AI DRIVEN CROP DISEASE PREDICTION

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ABSTRACT

Agricultural productivity is significantly impacted by various crop diseases, leading to decreased yields and economic losses. Early and accurate detection of these diseases is crucial for timely intervention and management. This project aims to develop an AI-driven crop disease prediction and classification system using advanced deep learning techniques. By leveraging convolutional neural networks (CNNs) and integrating digital soil sensors, the system analyses images of plant leaves to identify specific diseases. The system also incorporates soil nutrient data to recommend optimal crops for specific soil conditions. Through image processing and predictive modelling, this project seeks to provide a scalable solution for farmers to diagnose diseases in real-time, improve crop management, and enhance agricultural sustainability. The proposed solution also explores the use of open-source tools such as TensorFlow and PyTorch, offering flexibility and affordability for widespread adoption.

Keyword: - *AI&ML, CNN, Crop Disease prediction etc.*

1.Introduction

1.1 Introduction

Agriculture is a fundamental sector of the global economy, providing food and raw materials for industries. With the rise of technology, there is an increasing interest in utilizing artificial intelligence (AI) to address various challenges faced by the agricultural industry. AI-driven solutions are now being developed to enhance crop yield, optimize farming practices, and ensure sustainability. One of the key aspects is crop disease prediction, crop recommendation for soil, and fertilizer recommendations. These areas can significantly improve productivity and reduce losses, ensuring food security.

1.2 Problem Identified

Farmers are often faced with challenges such as crop diseases, suboptimal soil conditions, and improper fertilization practices. These issues result in reduced crop yields and increased costs. Manual methods of diagnosing crop diseases or recommending fertilizers are often inaccurate and time-consuming. Moreover, farmers may not have access to timely and reliable data to make informed decisions. AI can address these issues by providing real-time recommendations for crop selection, soil management, and disease prediction.

1.3 Problem Statements

- How can AI be used to predict crop diseases accurately based on environmental conditions and crop characteristics?
- How can AI recommend suitable crops for a given soil type to maximize yield and sustainability?
- How can AI-driven fertilizer recommendations optimize soil health and reduce environmental impact?

1.4 Motivation and Need

The motivation behind this project is to leverage AI to automate and optimize the agricultural process. The need arises from the growing demand for food and the limited resources available for agriculture. AI can help farmers reduce the risks associated with crop diseases, make more efficient use of resources, and improve crop productivity.

1.5 Project Idea

The AI-driven crop disease prediction system will work by analyzing various factors such as soil health, weather conditions, and crop type. The system will predict the likelihood of disease outbreaks and recommend preventive measures. Additionally, it will provide crop recommendations based on soil type and recommend fertilizers to improve soil health.

1.6 Features of AI-Driven Crop Disease Prediction

- Real-time disease detection
- Crop and fertilizer recommendations based on soil conditions
- Prediction of disease outbreaks based on environmental data
- Data visualization for farmers to understand the health of their crops

2. Problem Definition

2.1 Proposed Problem Definition

The proposed system aims to address the issue of crop diseases and improper fertilizer recommendations using an AI-driven approach. The system will predict crop diseases based on soil and environmental data, recommend the most suitable crops for a specific soil type, and suggest optimal fertilizers for improving soil health.

2.2 Modules

- **Crop Disease Prediction Module**: Uses AI models to predict potential diseases based on environmental and crop data.

- **Soil and Crop Recommendation Module**: Recommends crops suited for specific soil types based on historical data and soil properties.
- **Fertilizer Recommendation Module**: Provides recommendations for fertilizers based on soil analysis.

2.3 Existing System

Existing systems often rely on manual methods or basic software that lacks real-time AI integration. They may be ineffective in providing accurate disease predictions or fertilizer recommendations tailored to the unique needs of each farm.

2.4 Area of Project

The system focuses on enhancing crop health, improving soil fertility, and optimizing fertilizer usage to increase productivity and sustainability.

2.5 Project Scope

This system will be designed to support small to medium-sized farms. It will provide real-time insights into crop disease risks, recommend crops based on soil properties, and suggest fertilizers tailored to the needs of the soil.

2.6 Details of Algorithm

The system will utilize machine learning algorithms, such as decision trees, support vector machines, and deep learning models like convolutional neural networks (CNNs) for disease prediction. The crop and fertilizer recommendation modules will use regression models and decision trees.

