Semi-Supervised Weed Detection using YOLOv8

Leveraging Pseudo-Labeling for Improved Performance

INTRODUCTION

•- Weed detection in agriculture is critical for yield optimization.
•- Fully labeled datasets are expensive and time-consuming to create.
•- We use a semi-supervised approach combining labeled and unlabeled data.
•- Our method involves pseudo-labeling for better model performance.

Hey! There's no need to worry. Let's break it down step by step

DATASET AND PREPROCESSING

Let's begin by examining the dataset given and how we process it

- **Initial labeled dataset: 200 images**
- **Later augmented to 600**
- **Unlabeled dataset: 1000 images.**
- **Data augmentation using Albumentations.**
- **Flips, rotations, brightness contrast adjustments.**
- **Preprocessing for YOLOv8 training.**

BASELINE YOLOV8 MODEL

•- Used augmentation to improve generalization.

•- Trained on 600 labelled images.

•- Achieved initial evaluation score of 0.73.

- Next step: Leverage unlabelled data with semi-supervised learning.

PSEUDO-LABELING STRATEGY

Trained YOLOvm8 model on 600 pre-processed images.

Predictions with confidence > 0.80 are added as pseudo-labels and combined with the previous 600 images.

Trained YOLOvs8 model on the new dataset and again tested on the unlabelled data.

Predictions with confidence > 0.80 are added as pseudo-labels and combined with the previous images.

Model is retrained on the new and final training dataset.

Model is tested on the test data and we got accuracy as 73.60%.

EVALUATION AND PERFORMANCE

- \- Performance metrics:
- \- Mean Average Precision (mAP)
- \- Precision and Recall
- \- Metric for evaluation: 0.5 * (F1-Score) + 0.5 * (mAP@[.5:.95])
- \- Iterative improvement using pseudo-labelling.

CONCLUSION AND FUTURE WORK

- Semi-supervised learning effectively improves weed detection.
- Pseudo-labeling and FixMatch help utilize unlabeled data.

Future work:

- Fine-tuning confidence thresholds.
- Exploring more augmentation strategies.

Deploying model in real-world settings.

THANK YOU