Fruiting Mother-Shoot Counting System Based On Segmented Images

ID: 60019

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Personal Profile

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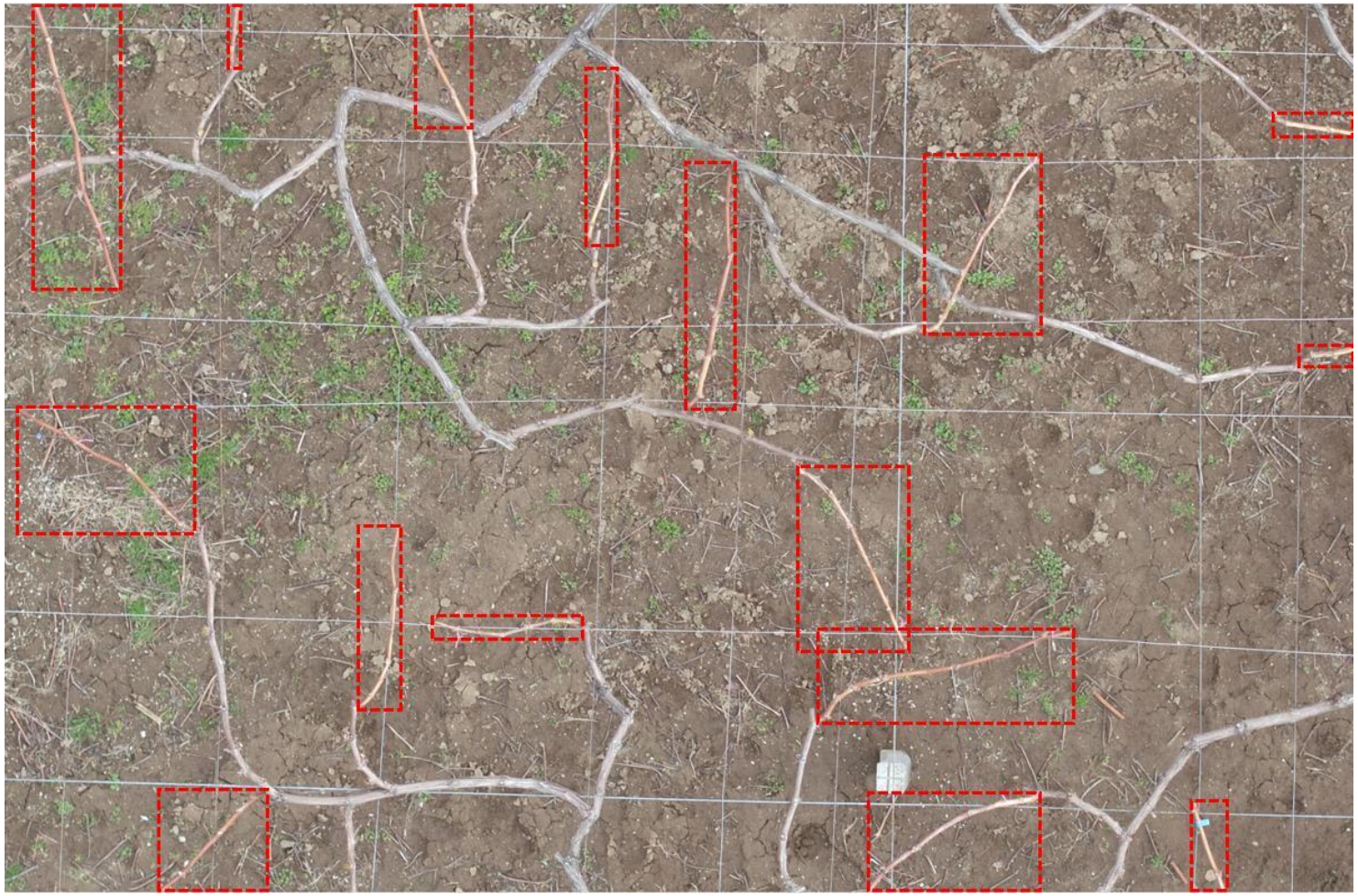
Graduated from Dali University with a degree in Computer Science and Technology, 2017.

Currently studying at Tokai University, majoring in Image processing and Artificial Intelligence.

Introduction

- To grow sweet grapes
- Control the number of fruiting bunches.
- It is important to determine the number of fruiting mother shoots.

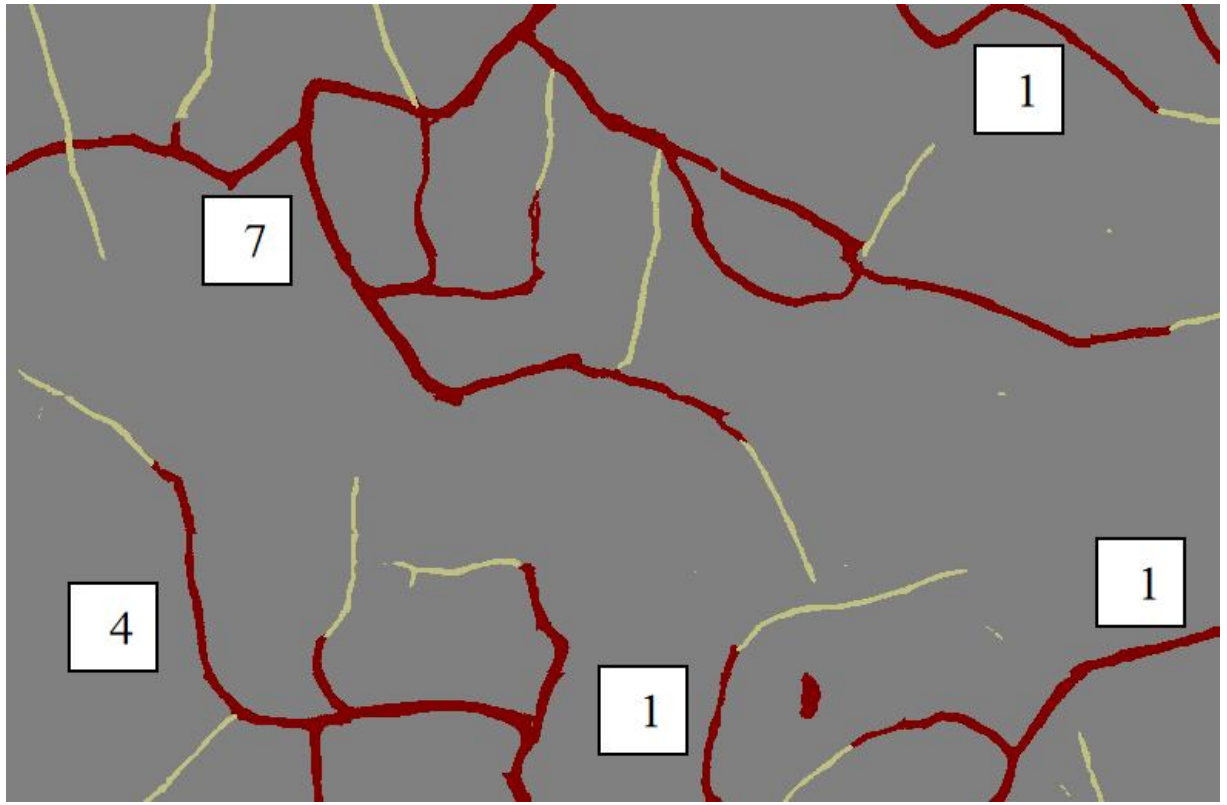


Red box: Fruiting mother shoots

Introduction

Produce teacher data for branches and fruiting mother shoots, and use Segnet for training identification.

