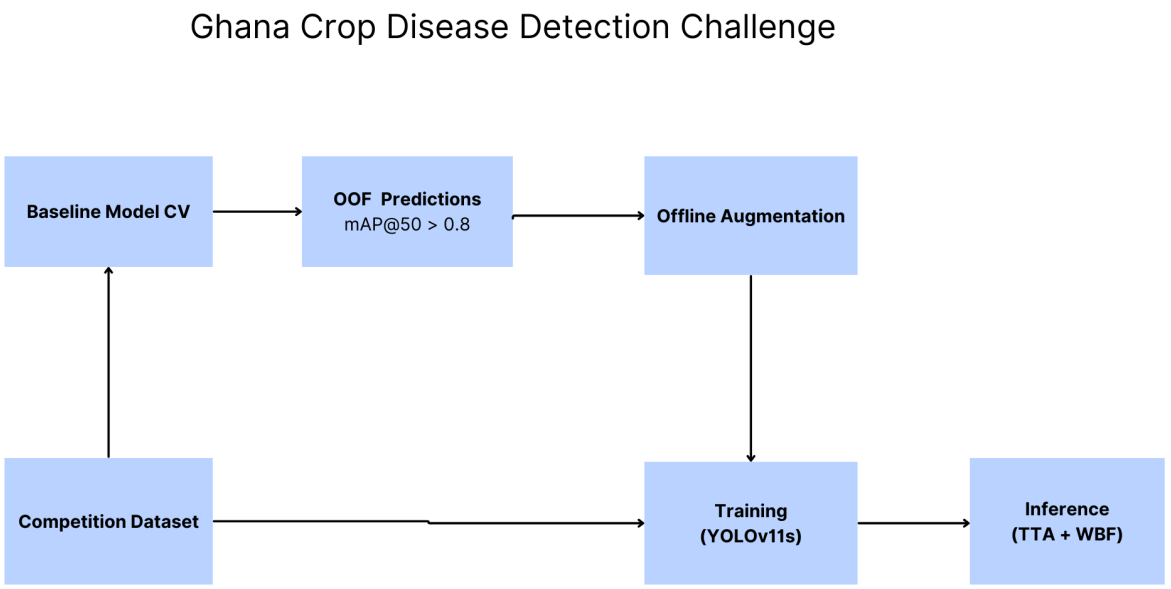
Ghana Crop Disease Detection Challenge - 5th Place solution

1. Overview

The goal of this challenge was to create an object detection and classification model capable of accurately identifying and localizing leaf diseases affecting corn, tomato, and pepper crops. A single *YOLO11s* model was trained, incorporating a weighted data loader to address class imbalance effectively. Offline augmentations were applied to a subset of high-confidence images to enhance dataset diversity while minimizing the risk of introducing excessive noise.

2. Architecture diagram



3. ETL process

A baseline model was initially trained on the complete dataset, and out-of-fold predictions were generated to evaluate individual image performance. High-confidence images with a mAP@.5 score > 0.8 were selected for offline augmentation. The augmented images and the original training set were then used to train the final model.

4. Data modeling

The following augmentations were applied to the training dataset during training:

- *RandomBrightnessContrast*
- *GaussianBlur*
- *RandomShadow*
- *GaussNoise*
- *ElasticTransform*
- *Perspective*
- *Affine*
- *RandomResizedCrop*

The *YOLO11s* model was selected due to its optimal balance of speed and localization accuracy. Experiments with larger YOLO variants did not yield significant performance improvements on local validation.

The model was trained for 50 epochs with the following parameters:

Training Parameters

- epochs: 50
- image size: 1024
- batch size: 20
- optimizer: AdamW
- learning rate (lr0): 3e-4
- momentum: 0.9
- weight decay: 1e-2
- close_mosaic: 30 (disable mosaic augmentation for the last 30 epochs)

5. Inference

Inference was performed using test-time augmentation across multiple image sizes. For each image and at each scale, up to 500 bounding boxes were generated. The predictions were then aggregated using Weighted Boxes Fusion (WBF).

6. Run time

- ETL: 1.5 hrs
- Training: 6 hrs
- Inference: 2 hrs

7. Performance metrics

- **Evaluation scores:**
  - **Public leaderboard mAP@0.5:** 0.520867359
  - **Private leaderboard mAP@0.5:** 0.478903225