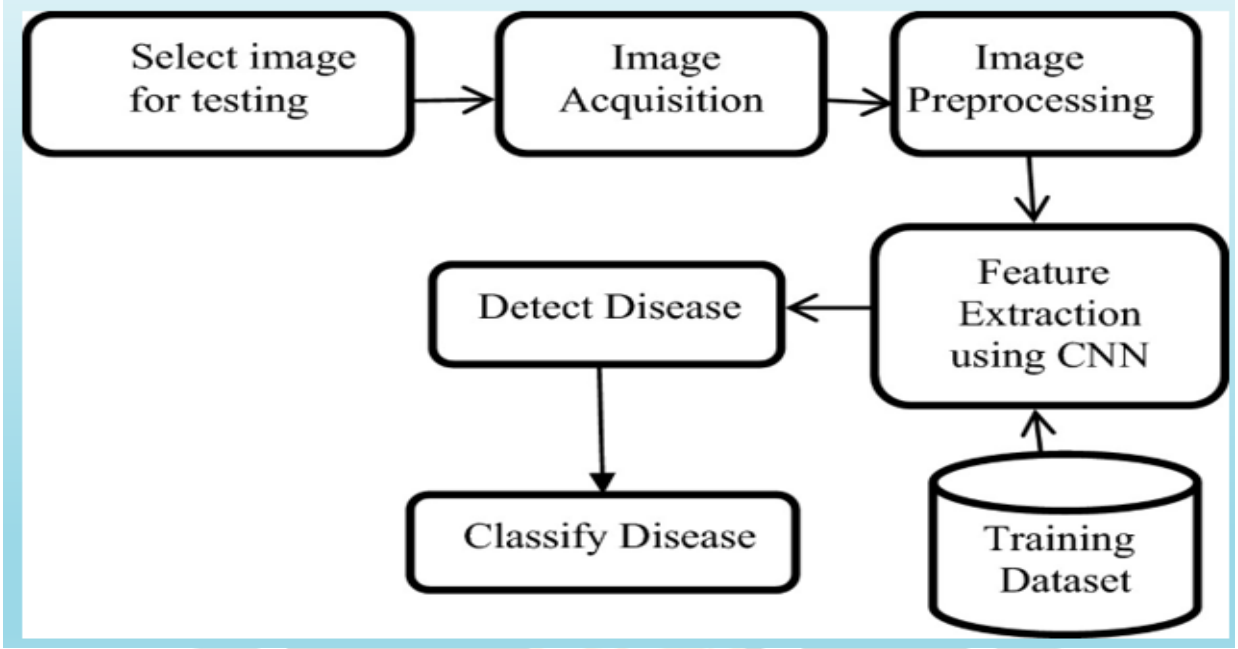
2.7 Goal

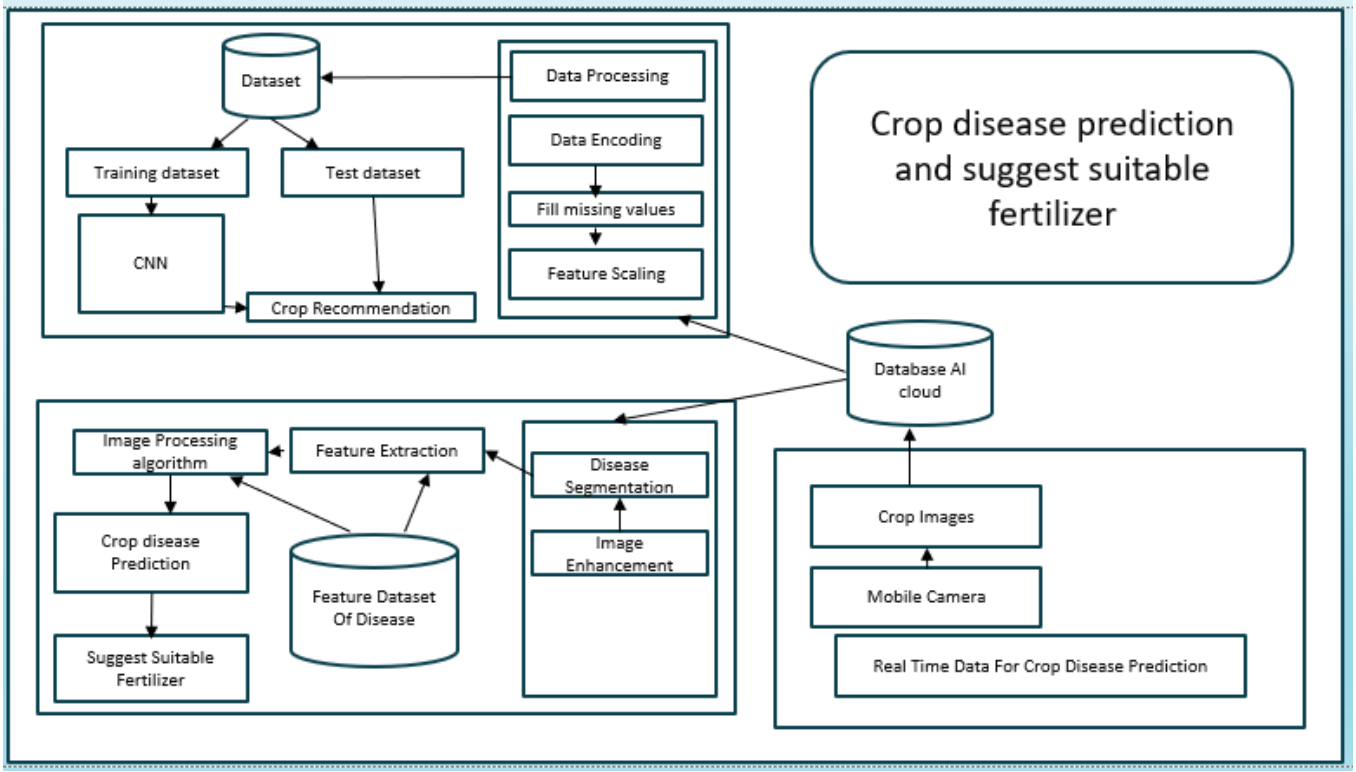
The goal is to build a comprehensive system that supports farmers in decision-making by providing accurate disease predictions and personalized recommendations.

2.8 Objective

- To develop an AI-based system for crop disease prediction.
- To provide accurate crop recommendations based on soil data.
- To optimize fertilizer usage based on soil health.

3. Block Diagram and Architecture


Select image for testing
Image Acquisition
Image Preprocessing
Feature Extraction using CNN
Detect Disease
Classify Disease
Training Dataset


Dataset
Data Processing
Data Encoding
Fill missing values
Feature Scaling
Training dataset
Test dataset
CNN
Crop Recommendation
Crop disease prediction and suggest suitable fertilizer
Database AI cloud
Image Processing algorithm
Feature Extraction
Disease Segmentation
Image Enhancement
Crop disease Prediction
Feature Dataset Of Disease
Suggest Suitable Fertilizer
Crop Images
Mobile Camera
Real Time Data For Crop Disease Prediction

4. HARDWARE AND SOFTWARE REQUIREMENTS

4.1 External Interface Requirements
4.1.1 User Interface

The user interface will be web-based, allowing farmers to access the system from any device. It will display disease predictions, crop recommendations, and fertilizer suggestions in a user-friendly format.

4.1.2 Hardware Interfaces

The system will require a server to host the AI models and process data, along with sensors for collecting soil and environmental data.

4.1.3 Software Requirements

- Python (for AI model development)
- TensorFlow/Keras (for deep learning)
- Django (for web application development)
- MySQL (for database management)

4.1.4 Software Requirement Specification

The software will need to handle large datasets, run machine learning models efficiently, and support real-time processing.

4.2 Non-Functional Requirements
4.2.1 Performance Requirements

The system should be able to process inputs and provide predictions within a reasonable time frame.

4.2.2 Safety Requirements

The system should be secure from cyber-attacks and protect user data.

4.2.3 Software Quality Attributes

The software should be reliable, efficient, and scalable to accommodate future needs.

4. CONCLUSIONS

This project aims to improve agricultural practices through AI by offering accurate disease predictions and personalized crop and fertilizer recommendations. By doing so, it can significantly enhance crop yield, reduce losses, and promote sustainable farming practices

6. REFERENCES

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