Aerial photograph



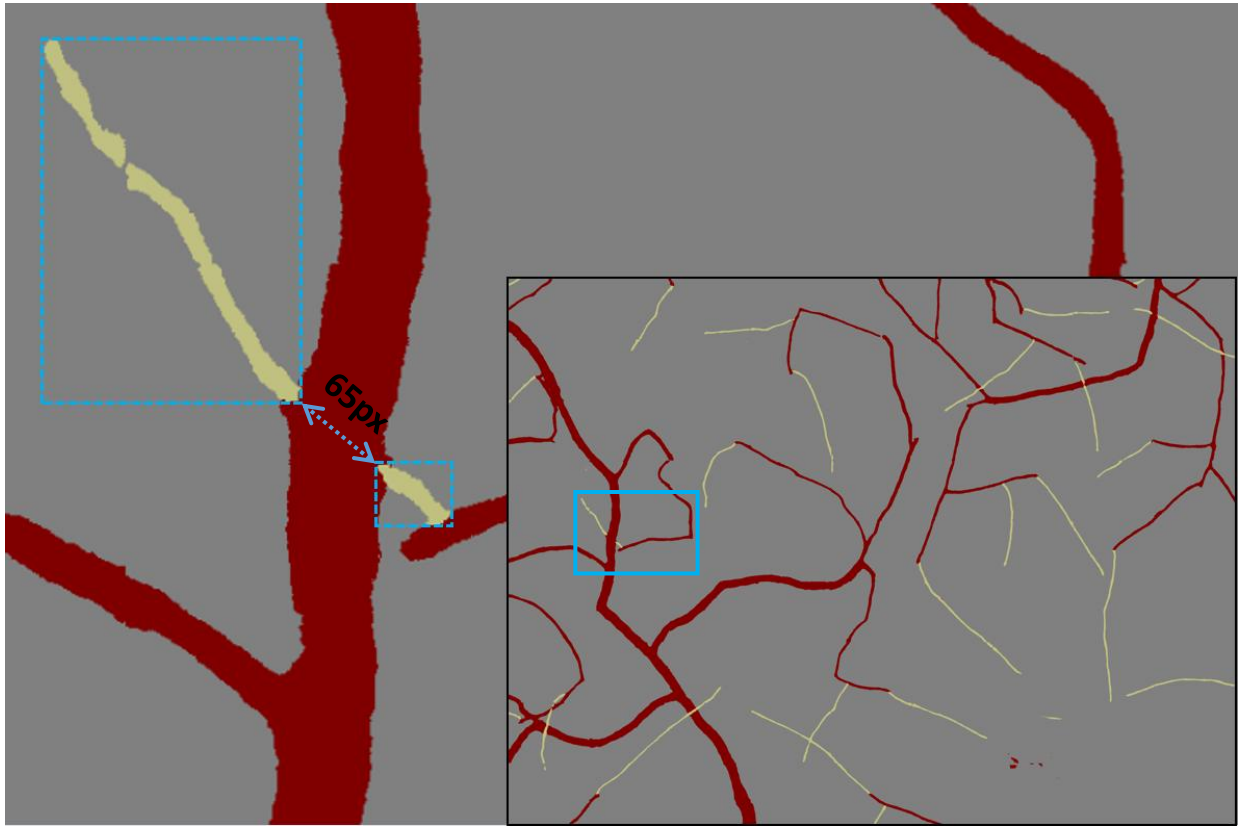
Segmentation analysis results

Funa Ito etc. , 『Shoot Counting System Based on SegNet』,
eKNOW 2020 : The Twelfth International Conference on Information, Process, and Knowledge Management

Problem

The fruiting mother shoot may be disconnected because some pixels of the fruiting mother shoot are not recognized or are misidentified as branch pixels. Results in an incorrect final count when the number of fruiting mother shoots is aggregated.

Aerial photograph

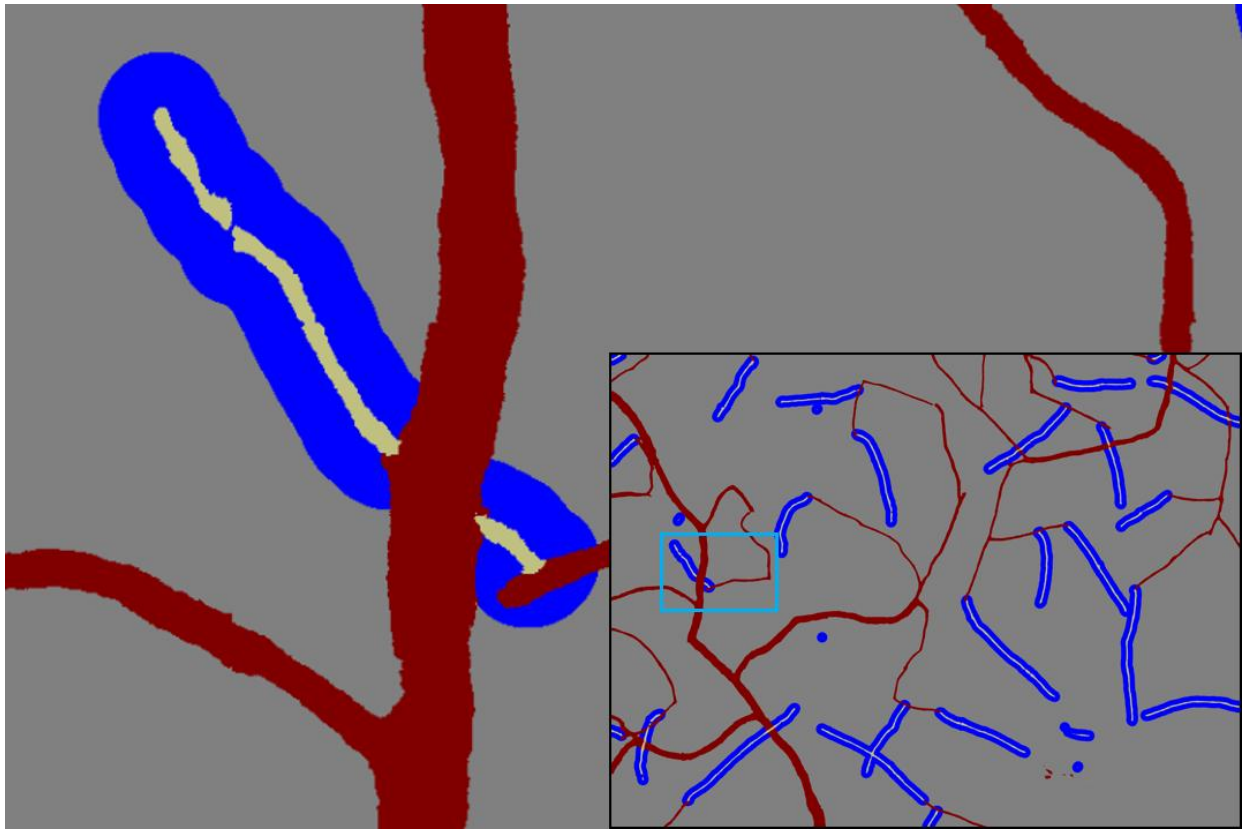


Segmentation analysis results

Problem

If the disconnected fruiting mother shoot is corrected only by distance, it is necessary to generate a blue region extending at least 33 px beyond the yellow pixel region representing the fruiting mother shoot.

