Project Report: Crop and Weed Detection

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Project Domain: Agriculture | Computer Vision

Tools Used: Python, Google Colab, YOLOv5, PyTorch

# Problem Statement

To develop an AI-powered object detection model using YOLOv5 to identify and classify crops and weeds in sesame fields, enabling targeted pesticide spraying and sustainable farming practices.

# Dataset Description

The dataset contains 1300 labeled images in YOLO format. Each image is 512x512 pixels in resolution and includes bounding box annotations for either 'crop' or 'weed' classes. Augmentation techniques were used to improve generalization.

# Approach

1. Preprocessed the images and labels.  
2. Converted dataset into YOLO-compatible structure with train/val split.  
3. Trained a YOLOv5s model on Google Colab for 50 epochs.  
4. Evaluated the model using mAP, Precision, and Recall.  
5. Visualized and saved predictions on test images.

# Results

Best Model Performance:

- Precision: 0.83  
- Recall: 0.78  
- mAP@50: 0.86

# Conclusion

The trained YOLOv5 model performs effectively in detecting weeds vs crops, achieving strong precision and recall. This system can be integrated into drone-based or robotic pesticide sprayers to automate selective treatment, reducing chemical usage and crop damage.