TreeAI Data Preparation Guide

About TreeAI

The TreeAI initiative is establishing an international collaboration to create the first global database for the detection of individual tree species using deep learning. Our ongoing data call seeks manual tree species canopy delineations and high-resolution aerial imagery.

By contributing to this initiative, you are offered co-authorship in the publication of the TreeAI database and a subsequent manuscript investigating deep learning approaches for individual tree species identification. The global database currently contains over 75 datasets from 32 countries, featuring more than 114,688 tree canopy annotations and over 100 tree species.

Submission link: https://www.treeai.earth/submit.html
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Definitions

Tree crown segmentation is the process of drawing or adjusting polygons around each visible tree crown in the aerial image. It is also referred to as tree crown delineation. Think of it as drawing the tree canopy shapes.

Tree species labelling involves assigning the correct tree species to each segmented crown. Think of it as naming the trees.

Annotation is the combination of the tree crown segment and the species label.

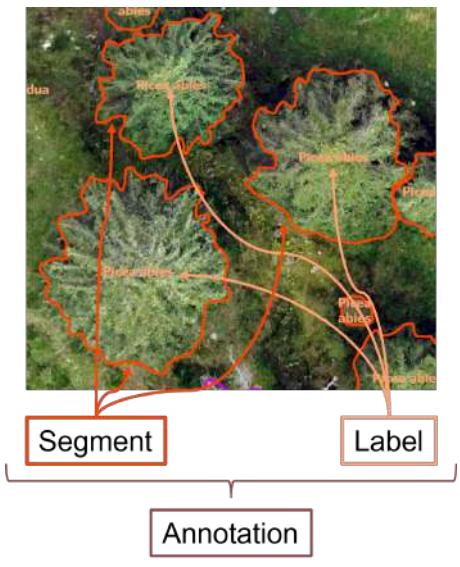

Figure 1: Illustration of tree annotation and its two components: tree crown segmentation and tree species labelling.

Data Requirements

Imagery Format

RGBI (red, green, blue, and near-infrared) or RGB imagery with a spatial resolution of 10 cm (about 3.94 inches) or less. The files must be provided in GeoTIFF format and projected in the WGS 1984 UTM coordinate system.

a)

b)

FID	Shape	Species
35	Polygon	Picea abies
36	Polygon	Picea abies
37	Polygon	Pinus sylvestris
38	Polygon	Larix decidua
39	Polygon	Picea abies
40	Polygon	Larix decidua

Figure 2: (a) Example RGB/RGBI imagery with tree crown segmentations; (b) the corresponding attribute table, in which each crown polygon is assigned its Latin species name.

Annotation Format

A minimum of 100 individual trees is required per submission. We strongly prefer **fully labeled** polygon shapefiles representing one polygon per tree crown. GPS point coordinates are only accepted if accompanied by tree height or diameter at breast height (DBH) data. Shapefiles should be submitted as a .zip containing .shp, .dbf, .shx, and .prj files.

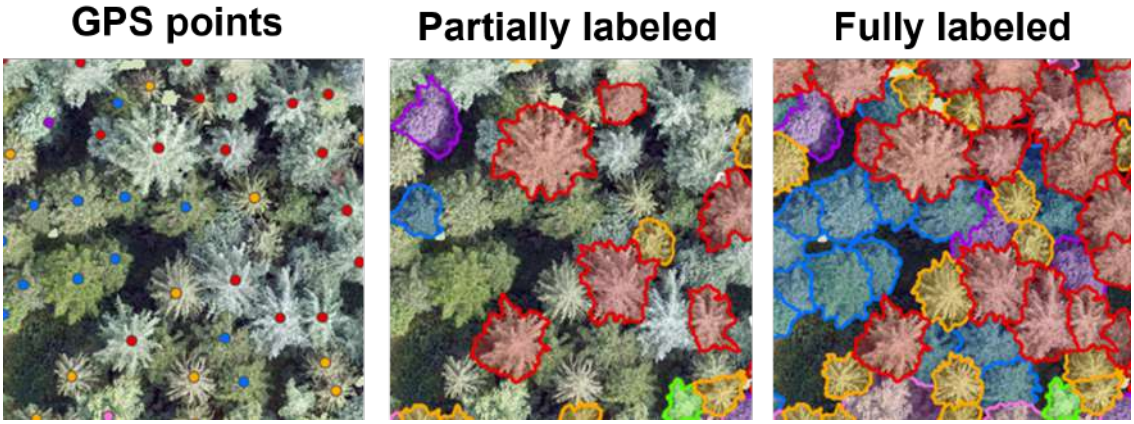

Figure 3: Example of GPS points, partially labeled and fully labeled data.

Workflow Guide

1. Crown segmentation

Goal: Each visible tree crown in the orthophoto have one accurate polygon representing its outline.

Procedure:

Use the automatic segmentation that we have provided as a starting point.

Carefully **check each segment**:

If a crown is **missing**, draw a new polygon around it.

If **two or more crowns are merged**, split the polygon accordingly.

If a polygon is **too small or incorrect**, adjust or delete it.

Correct any other mistakes

Include **all clearly visible crowns** in the area. Crowns that are **not seen in the aerial image** i.e. completely hidden by shade or overlapping trees can be ignored.

Created segments should not overlap.

Output: A complete set of polygons, where **each visible crown in the reference area** is accurately segmented. There should not be tree crown that are visible and not segmented.

2. Species labelling

Goal: Assign the correct tree species to every segmented crown.

Procedure:

For every crown polygon, add a species label (species name in Latin) as an attribute field.

Use consistent **species names** (in binominal nomenclature, i.e. *Picea abies*, *Fagus sylvatica*) across all reference areas.