Aerial photograph

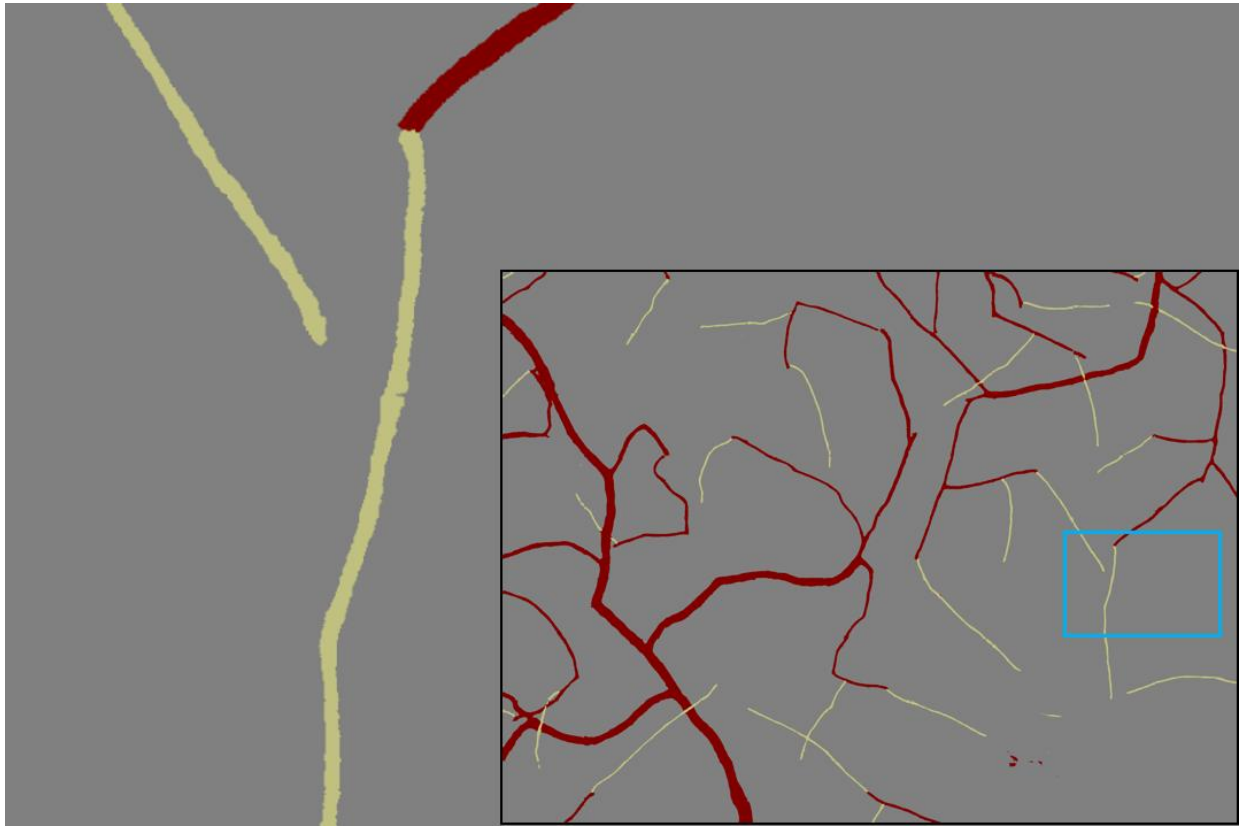


Segmentation analysis results

Problem

Correction of the disconnected fruiting mother shoot was accompanied by the occurrence of a new misconnection.

