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DEPARTMENT OF
COMPUTER SCIENCE & ENGINEERING

7th Semester Project Work (21CSP76)

Synopsis on

"Deep Learning-Based Mobile and Web App for Multi-Plant Disease Detection and Treatment"

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Deep Learning-Based Mobile and Web App for Multi-Plant Disease Detection and Treatment

1. Introduction to Problem Statement

Agriculture is a critical industry where plant diseases can severely impact crop yield and quality. Early and accurate detection of diseases in plant leaves is essential to minimize damage and ensure healthy crops. This project aims to develop a comprehensive solution for plant disease detection using deep learning techniques. The system will classify diseases in various plant leaves and provide additional information on the disease and its treatments. A mobile and web-based application will be developed, allowing users to upload images for disease prediction, view treatment details, and even purchase recommended products.

Introduction to AI, ML, and Deep Learning:

Artificial Intelligence (AI) is the broad concept of machines being able to carry out tasks that would normally require human intelligence. AI covers a wide range of activities, from rule-based systems to more advanced techniques like machine learning.

Machine Learning (ML) is a subset of AI that allows systems to learn from data and improve their performance over time without being explicitly programmed. ML algorithms analyze patterns in data to make predictions or decisions.

Deep Learning (DL) is a further subset of ML that uses neural networks with many layers (hence "deep") to model complex patterns in data. It is particularly effective for tasks such as image and speech recognition due to its ability to automatically extract features from raw data.

Why Use Deep Learning for Plant Disease Detection?

Deep learning, especially **Convolutional Neural Networks (CNNs)**, is ideal for plant disease detection because of its ability to process and learn from image data. CNNs can identify intricate patterns in leaf images to classify diseases with high accuracy. Unlike traditional methods, DL can automatically extract features, making it more powerful for visual data tasks like plant disease classification

Deep learning evolved after AI and ML because of advancements in computational power and the availability of large datasets, allowing for deeper neural networks that outperform traditional ML algorithms in complex tasks.

2. Objectives of the Project

- Develop a system that can detect multiple types of diseases in different plants using images or data.
- Ensure the system correctly identifies the specific disease affecting a plant.
- appropriate treatment methods or solutions for each detected disease.
- Enable real-time tracking and detection of diseases in plants.
- Help farmers or gardeners reduce plant damage and increase crop yield through early detection and effective treatment.

3. Literature Survey

1. **Sue Han Leea et al., "New perspectives on plant disease characterization based on deep learning"**
   This study explores deep learning, particularly CNNs, for early plant disease detection. It highlights the effectiveness of fine-tuning pre-trained models and introduces a method that categorizes diseases independently of crops, addressing limitations of traditional crop-disease models.

2. **Srdjan Sladojevic et al., "Deep Neural Networks Based Recognition of Plant Diseases by Leaf Image Classification"**
   This paper presents a CNN-based model capable of identifying 13 plant diseases with 96.3% accuracy using the Caffe framework, covering the process from dataset creation to model training.

3. **G. Senthilvelan et al., "Leaf Disease Detection using Machine Learning"**
   This research applies CNNs to distinguish healthy and diseased leaves, focusing on tomato plant diseases. It emphasizes using machine learning and image processing to aid agricultural productivity and disease management.

4. **Sharada P. Mohanty et al., "Using Deep Learning for Image-Based Plant Disease Detection"**
   The study uses a dataset of over 54,000 images to train a CNN, achieving 99.35% accuracy in identifying 26 diseases across 14 crop species, demonstrating the potential of smartphone-assisted disease diagnosis.

5. **Yenn LeCun, Yoshua Bengio, "Convolutional Networks for Images, Speech, and Time-Series"**
   This foundational work on CNNs discusses their superior performance in visual data processing tasks, explaining how CNNs excel in extracting hierarchical features for image classification, outperforming traditional ML methods.

4. Methodology/Architecture

- **Data Collection & Preprocessing:** Image datasets of plant leaves, including healthy and diseased leaves, will be collected, cleaned, and augmented to improve model performance.

- **Algorithms for Plant Disease Classification:**
  - **CNNs with Transfer Learning**: A pre-trained Convolutional Neural Network (CNN) like **ResNet**, **VGG16**, or **EfficientNet** will be fine-tuned on the dataset for high-accuracy disease classification. Transfer learning allows leveraging existing knowledge from models trained on large image datasets, speeding up training and improving performance.
  - **Alternative Algorithms**: Traditional machine learning methods such as **Support Vector Machines (SVM)** or **Random Forests** can serve as baselines or alternatives to deep learning models, especially for smaller datasets or specific plant species.
  - **Model Evaluation**: Metrics such as accuracy, precision, recall, and F1-score will be used to evaluate the models, and hyperparameters will be fine-tuned to ensure optimal performance.

- **API Development with FastAPI:**
  - The FastAPI framework will be used to build a high-performance, asynchronous API to serve disease predictions.
  - The API will handle image uploads, process the data, run the predictions using the deep learning model, and return results to the frontend (web and mobile).

