SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY

(AUTONOMOUS)

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Puttur -517583,Tirupathi District, A.P. (India)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CSE (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE)

Academic Year 2025-26

Project First Review

Title of Project : **Multi-stage neural network based ensemble learning approach for Wheat leaf disease classification.**

Batch Details

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OBJECTIVE

- To accurately classify wheat leaf diseases using deep learning.
- To design a multi-stage CNN model for effective feature extraction.
- To apply ensemble learning to improve prediction accuracy.
- To handle real-world variations through preprocessing and augmentation.
- To build a robust system suitable for agricultural disease detection.

ABSTRACT

Wheat is a globally important food crop and is highly affected by foliar diseases such as leaf rust, yellow rust, septoria, and powdery mildew. Manual identification of these diseases is time-consuming, requires domain experts, and is unsuitable for large-scale farming.To address this, the project proposes a Multi-Stage Neural Network–based Ensemble Learning Approach for wheat leaf disease classification. The method combines multiple deep learning models at different stages to extract hierarchical and discriminative features from leaf images. Through ensemble learning, predictions from various CNN models are integrated to improve accuracy, robustness, and generalization. The dataset undergoes preprocessing and augmentation to handle variations such as illumination, background noise, and image angles.

Experiments show that the ensemble model significantly outperforms single CNN models, achieving higher precision and recall.This system can assist farmers and agricultural experts with early disease detection, supporting timely intervention, reducing crop loss, and improving wheat productivity.

Modules

- **Data Module**

  Images containing : Healthy WheatCrown & Root Rot, Leaf Rust,Loose Smut

  Preprocessing : Resize, normalize Noise removal Data augmentation (rotation, flip, brightness, zoom)

- **Model Module**

  Pretrained CNN models :

  1. VGG19
  2. InceptionV3
  3. ResNet152
  4. Xception

- **Prediction Module**
- **Visualization Module**
- **Web Interface**

Technological Approach

Data preprocessing:

- OpenCV,
- TensorFlow augmentation

Multi-stage CNN models:

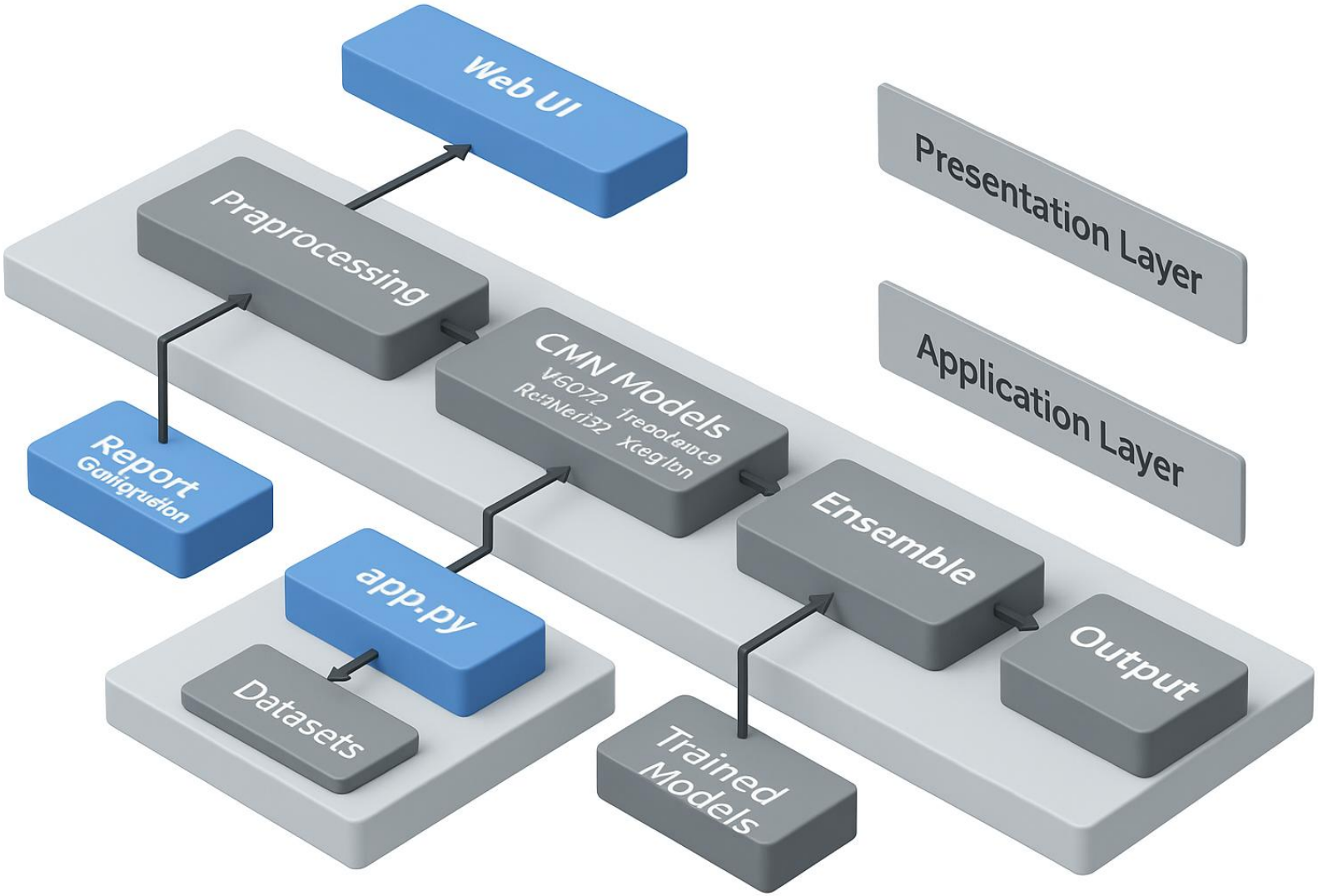
- VGG19,
- InceptionV3,
- ResNet152,
- Xception

