LAST-Straw standard procedure for annotation

Background:

The purpose of this document is to ensure accurate and consistent annotations across the LAST-Straw dataset in Segments.ai. Thank you for your contribution of time towards annotation.

Requirements:

Annotation is performed in Segments.ai. Please sign up, requesting an educational licence and then contact kajames@lincoln.ac.uk, 18727004@students.lincoln.ac.uk or gcielniak@lincoln.ac.uk to supply your **username** to be added to the dataset with labelling permissions.

Guidelines:

Identify the **unlabeled** sample from either the Zara or Katrina folders with the lowest value priority (see Fig. 1).

	Name	Label status	Prio	Last updated
	katrina2_20220707.pcd	Unlabeled	6.00	last week
	katrina2_20220620.pcd	Unlabeled	3.00	last week
	katrina2_20220627.pcd	Unlabeled	1.00	last week
	katrina2_20220525.pcd	Reviewed	0.00	8 months ago
	katrina2_20220608.pcd	Reviewed	0.00	8 months ago
	katrina2_20220729.pcd	Reviewed	0.00	7 months ago
	katrina2_20220519.pcd	Reviewed	0.00	8 months ago
	katrina2_20220616.pcd	Unlabeled	0.00	9 months ago
	katrina2_20220531.pcd	Reviewed	0.00	8 months ago
	katrina2_20220721.pcd	Reviewed	0.00	7 months ago
	katrina2_20220512.pcd	Reviewed	0.00	8 months ago

Figure 1. Select the next sample to annotate using 'prio' column. Check both Zara and Katrina folders to identify the lowest non-zero value that is marked as unlabeled.

Basic operation guidelines

Select the file name of the point cloud to open it and begin labelling. Please select 'Pre-labeled' at the top of the screen so that we can tell someone has started work on it. When you are complete, please change this to 'Labeled'.

If the point cloud is all red: select the settings tab on the right hand side and uncheck the "Gradient colouring" box. This will restore point cloud colour. Select object colouring by instance.

Navigate:

- Press and hold shift with left click to rotate the point cloud.
- Zoom in/out using the mouse wheel.
- Shift plus right click to move the point cloud from side to side.

How to paint an organ:

We are annotating organ **instances.** This means each leaf should be one leaf object with its own label. Select the paintbrush tool on the left hand side. Paint using left click (holding this button down). You can also use the polygon tool to mark areas. The eraser tool on this toolbar is used to remove mistakes. **It is easiest if you lock annotations so that you don't paint over objects you have already painted.**

When you are complete with an organ instance, press escape. You will now be able to view the instance of annotation in the "Labeling" tab on the right hand side, and use the drop-down menu to change the class, see Fig. 2. Please note we use 'petiole' to mean anything in the **STEM class.**
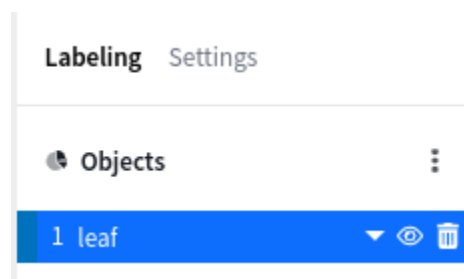

Figure 2. Select semantic class

It is important to save your work from time to time, using the button at the top right.

You can also hide the object using the eye icon in Figure 2.

Guidelines for annotation

The exact separation of the plants into functional organs and instances is not trivial and somewhat subjective. To minimise ambiguity, start the labelling process by focusing on the regions that offer the clearest distinctions and proceed to more uncertain areas.

The semantic classes are 1) leaf or leaflet, 2) stem (including petiole, peduncle, pedicel, and stolon), 3) berry, 4) flower, 5) crown, 6) background, 7) other plant part, 8) scanning table, and 9) emergent leaf. A reference is provided for the anatomical names of the plant in Fig. 3.

Please be aware that the strawberry plants were in grow bags next to other plants, which means that there are sometimes leaves etc from a different plant in the scan. These should be marked as background.

