process/Details



RESULTS


Botanic Image Analyzer
Upload an image...
Drag and drop file here
Limit 200MB per file • JPG, JPEG, PNG
Browse files


Botanic Image Analyzer
Upload an image...
Drag and drop file here
Limit 200MB per file • JPG, JPEG, PNG
Browse files
image (6).JPG 11.6KB
DETECT
Prediction: Tomato___Early_blight

Conclusion

The botanic image analyzer web application has successfully achieved its its objectives, providing a robust and user-friendly tool for identifying and and classifying various plant species. The proposed system has demonstrated demonstrated significant advantages over existing solutions, offering improved improved accuracy, scalability, and ease of use.

FUTURE SCOPE

This web application has tremendous potential to revolutionize plant identification and analysis. With advancements in computer vision and deep learning, the system can be further enhanced to recognize a wider range of plant species, provide more detailed information, and integrate with other platforms for a seamless user experience.

- Crop Health Monitoring
- Habitat Monitoring
- Medicinal Plant Identification
- Genetic Research
- Carbon Sequestration
- Big Data Analytics

Key Features and Enhancements

Expanded Plant Database

Continuously expand the plant species database to cover a more comprehensive range of flora, including rare and endangered species.

Improved Image Recognition

Enhance the image recognition algorithms to provide more accurate and detailed plant identification, including the ability to distinguish between similar species.

Personalized Recommendations

Implement machine learning models to offer personalized plant care recommendations based on user's location, climate, and gardening preferences.

THANK YOU!