Methodology

Introduction

Line Segment Detection (LSD) is the most common and essential step that has been studied thoroughly in many computer-vision research and projects. The major challenge in LSD is noise, selecting accurate segment out of several segments and variability present in an image.

In this research, Run-Length Encoded (RLE) and annotated images in JSON format were used as the initial data source for the implementation of the Line Segment Detection Algorithm. After RLE data has been decoded to an image, preprocessing and preparation steps were described in section 3.2. Then in section 3.3, Feature extraction step was described. Which is the most important step to detect all the line segments in the image. In the final step, (Section 3.4) line segments between two bounding boxes were successfully identified on the stem of each plant.

3.2 Preprocessing and Preparation

In this project, an image annotation tool called “Hasty” was used to create ground-truth dataset. During the annotation, the object classes of the image were defined as “First Section Cutting”, “Redundant Top End” and “Tip Cutting” etc. Finally, the annotated image was encoded to a run-length encoded (RLE) binary mask, which is a compressed representation of a binary image. In this encoding, the binary image is represented by a sequence of pairs (start, length), where each pair represents a consecutive run of 1's in the image.

In the 1st part of the algorithm, this mask was decoded and created a 2D numpy array. Also, image dimensions, bounding box details, selected object classes (First Section Cutting, Redundant Top End, Redundant Bottom End, Tip Cutting, Non-Viable Part, Second Section Cutting, Third Section Cutting, Fourth Section Cutting) which are useful for the line segment detection were gathered in this stage.

Usually sample images contain one or more plants, and in the second part of the algorithm, two Python lists were generated. Typically, in the Hasty Generated JSON file, plant sections are annotated with specific small bounding boxes and saved separately. The exact coordinates of these small bounding boxes were stored in the first Python list. Also, large bounding boxes were defined for each plant (with all the section cuttings) in the JSON file and saved separately in the second Python list. In addition, a dictionary was created to store the details of each plant section. In this case, the background of the image was saved as "0" and the foreground as "1".

Then 3rd part of the algorithm is used to define the