Weed Discrimination Using Yolov8 Deep Learning Algorithm

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Introduction

Farmers in the western U.S. are dealing with reduced crop yields due to invasive weeds and plant diseases. Automating crop anomaly detection and developing an advanced AI algorithm for object detection allows targeted crop-tending, saving time and resources for agricultural practitioners.

Goals

- Developing a self-sufficient approach to discerning crops and weeds within agricultural fields.
- Ensure the algorithm achieves a minimum mAP rate of 85%.
- Implement findings for immediate real-time application, thereby delivering farmers an enhanced solution for safeguarding and optimizing crop growth.

Challenges

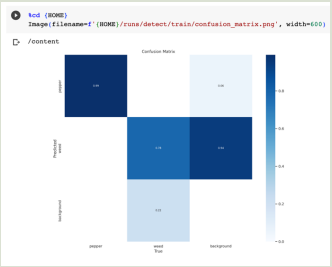
- Annotating drone images can be challenging due to the intricate intermingling of weeds among crops, leading to a significant risk of imparting erroneous data to the algorithm.
- The learning trajectory associated with employing YOLOv8's convolutional neural networks and understanding the intricacy of fine-tuning its hyperparameters to achieve optimal performance for specific tasks and datasets.

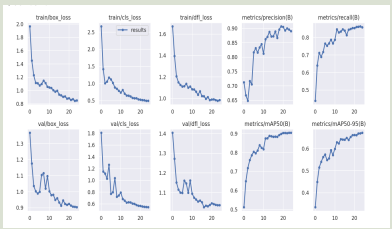
Materials and Methods

Employed Roboflow as a strategic tool to streamline the meticulous process of generating annotated datasets, enabling accurate differentiation between crop fields and invasive weeds.

Transferred datasets of over 350 images to YOLOv8's convolutional neural networks, leveraging its PyTorch framework to construct models employing a train-valid-test methodology.

Operated using Google Colab to ensure optimized runtime and results





Results

The pepper classification algorithm produced remarkable outcomes, boasting a pepper accuracy of 99%, a weed accuracy of 78%, and an impressive overall mean average precision (mAP) score of 89.5%.

Moving Forward

Contemporary technology facilitates the deployment of our model through the seamless importation of images designated for testing, all accessible via the convenience of a mobile device. Employing a comparable approach, we can systematically formulate classification algorithms for a range of crops, potentially expanding to encompass crop disease identification and weed categorization. The refinement of this process through the pepper discrimination algorithm signifies just the initial stride in leveraging artificial intelligence to transform our agricultural methodologies.