Ensemble learning:

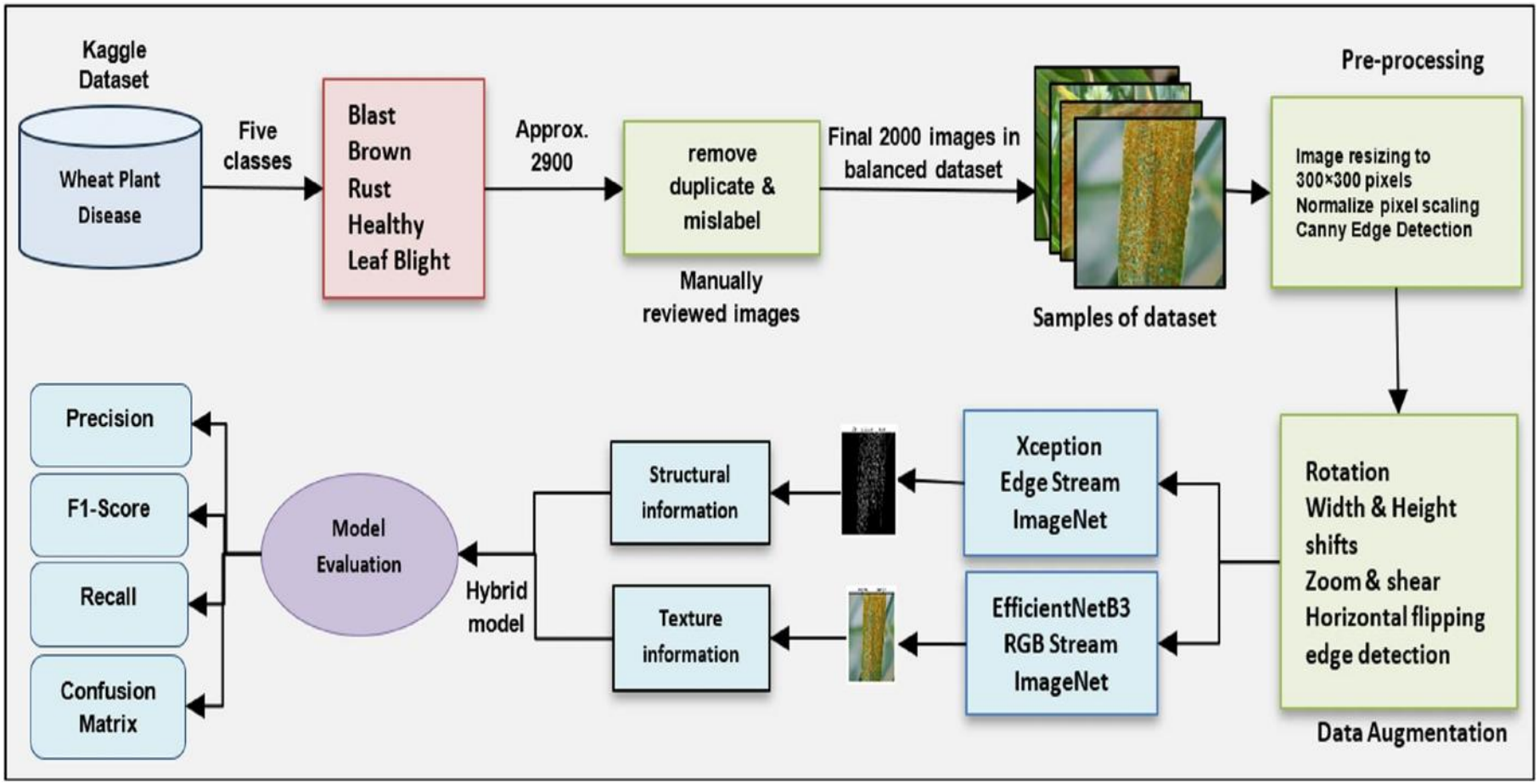
- Bagging, voting,
- weighted averaging

Backend & Frontend: Flask for prediction : HTML/CSS/JS for image upload.

Display PDF report: Report Lab Deployment: Local/Cloud (CPU/GPU support)


Web UI
Presentation Layer
Preprocessing
CNN Models
Application Layer
Report
Configuration
Ensemble
app.py
Output
Datasets
Trained
Models

System Architecture



Conclusion

- Project development is in progress with major components planned and partially implemented.
- Multi-stage CNN architecture and ensemble learning strategy has been designed to improve accuracy.
- Dataset preprocessing, augmentation flow, and model training pipeline have been structured.
- Web interface layout for image upload, prediction, and PDF reporting is prepared.
- Integration of deep learning models with the web application is ongoing.
- The system is expected to deliver real-time disease detection, improved generalization, and practical usability for farmers and agricultural experts.