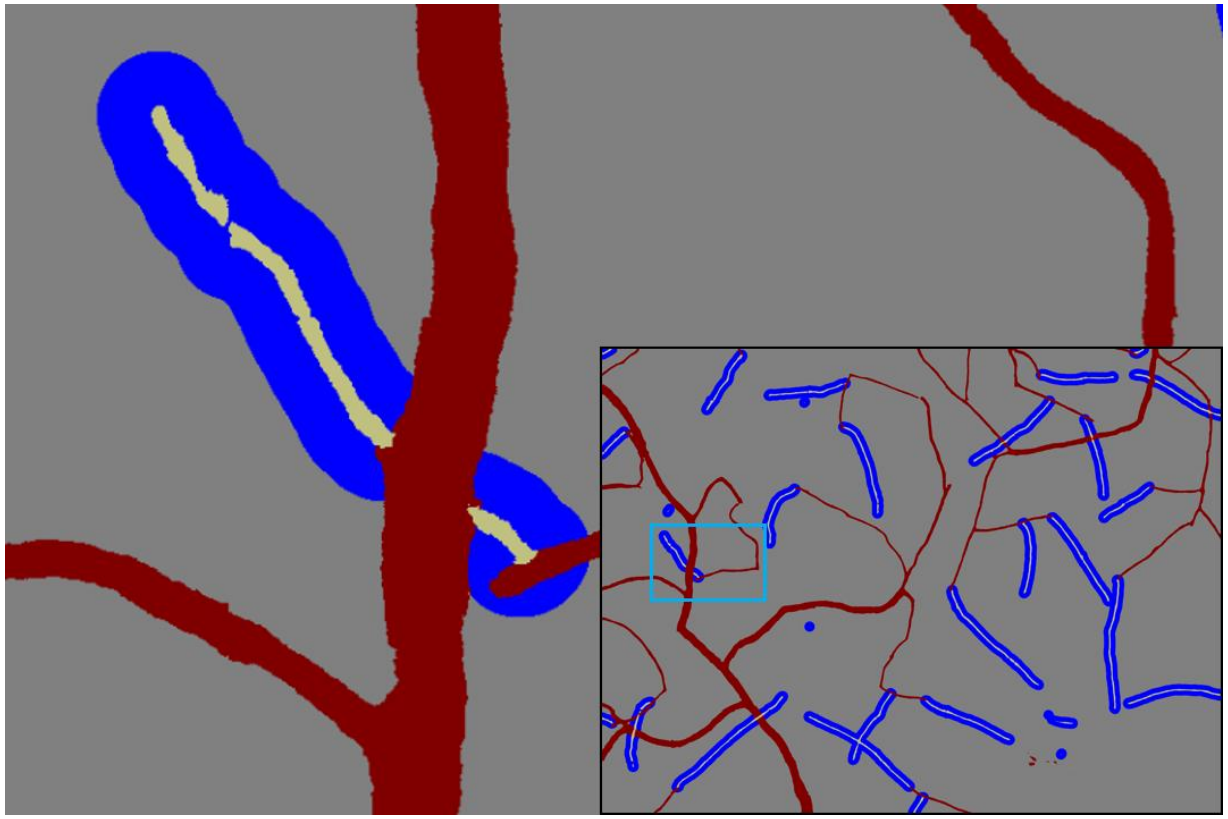
Aerial photograph



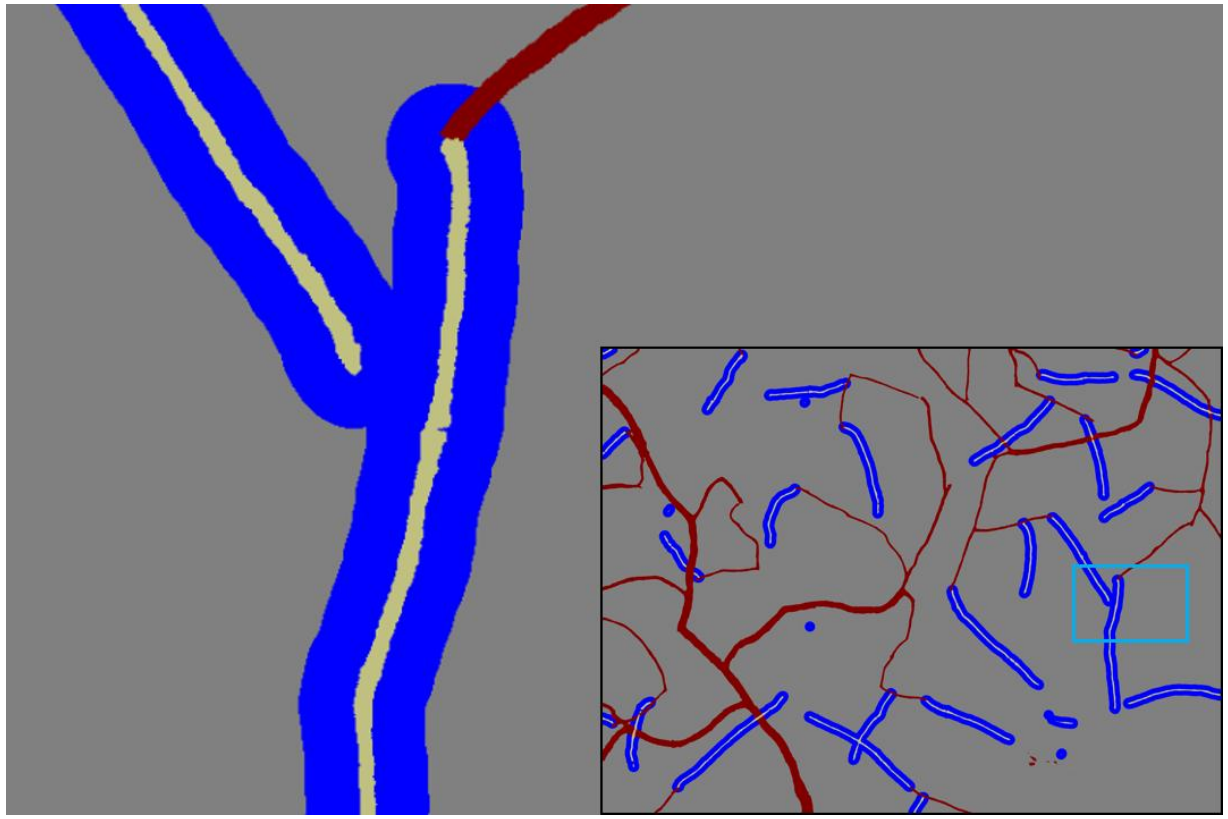
Segmentation analysis results

Problem

Correction of the disconnected fruiting mother shoot was accompanied by the occurrence of a new misconnection.



Correct Correction



False Correction

Purpose

Improve the method so that the number of fruiting mother shoots can be counted correctly.

・The system automatically selects the areas that need to be corrected and the areas that do not need to be corrected.
・Correct only the areas that need to be corrected.

Proposed Method

The fruiting mother shoots has characteristics of grow as straight as possible.Therefore, we propose a fan-shaped search method. The process involved in the fan-shaped search method is described below.

(1) Find the two endpoints of a fruiting mother shoot.

(2) Make an extension line for each endpoint.

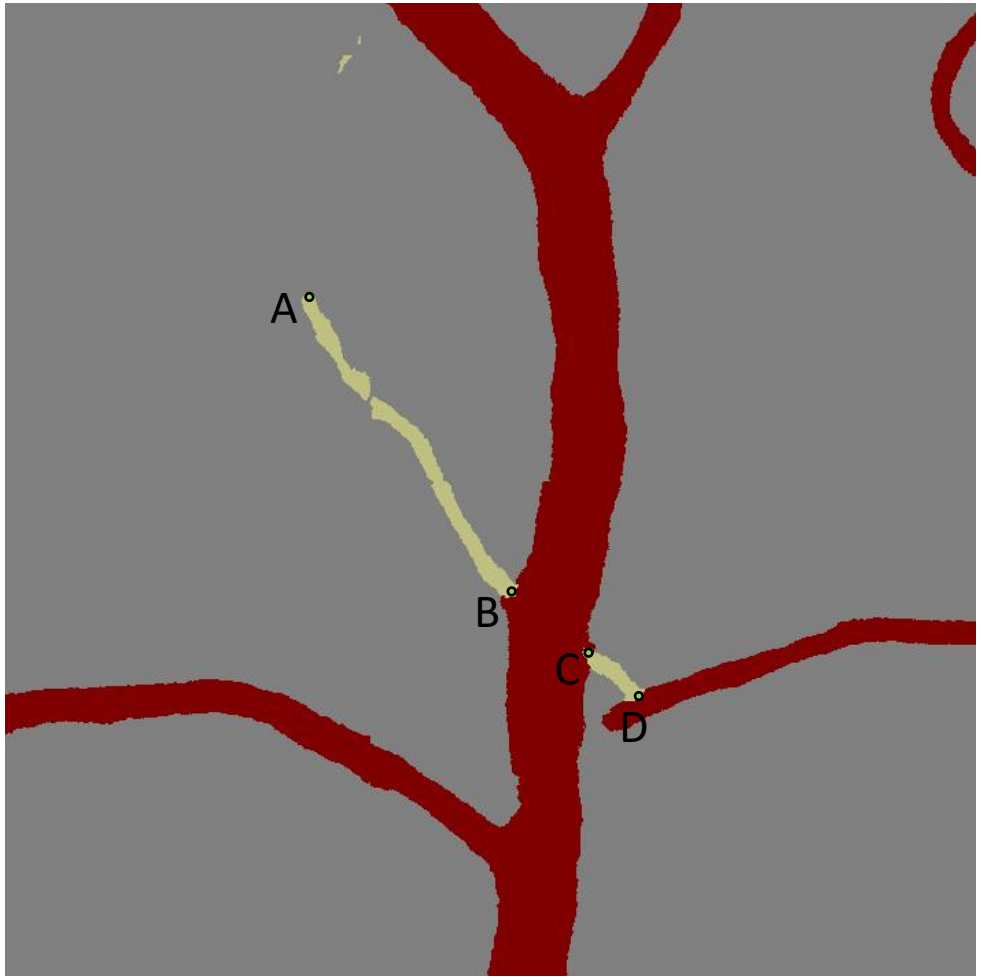
(3) Plot a fan-shaped area at the specified angle and radius using the extension line as the base.

