Individual Lab Report 10

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1 Individual Progress

1.1 Attempt for generalized Unet

This week most of the individual work has been focused on trying to generalize the existing neural network pipeline for the unseen pants. It is worth pointing out that aside from imbalance training data across background, holes, and fungus, there are also significant imbalance training data across different types of plants. For example, kale tends to have a much larger hole size compared to broccolini, which would gravitate the training towards kale. Thus a sampler is introduced to counteract this imbalance by sampling more broccolini than kale. Also, some parameters such as the weighting functions across different classes as well as image normalization are applied to improve the performance. Despite all these efforts, however, the performance still drops 10 to 20% on precision and recall across all plants compared to a separate model for each plant.

1.2 Test on newly collected data

Meanwhile, curly kale and broccolini are repeated plants that are presented in the field both last semester and this semester. So separate models trained on data collected from last semester is put to test on newly collected data to see how well the model generalizes.

The testing procedure is (1) select a hole to fungus threshold such that equal error rate is achieved on development data (2) test the model again on a separate test data with parameter in (1)

For curly kale, it seems to has a much easier setup this semester: the ground is covered with a black tarp which reduces false-positive caused by ground, and there is relatively few fungus per plant on the field per plant, making it a clear-cut problem. Therefore, 100% precision and recall performance are achieved (Fig 1). For broccolini, we have 80 for precision and 78 recall on holes, 68 precision and 93 recall on the fungus. after a close examination, it's found that there are new plants on the field that cause the network to malfunction (Fig 2). As for cabbage since we do not have data collected from last semester, the best results were obtained with kale model, which achieved 100% recession and 46% recall on holes; 92% precision and recall for fungus.

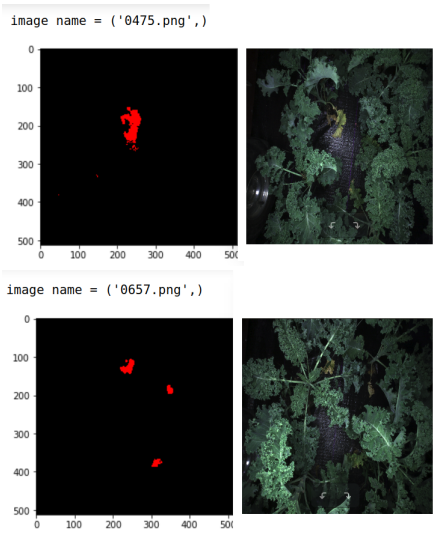

Figure 1: Model generalize very well for curly kale fungus

Figure 2: Unseen plants on the field mis-classified as fungus

1.3 Getting more data

So far it is concluded that the motto is not able to generalize well due to insufficient training data, specifically lacking variety in data e.g. plants in different seasons under different conditions. To address this issue we have contact external companies for data labeling service.

1.4 Challenge

The main challenge remaining so far is whether new data can be obtained in time from these external companies. The fullback plan is to label new data ourselves. However, given the remaining time, the number of labeled-data will probably be small and therefore not meeting our target goal.

1.5 Team work

this week John has been working on particle filters and using segmentation algorithms on LIDAR range data for road detection. Aaditiya has been working with Hillel on integrating monitoring pipeline and having it worked on multiple rows with additional features. Aditya has also been supporting Aman on navigation, specifically resolving ros time asynchronous issues between different computers. Aman has been working on the debugging extended Kalman filters using GPS IMU and visual odometry data. Hillel has been working on plant guards and visualization GUI