Scanning and Forecasting methodology

Forecast gives an idea of harvestable mushroom production in a tunnel. According to LMF, they look for net weight in terms of KGs that can be harvested from each tunnel at the end of the day. Forecast also gives an idea of grading of mushroom e.g. how much of that net weight per tunnel will consist of class A –best quality mushroom- and class B with lower quality.

There is a strong correlation between size and weight considering mushroom health that corresponds to whether the cap is closed or opened, stalk is bigger than usual, discoloration and texture.

To do forecasting we need image data and from image data all sorts of sizes (range of sizes) and counts with correspondence will be derived. This information will play as a backbone of the forecast system being an intermediate stage of forecasting. Following this data net weight can be accomplished.

Stages Involved to target the whole task -

In first stage once sufficient mushroom images are made available (either through image collection using Mark1 as planned or existing images) with the segmentation algorithm size ranges with counts will be derived. How bed scan should be done and how often is descried in Bed scan section. Each of the methods to get forecast has its own pros and cons, but considering the forecast system of the farm, recommendation lights up destructive method and keeping it simpler, time scale size with count might be the best to start approaching the problem, in personal opinion.

Bed scanning methods:

There are two options we can do bed scanning and forecasting-

* Destructive test:

Under destructive way of scanning and forecasting, the whole bed will be scanned every 3 hours or according to the pickers’ picking frequency given a mushroom grows less than 1 mm in an hour so there needs to be sufficient time interval for each scan. Scan will be taken and then pickers will do picking followed by another scan done afterward. This method is quite natural for forecasting as mushrooms grow the way they are supposed to grow. The drawback with this method is that matching same mushrooms from each scan is difficult and with fallacy it will lead to wrong forecast in terms of mushroom growth, size available in time Therefore, for each scan the same mushrooms would need to be recognised for processing.

This is how we can fetch different sizes and their counts in different time intervals. With this information weight can be derived over time. This whole data will be fed to a statistical model or DL model to train that will be used for forecasting once it is ready to predict.

Use of Ground truth:

Valuation needs to go in parallel to model building. With this method the ground truth will be the previous batch of the current. For example, the happened a scan at 7 am Today following other scans done at 10 am, 1 pm and so on.

The ground truth of 1 pm scan will be the scan done at 10 am, similarly, the ground truth of 1 pm scan would be 10 am one and this is how it will move forward. Moreover, manual ground truth can also be done but that will require a lot of time.

This calibration or verification process with ground truth can be done either by tracking down individual mushrooms and matching them from each scan resulting having a *time scale growth* in terms of *size* and eventually weight. Otherwise, just sizes with counts will be recorded per scan and there will be a *time scale growth* in terms *of sizes and counts*, leading to *weight* at the end. For example, 20-25 mm with count 240, 30-35 mm with count 300 and so on at 7 am ; 20-25 mm with count 140, 30-35 mm with count 200 and so on at 10 am and it continues. Either way forecast can be done but the later way will be way too faster.

Once weight forecast is sorted, class allocation will be done. With features mentioned earlier-cap, mushroom and compost health etc- this can be done using image processing tools.

* Non-destructive test:

With non-destructive way of forecasting, a whole bed will be scanned, given images will be collected covering each shelf (18) of a particular tunnel and no picking operation will be conducted through from the beginning of first scan to the end of last scan. There will be no destruction of data in the meanwhile.

The benefit with this technique is that we can skip mushroom tracking from scan to scan. Mushrooms grow but rarely the centre of the cap dislocates significantly unless they are in tacked cluster. We can record individual mushroom’s growth in time or do size and count, both leading to net weight, as described in destructive test.

For calibration or valuation, the use of ground truth will remain the same as that in destructive method described earlier e.g. current scan’s forecast will be calibrated with the scan data coming up in 3 hours or whatever the time interval of scanning is set.

Process in brief-