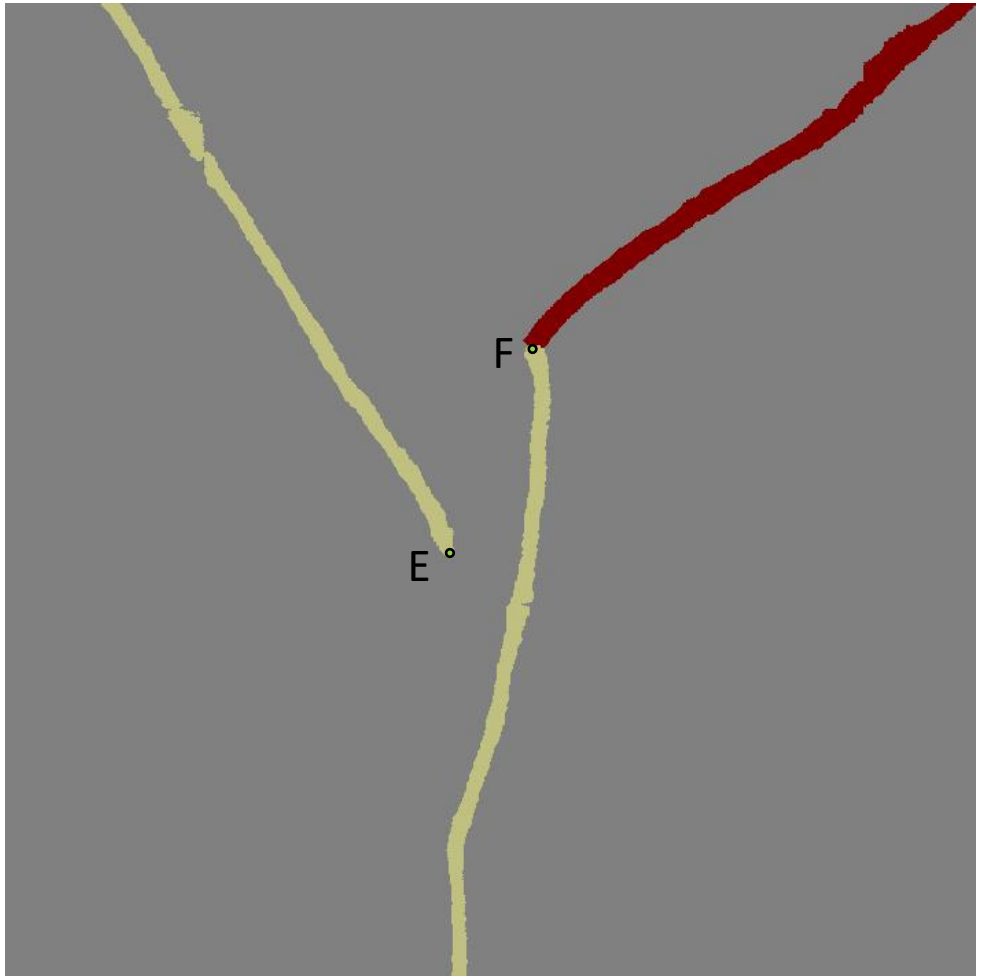
(4) Search for other endpoints within each fan-shaped region.

(5) When the two endpoints are within each other's fan shape, connect only the single endpoint closest to the search target.

Proposed Method

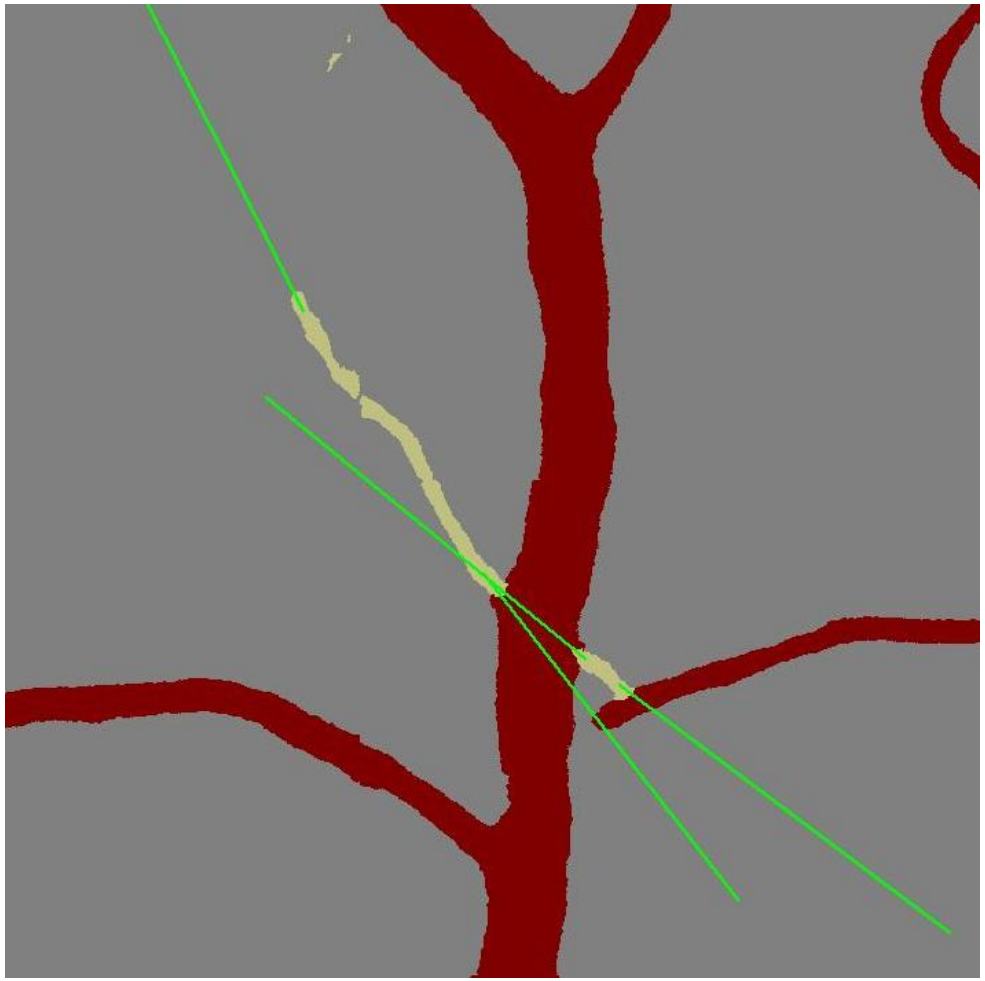
(1) Find the two endpoints of a fruiting mother shoot.

