**AI – Based Leaf Disease Detection**

*A project report submitted in partial fulfillment of the requirements for*

*the award of the degree of*

**Bachelor of Technology**

*By*

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**Certificate**

This is to certify that this is the bonafide record of the application development entitled, “AI-BASED LEAF DISEASE DETECTION” submitted by **Manikant Kumar(2311CS020388), M. Dinesh(2311CS020391), M. Nithin (2311CS020396), M. Sanjana Reddy**

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## Abstract

In precision agriculture, detecting leaf diseases early is essential for improving crop yields and reducing losses. This project introduces an AI-based system designed to detect anthracnose disease in mango leaves using image analysis.

The system uses Convolutional Neural Networks (CNNs) to analyse high-resolution images of mango leaves. CNNs are very good at finding patterns and anomalies in images, which helps in identifying disease symptoms accurately. After the CNN identifies these features, Artificial Neural Networks (ANNs) take over to classify the type of disease, providing a reliable diagnosis.

This approach not only helps in early disease detection but also supports sustainable farming practices. By detecting diseases early, farmers can take timely actions to prevent the spread of the disease, reducing the need for widespread pesticide use and promoting healthier crops.

Additionally, the system provides real-time analysis and feedback, giving farmers actionable insights. This leads to better decision-making, efficient resource use, cost savings, and higher crop yields.

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## Chapter - 1 INTRODUCTION

Anthracnose disease, caused by a fungus, is a major problem for mango growers. It creates dark, sunken spots on mango leaves, which can reduce fruit quality and yield. Detecting this disease early is crucial to manage it effectively and protect the crop.

With advances in technology, we can now use artificial intelligence (AI) to help. An AI-based system can analyze images of mango leaves to spot signs of anthracnose. It can distinguish between the specific symptoms of this disease and other leaf issues.

This AI tool makes it easier and faster to identify anthracnose, allowing farmers to act quickly and reduce the disease’s impact on their crops. By using this technology, mango farming can become more efficient and productive, helping to keep mangoes healthy and high-yielding.

**1.1 Problem Definition**

Develop an AI-based system for the accurate and efficient detection of anthracnose disease in mango leaves using image analysis. The system should be capable of identifying symptoms of anthracnose, such as dark, sunken lesions, and differentiating them from other potential leaf abnormalities. Anthracnose is a significant threat to mango cultivation, leading to reduced fruit quality and yield. Early and accurate detection of anthracnose on mango leaves is crucial for effective disease management and minimizing the impact on crop health.

The proposed system will utilize Convolutional Neural Networks (CNNs) to analyse high-resolution images of mango leaves. CNNs are highly effective in extracting features from images, allowing them to recognize the specific patterns and anomalies associated with anthracnose. By training the CNN on a large dataset of annotated images, the system will learn to identify the characteristic dark, sunken lesions that signify the presence of the disease.

**1.2 Objective of project**

To develop an AI-based system for the accurate and efficient detection of anthracnose disease in mango leaves using image analysis. The system will leverage Convolutional Neural Networks (CNNs) to identify symptoms of anthracnose, such as dark, sunken lesions, and differentiate them from other potential leaf abnormalities. This early and precise detection is crucial for effective disease management, aiming to minimize the impact on crop health and improve mango yield and quality

The system will be trained on a large dataset of annotated images to ensure high accuracy in identifying the characteristic symptoms of anthracnose. By utilizing advanced image processing techniques, the system will be able to analyse high-resolution images and extract relevant features that indicate the presence of the disease. The ultimate goal is to provide farmers with a reliable tool for early disease detection, enabling timely and targeted interventions to prevent the spread of anthracnose and reduce the need for extensive pesticide use. This will promote sustainable farming practices and enhance overall crop productivity.

**1.3 Scope and Limitation**

**Scope:**

The scope of this project includes collecting and annotating images of mango leaves, developing a CNN model to detect anthracnose symptoms, and using ANNs to classify these symptoms. The system will be integrated into a user-friendly interface for real-time analysis. It will be validated and tested for accuracy, then deployed for farmers with training and support. The goal is to enable early disease detection, promote sustainable farming, and improve crop yield and quality. Additionally, the system will provide actionable insights to farmers, helping them make informed decisions. This will lead to more efficient resource use and cost savings, ultimately enhancing overall agricultural productivity.

**Limitation:**

1. **Data Quality**: The system’s accuracy depends on the quality and variety of the images used for training.
2. **Environmental Factors**: Changes in lighting and weather can affect image analysis accuracy.
3. **User Training**: Farmers may need training to use the system effectively.
4. **Cost**: Initial setup and maintenance might be expensive for small-scale farmers.

## Chapter -2 LITERATURE SURVEY

**“Classification of mango leaves infected by fungal disease anthracnose using deep learning. (2020-2021)”**

Pankaj Kumar’s 2020-2021 research focused on classifying mango leaves infected by the fungal disease anthracnose using deep learning techniques. His study likely employed convolutional neural networks (CNNs) or other deep learning architectures, which are well-suited for image classification tasks. The results of his research were probably compared to traditional methods for mango disease detection to highlight the advantages of deep learning. Additionally, the study emphasized that the quality and quantity of the training dataset significantly impact the performance of a deep learning model.

**“Transfer learning based convolutional neural network model for classification of mango leaves infected by anthracnose. (2020)”**

Y Nagaraju, TS Sahana, and S Swetha’s 2020 research focused on using a transfer learning-based convolutional neural network (CNN) model to classify mango leaves infected by anthracnose. The study detailed the specific CNN model and transfer learning approach used, along with the dataset and evaluation metrics. Results included the model’s accuracy, precision, recall, and F1-score. The research also discussed limitations such as dataset size and quality, and the model’s generalizability to different environments or mango varieties.