Mention the genus name when the species is **NOT** known i.e. *Quercus* sp., *Acer* sp.

Dead trees should be named: **Dead tree**.

Output: A fully segmented and labelled dataset where each tree crown polygon includes its corresponding species information.

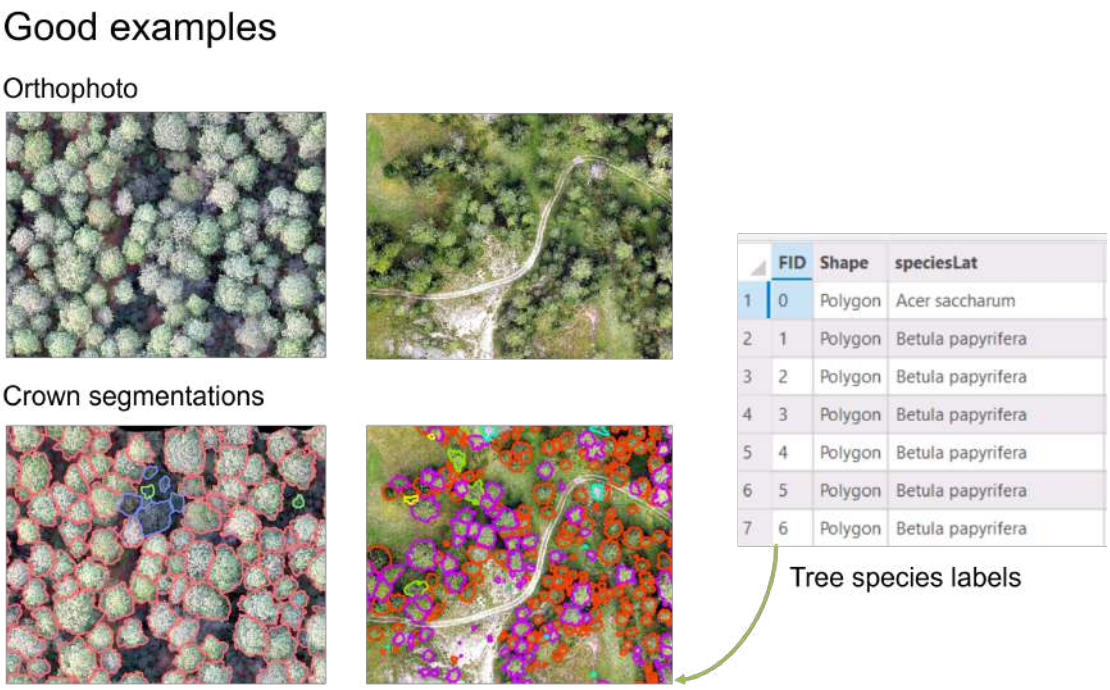

Figure 4: Good example of fully labeled crowns: orthophoto, crown segmentations, and tree species labels.

Frequently Asked Questions

Q: How should we assess the crowns in terms of shade? Does the shade always have to be cut away, or does it not matter?
A: If the shaded area belongs to the same tree crown, please keep it within the crown segment. If the shade falls on another tree or object, it should be cut away and not included in the segment of the tree that cast the shade. This ensures that each polygon accurately represents one complete crown as it appears in the image, including its own shaded parts but excluding shadows cast onto others.

Q: Is it important that every crown within our 50x50m areas is recorded, or is it sufficient to label those that are clearly visible?
A: Please label every crown that is clearly visible in the orthophoto. If a tree is completely hidden by surrounding crowns and not visible in the aerial image, you can leave it out. The goal is to capture all crowns that can be confidently identified.

Q: Is 50x50m sufficient, or would larger test areas be more useful?
A: A 100x100m area is preferable for us. It allows us to split each site into multiple smaller image tiles for model training. With 50x50m areas, this becomes more difficult and results in fewer usable images.

Q: What quality of the delineation is required?
A: High-quality delineation requires clear boundaries and precise polygons that tightly follow the canopy shape to ensure pixel-level purity. While slight over-extension is tolerable, you should avoid stretching polygons across empty spaces between separate trees.

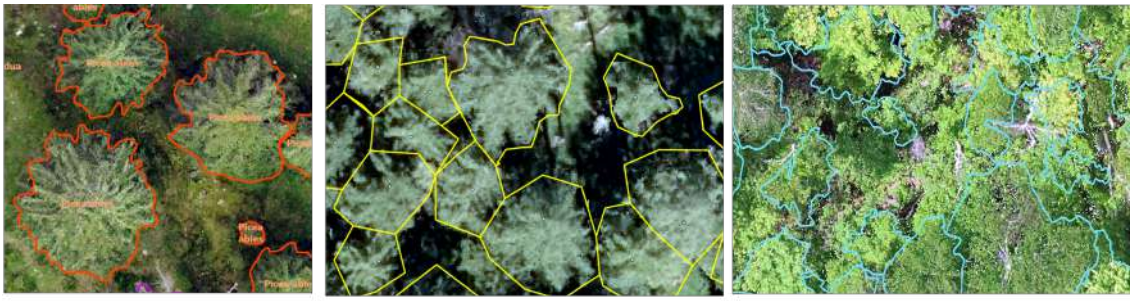

Figure 5: Examples of delineation quality classification.

Information Required from Contributors

When submitting your dataset, please ensure the following details are included:

1. **Affiliation.**
2. **Co-authors list.**
3. **Corresponding email.**
4. **Data license.**
5. **Time (year)** of the image collection and annotation, respectively.
6. **Annotation source (fidelity):** ground truth survey, visual interpretation, or model prediction.
7. **Image bands**, such as RGB or RGB-NIR (make sure the bands sequence is correct).