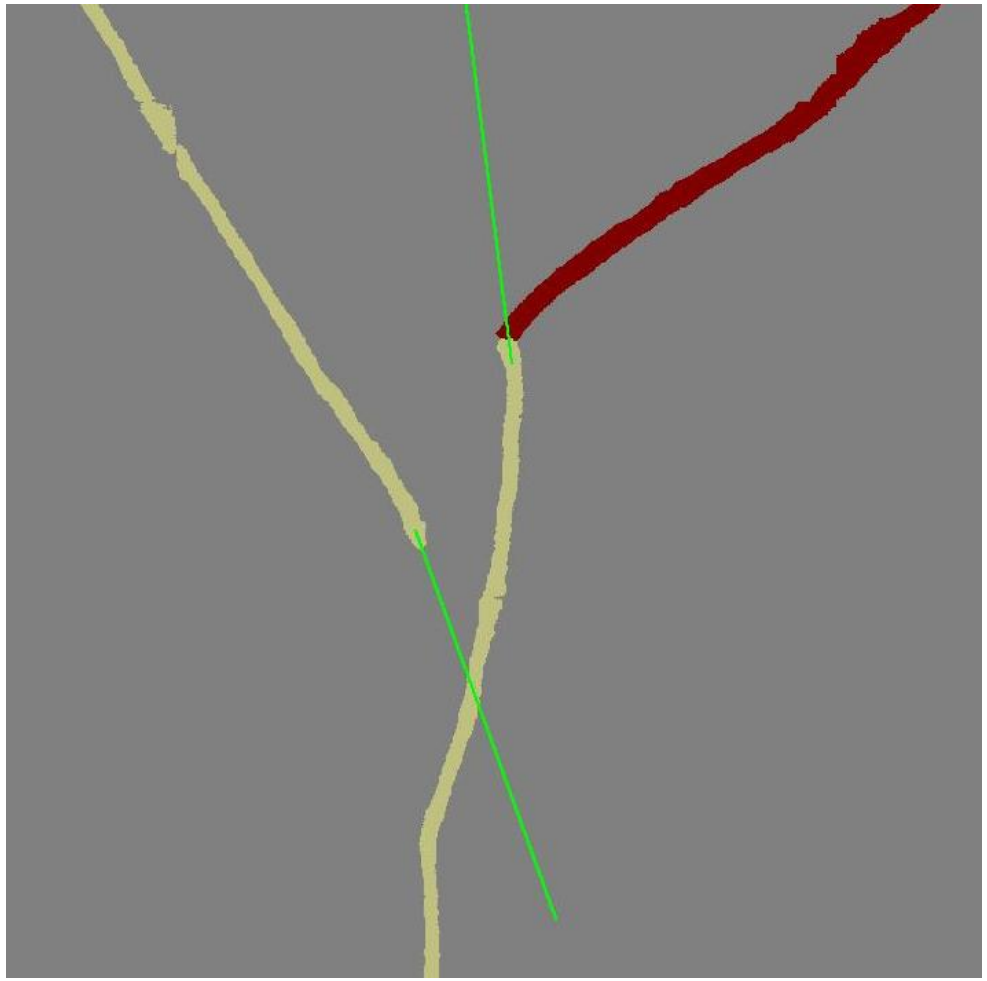




Proposed Method

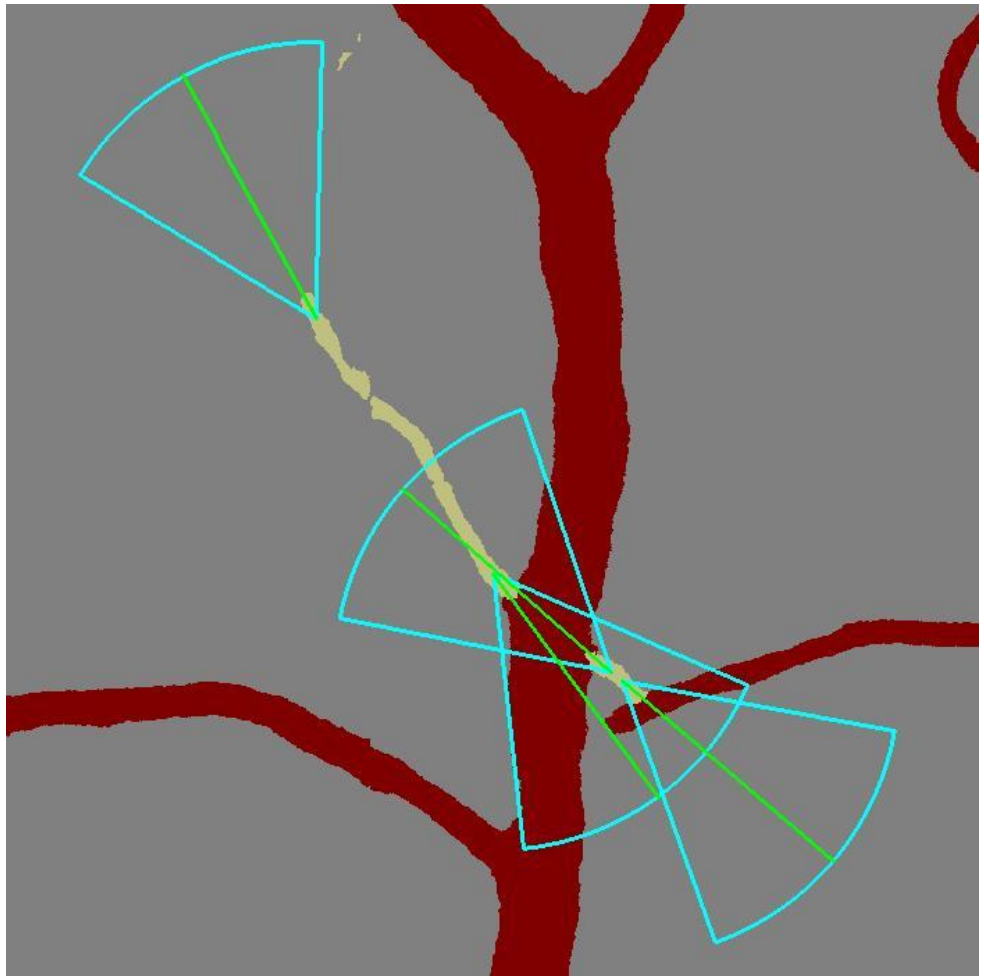
(2) Make an extension line for each endpoint.

