Monitoring Crop Health using Computer Vision

1. Problem Overview

This project simulates a drone-based system for monitoring crop health using deep learning. It detects unhealthy or diseased regions in aerial images of crops and visually highlights them using segmentation masks.

2. Dataset Used

Dataset: New Plant Diseases Dataset (Kaggle)

URL: https://www.kaggle.com/datasets/vipoooool/new-plant-diseases-dataset

Used only two classes to simulate healthy vs. unhealthy classification:

- Apple___Black_rot (unhealthy)
- Apple___healthy

3. Preprocessing Steps

- Resized all images to 128x128
- Normalized pixel values (0-1)
- Created binary segmentation masks using HSV filtering
- Split into train/test (80/20)

4. Model Details

Model: U-Net

Framework: TensorFlow 2.x

Loss: Binary Crossentropy

Optimizer: Adam

Epochs: 20 * 5

Achieved ~99.6% accuracy with clear segmentation results.

5. Results and Interpretation

Inference overlays predicted unhealthy regions as heatmaps on original images.

Prediction was visually verified on sample test images.

Red heatmaps correspond to diseased/stressed areas.

Bounding box detection was tested but excluded from final visuals due to noise.

6. Files Submitted

- Training notebook (`notebooks/training.ipynb`)

- Inference notebook (`notebooks/inference.ipynb`)

- `src/utils.py` for preprocessing and prediction

- `models/crop_health_unet_model.h5`

- `README.md` with instructions

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