For annotation we are performing **instance** annotation. This means that each leaf (and other organs) needs to be annotated separately, but belong to the relevant class.
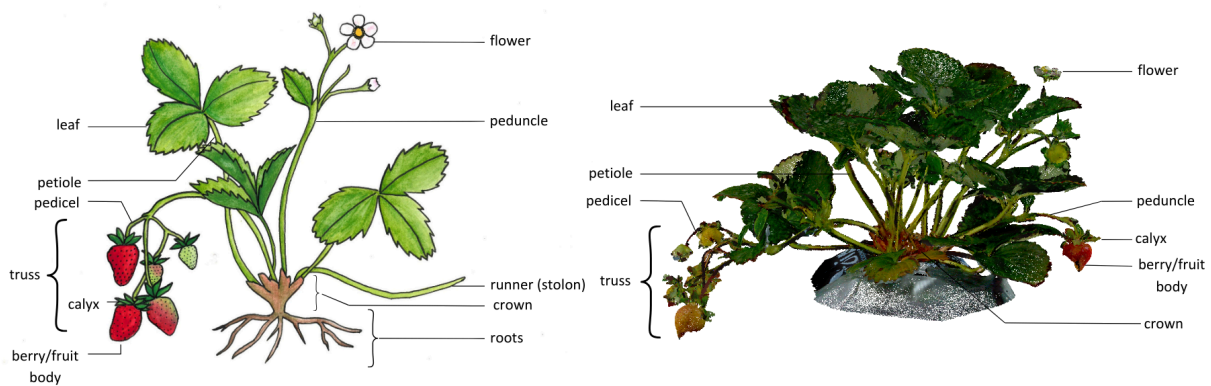

Figure 3: Anatomy of a strawberry plant. Left: annotated illustration. Right: sample from the LAST-Straw dataset.

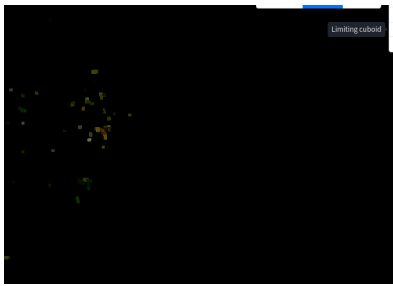The following rules for the categorisation of ambiguous areas:
- An emergent leaf or leaflet has to be identifiable as a growing leaf but has not yet unfurled, yet visibly diverged from the axis of its petiole.
- The cut-off point between flowers and berries is based on whichever occurs first: either the protruding cone shape of the berry becomes distinctly visible at the centre of the structure, or a noticeable colour change is observed in the receptacle, transitioning from yellow to white.
- The crown class is defined as any central structure around the emergence point of the plant that is not otherwise identifiable.
- The class `other plant part' consists of small structures associated with newly emerging organs that are not yet characterisable.
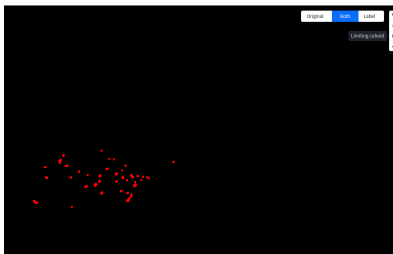
Please check that your annotations are firmly 'on' each organ and not 'splashed' onto others or elsewhere in the point cloud.

Annotation feedback

Things to watch out for:

Junction points		The peduncle (orange) should extend right up to the calyx.
Splash		Turn off other organs to check that there are no points that were accidentally annotated far away from the organ of interest and fix these if so. Here we see orange splash from the petiole on the leaf. This is the most common error type.
Crown - mislabel		The crown is NOT a dense region in the truss where it splits as shown here. The crown is only the region at the bottom of the plant.
Crown - transition with petioles and growbag		If the petiole is still very clearly a petiole, as seen in the unannotated sections, this should be marked as petiole rather than crown. Only transition to crown when it is clear that it is no longer petiole (becomes fat, leafy, irregular…). There is an example of splash on the grow bag as well.

		Another example of this. As you can see the petiole has been annotated correctly in the image below, whilst it was still part of the crown in the image on the left.
Misannotations		In cases like this the annotation should clearly show that the petiole passes in front of the berry and the petiole should not be lumped in with the berry class where they touch, as done in this annotation.
Unannotated points		If all annotated organs are turned off, there should be no points remaining. These should all belong to one of the existing organs. You can remedy this by selecting one organ at a time and colouring over it.
Empty labels		Organs should contain points - please double check for empty organs. Non-empty ones will highlight their points in pale yellow/orange if you click on them.