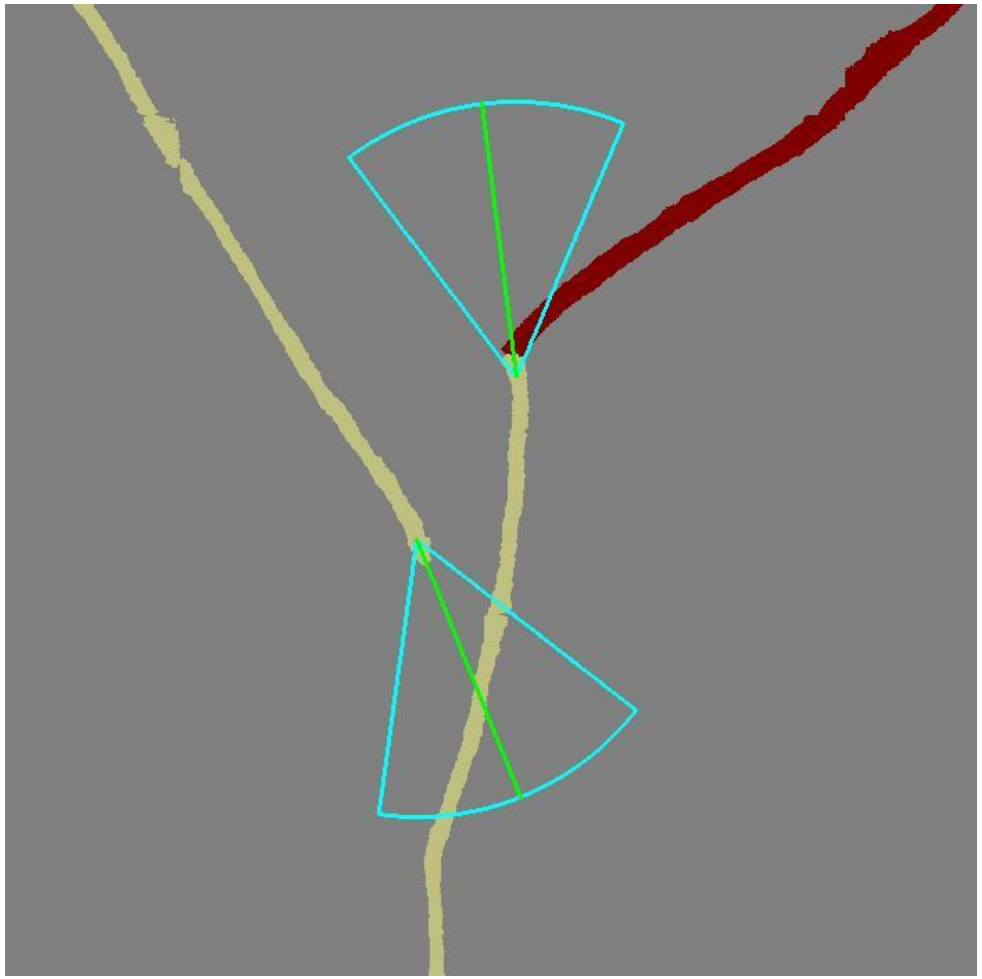




Proposed Method

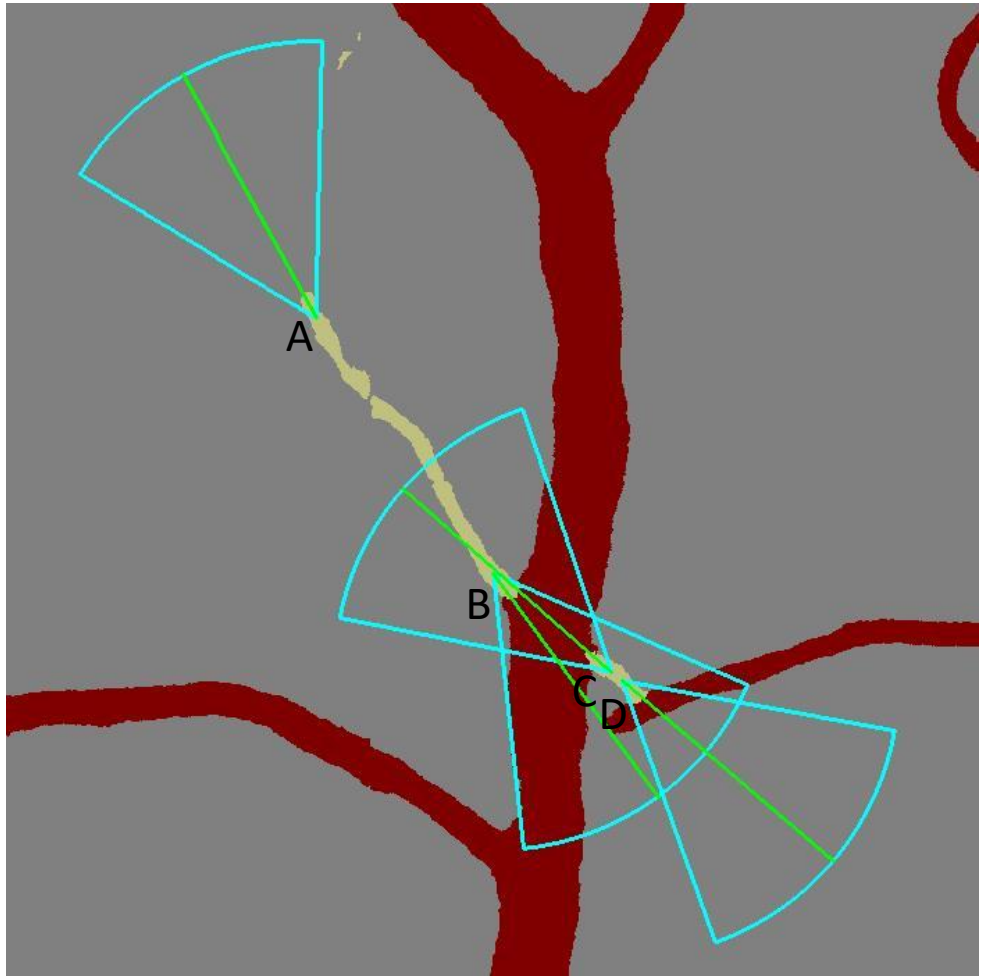
(3) Plot a fan-shaped area at the specified angle and radius using the extension line as the base.

