Anomaly segmentation of plants in open-set settings.

When an agricultural robot is deployed to a field, its perception capabilities are trained to detect a range of expected plants such as the targeted crops and common weeds. But how are unknown plants handled by the robot? Are they identified as crop, weed or background by the detection model?

In this work, we would like the model to identify unknown plants while not sacrificing performance on the detection of inlier (known) plants. Anomaly segmentation is predominantly researched for the domain of autonomous driving, where they aim to identify unknown obstacles on roads. The most popular benchmark is *SegmentMeIfYouCan* and there are several state-of-the-art approaches that can be considered for this master project (Maskomaly, ContMAV, RbA).

In this work, you will work with the publicly available grassland dataset *RumexWeeds. It* targets the detection of the weed Rumex. *RumexWeeds* includes whole image sequences with totally 5,510 images of 2.3 MP resolution and 15,519 manual bounding box annotations as well as 340 ground truth pixels-wise annotations, collected at 3 different farms and 4 different days in summer and autumn 2021. Apart from the targeted weed Rumex, it contains plants of other, unlabeled species which serve as anomaly objects for this project. There are also options to extend the anomaly data with images sourced from the internet or captured with your phone.

Anomaly segmentation of plants in a field has different relevant applications. We can envision it as a mechanism to identify new enriching datapoints to add to a continuously growing image dataset. Furthermore, in the domain of mixed cropping it is desired to grow different plants together that complement each other. Depending on the plant characteristics of the "unknown" plant, it might be beneficial to keep or remove it. A human-in-the-loop mechanism can provide further information on the discovery of new plant species.

Keywords: Anomaly Segmentation, Open-Set, Mixed Crop Settings, Grassland

Related Work:

SegmentMeIfYouCan: https://arxiv.org/pdf/2104.14812

RumexWeeds: https://onlinelibrary.wiley.com/doi/10.1002/rob.22196

Maskomaly: https://arxiv.org/pdf/2305.16972

ContMAV: https://arxiv.org/pdf/2403.07532

RbA: https://arxiv.org/abs/2211.14293

Required Level: Master student with experience in computer vision, deep learning, and pytorch. You should have performed a computer vision deep learning project before.

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