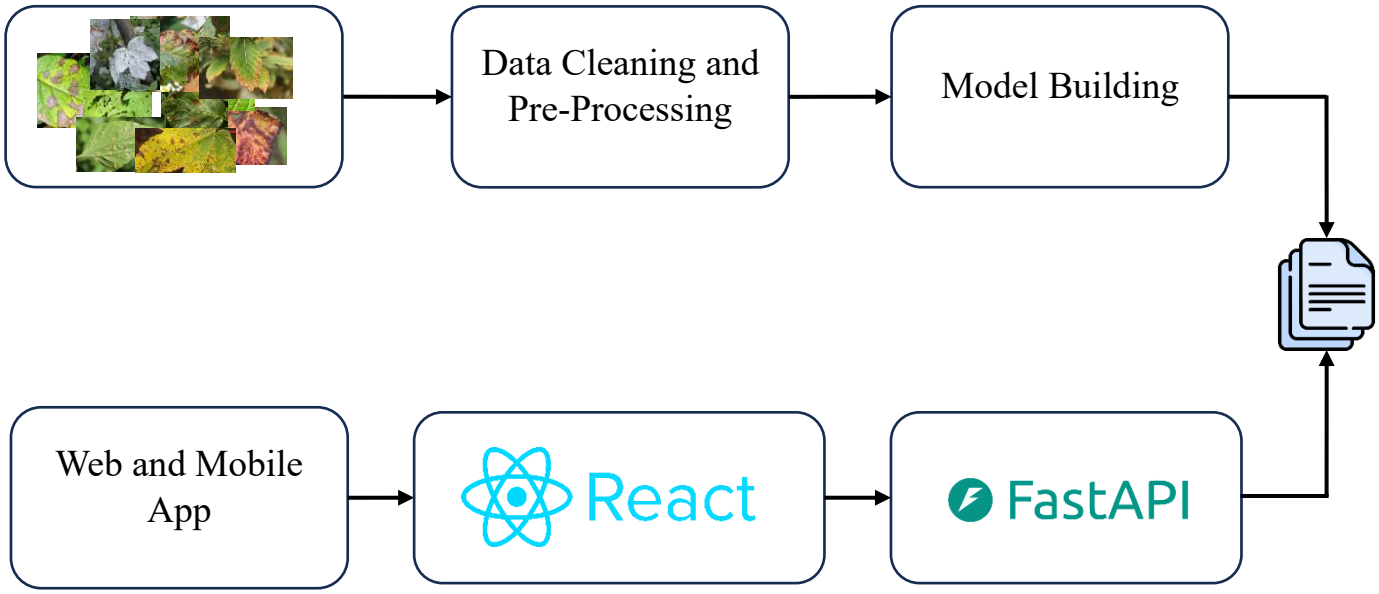
- **Mobile App Development:**
  - React Native or Flutter will be used to create a cross-platform mobile app.
  - The app will allow users to upload leaf images, view disease information, treatment suggestions, and related product recommendations.

- **Web App Development:**
  - ReactJS will be used to develop a responsive web application where users can interact with the system similarly to the mobile app.

- **Database:**
  - A relational database like PostgreSQL will be used to store disease information, user interactions, and treatment data.

- **Deployment:**
  - The backend will be deployed on cloud platforms like AWS or GCP, and the mobile app will be deployed on the Google Play Store.

Architecture:



5. Software/Hardware Requirements

- **Software:**
  - FastAPI for backend development and API creation.
  - TensorFlow/Keras for deep learning model development.
  - ReactJS for the web interface.
  - React Native/Flutter for mobile app development.
  - PostgreSQL or MySQL for database management.
  - AWS/GCP for cloud deployment and hosting.
  - Postman for API testing.
- **Hardware:**
  - At least 8 GB of RAM is recommended, but for more complex models and datasets, 32 GB or more will be beneficial.
  - High-performance server or cloud GPU for model training.
  - Android/iOS devices for mobile app testing and deployment.

6. Applications

- **Agriculture and Farming:** Disease prediction and management for crops.
- **Agri tech Solutions:** Real-time, AI-powered tools for farmers.
- **E-commerce:** Integrated solutions to recommend and purchase treatment products for detected diseases.
- **Educational Tool:** Can be used to educate farmers on various plant diseases and their treatments.

7. References

[1] **"Plant Disease Detection Using Deep Learning"** IEEE 2021 6th International Conference for Convergence in Technology (I2CT), Ebrahim Hirani, Varun Magotra, Jainam Jain, Pramod Bide Department of Computer Engineering, Sardar Patel Institute of Technology Mumbai-400058, India.

[2] Sue Han Lee, Herve Go ´ eau, Pierre Bonnet, Alexis Joly, New perspectives on **"plant disease characterization based on deep learning",** Computers and Electronics in Agriculture, Volume 170, 2020, 105220, ISSN 0168-1699

[3] Srdjan Sladojevic, Marko Arsenovic, Andras Anderla, Dubravko Culibrk, Darko Stefanovic, "**Deep Neural Networks Based Recognition of Plant Diseases by Leaf Image Classification"**, Computational Intelligence and Neuroscience,2016

[4] Trivedi J., Shamnani Y., Gajjar R. (2020) **"Plant Leaf Disease Detection Using Machine Learning".** In: Gupta S., Sarvaiya J. (eds) Emerging Technology Trends in Electronics, Communication and Networking. ET2ECN 2020. Communications in Computer and Information Science, vol 1214. Springer, Singapore

[5] Bengio, Y. Lecun, Yann. (1997). **"Convolutional Networks for Images, Speech, and Time-Series".**

[6] Mohanty Sharada P., Hughes David P., Salathe Marcel, **"Using Deep Learning for Image-Based Plant Disease Detection",** Frontiers in Plant Science, vol.7, 2016