**“Manisha Bhangea - Web based tool for identifying disease from the image”**

Manisha Bhangea designed modern techniques which is web based tool for identifying disease from the image. In this techniques, first uploaded image in the web portal is resized and extracted image feature such as color, morphology etc. Author uses K-means for clustering and for classification SVM was used. In this paper farmers need to upload the plant leaf for disease detection in real time. Proposed framework that maintains two image databases for disease detection. One for training and other for testing. Author used erosion morphology techniques for description and representation of region shape. Author categorizes three stages for infection such as infected first stage, second stage, and Third stage. The paper presented for bacterial blight disease in pomegranate fruit. Further research is improving system performance to detect disease in large dataset.

**“Sardjan Sladojevic – Convolution network approach for leaf disease recognition.”**

Srdjan Sladojevic used deep convolution network approach for leaf disease recognition using classification method. Researcher proves that climate change can alter stage and pathogen development rate. Trained deep neural network to differentiate surrounding of leaves. To highlight region of interest all images are cropped manually by making square around the leaves. Author applied augmented process to increase dataset. Augmentation includes rotations, transformation and affine transformation. This paper presented caffe as a deep CNN framework.

**“Joshi** - **Proposed a solution for rice disease control”**

Joshi proposed a solution for rice disease control he classified with the help of image processing and machine learning-based classifiers. The researchers used self-acquired rice leaf images of four rice diseases: bacterial-blight, blast, brown spot, and sheath-rot. Different features like the shape and the color of the infected region of the leaf were extracted and fed into the two different classifiers: Minimum Distance Classifier (MDC) and K-Nearest Neighbor classifier (KNN) for the disease classification.

## Chapter -3 PROPOSED METHODOLOGY

**3.1 Existing System**

Existing AI-based systems for detecting anthracnose disease in mango leaves use image analysis and machine learning. These systems analyze photos of leaves to spot disease symptoms. Machine learning methods preprocess images and use classifiers like SVM or

KNN to identify the disease. Mobile apps also help by letting farmers take pictures of leaves and get instant feedback. However, these systems need large datasets, high computational power, and can be affected by different lighting and field conditions.

**3.2 Proposed System**

**Image Capture and Enhancement**

* Photo Capture: Farmers take a photo of mango leaves.
* Quality Enhancement: The images are processed through steps like resizing and normalization to enhance their quality.

**Disease Detection**

* Deep Learning Models: Advanced models, particularly Convolutional Neural Networks (CNNs), analyze the images.
* Disease Identification: The system detects signs of anthracnose disease and classifies the leaves as either healthy or diseased with high accuracy.

**User Interface**

* Instant Results: The results are displayed instantly on a user-friendly mobile app or web interface.
* Quick Information: Farmers receive quick and actionable information about the health of their crops.

**Real-Time Feedback**

* Immediate Action: Real-time feedback allows farmers to take immediate action if their crops are affected.
* Disease Management: The system offers recommendations for managing the disease, including treatment options and preventive measures.

**3.3 Modules**

1. **Data Collection and Preprocessing**

* **Image Acquisition**: Collect a large dataset of mango leaf images, including both

healthy and anthracnose-infected leaves. Ensure diversity in lighting, angles, and leaf conditions.

* **Data Augmentation**: Apply techniques like rotation, flipping, and scaling to increase the variability and size of your dataset.
* **Preprocessing**: Normalize the images, resize them to a consistent size, and apply techniques like histogram equalization to enhance image quality.

1. **Model Training**

* **Convolutional Neural Network (CNN)**: Train a CNN model to automatically learn

and extract features from the images.

* **Artificial Neural Network (ANN)**: Train an ANN to classify images of mango leaves.

ANNs can be particularly useful for simpler classification tasks and can serve as a good baseline model.

1. **Disease Detection and Classification**

* **Classification Model**: Implement a classification model to categorize the images into

healthy or anthracnose-infected. Use Convolutional Neural Networks (CNNs) for this purpose.

1. **User Interface**

* **Mobile/Web Application**: Develop a user-friendly interface for farmers to upload

images and receive instant disease diagnosis.

* **Real-time Detection**: Ensure the system can process images in real-time for immediate

feedback.

**3.4 Architecture**

**3.5 Method and Algorithm**

1. **Data Collection:**
   * Collect a diverse dataset of mango leaf images, including both healthy and infected leaves.
   * Annotate the images to indicate the presence or absence of anthracnose.
2. **Preprocessing:**
   * Enhance image quality using techniques like noise reduction and contrast adjustment.
   * Segment the leaf from the background using methods like thresholding or edge detection.
3. **Feature Extraction:**
   * Use a pre-trained CNN (e.g., ResNet, VGG16) to extract high-level features from the images.
   * Fine-tune the CNN on your dataset to improve feature extraction specific to anthracnose detection.
4. **Model Training:**
   * Train the CNN for direct image classification.
   * Use the features extracted by the CNN as input to an ANN, and train the ANN for classification.
5. **User Interface Development:**
   * Design: Create a user-friendly interface where users can upload images of mango leaves for analysis. This could be a mobile app or a web-based platform.
   * Integration: Integrate the trained models into the interface to process the uploaded images and provide real-time or near real-time diagnosis.
   * Feedback: Include features for users to provide feedback on the diagnosis, which can be used to further improve the model.

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