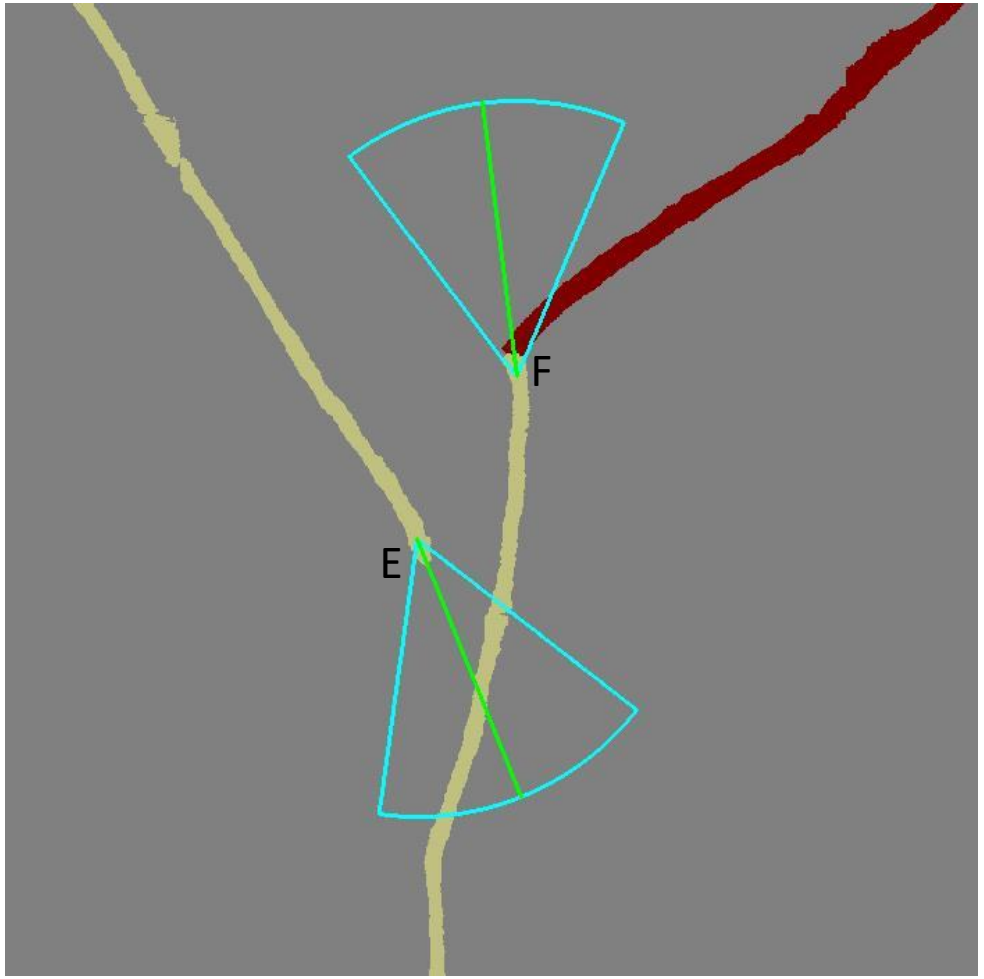




Proposed Method

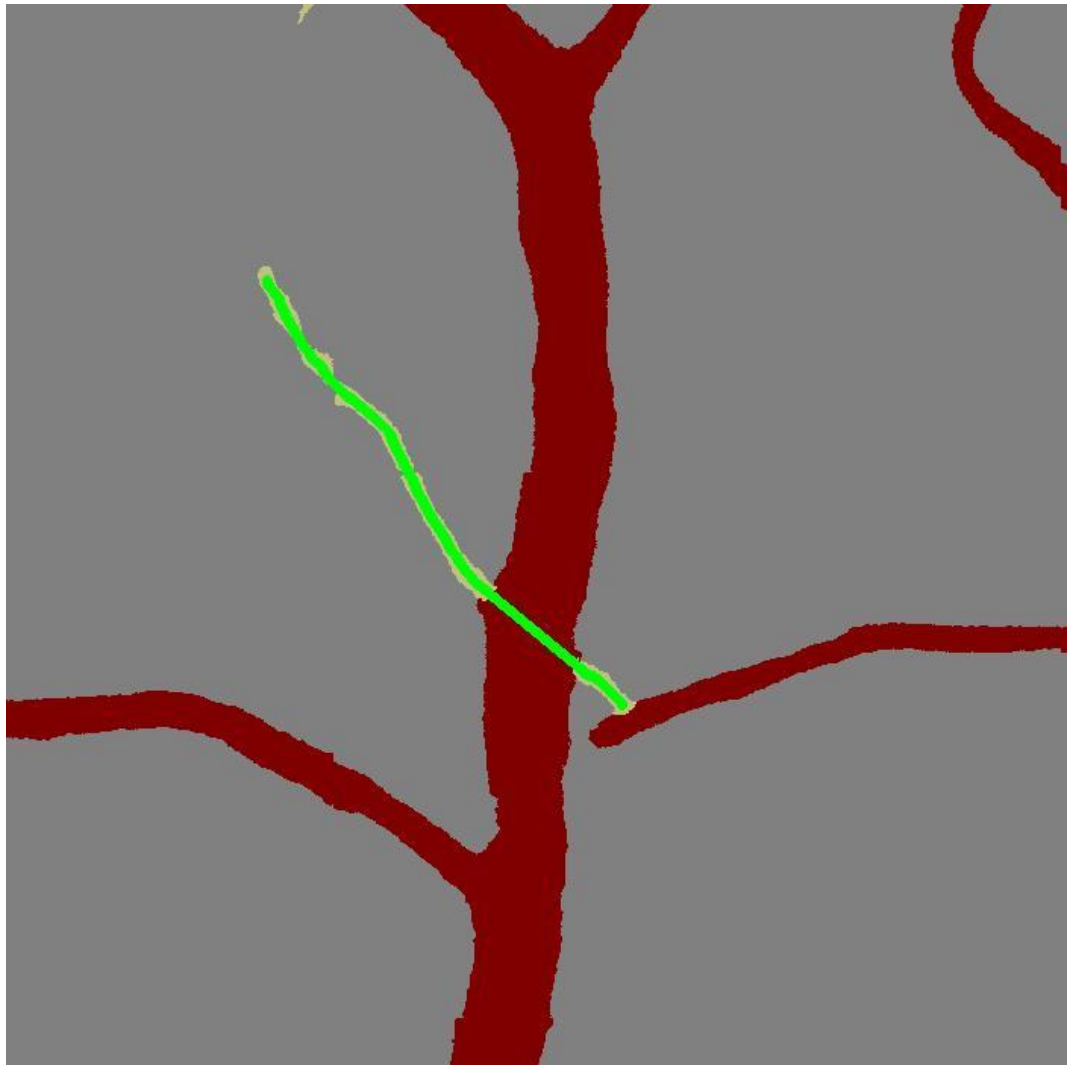
(4) Search for other endpoints within each fan-shaped region.

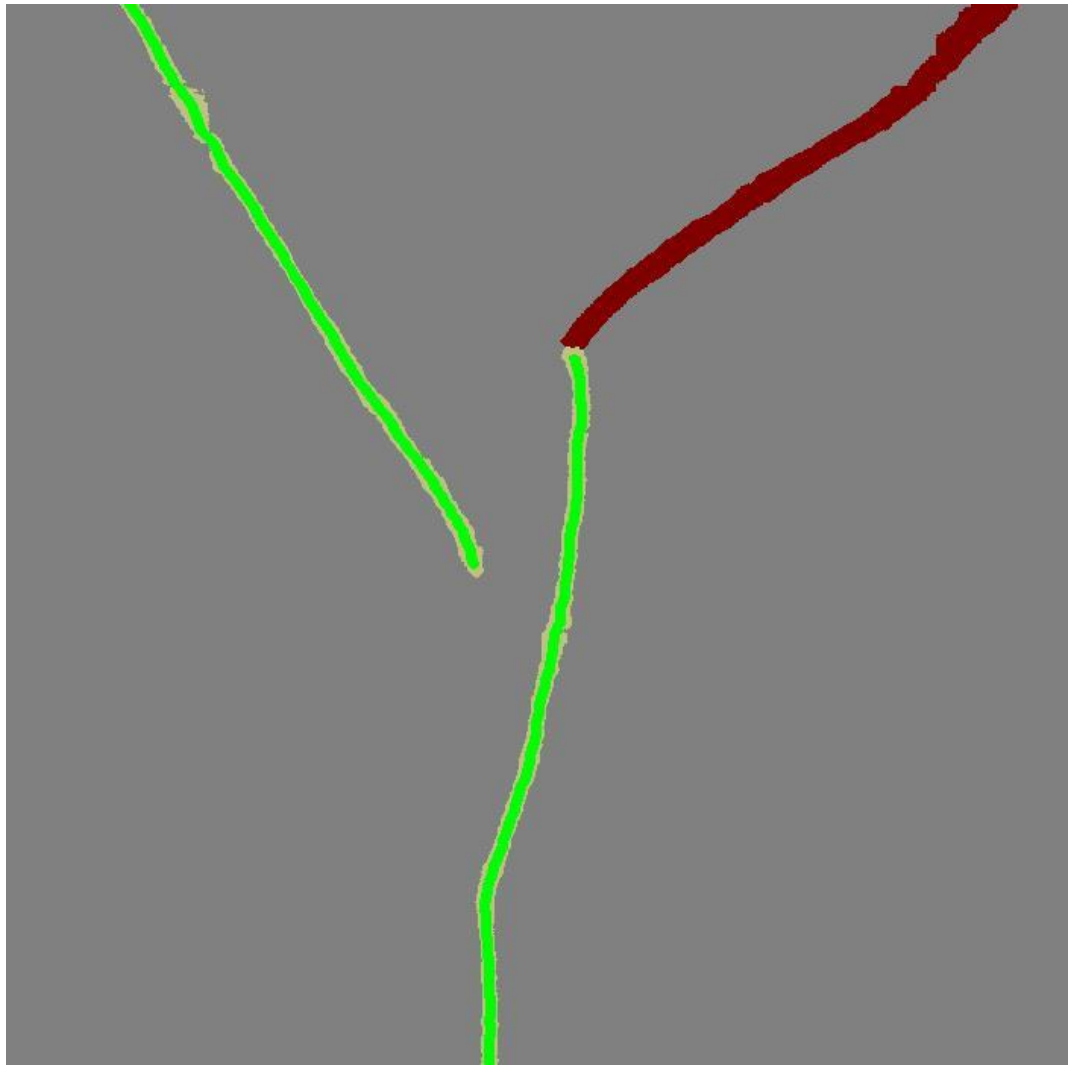




Proposed Method

(5) When the two endpoints are within each other's fan shape, connect only the single endpoint closest to the search target.





Experiment

To verify the effectiveness of the proposed method, we compared the number of fruiting mother shoots counted by the method that corrects only by pixel range, and that by our method.

The accuracy of fruiting mother shoots that are counted correctly can be expressed by the following formula.

$$\text{Accuracy} \uparrow = \frac{\text{Number of Corrections not Needed} + \text{Number of Corrected} \uparrow - \text{Number of False Corrected} \downarrow}{\text{Actual Total Number of Fruiting Mother Shoots}}$$

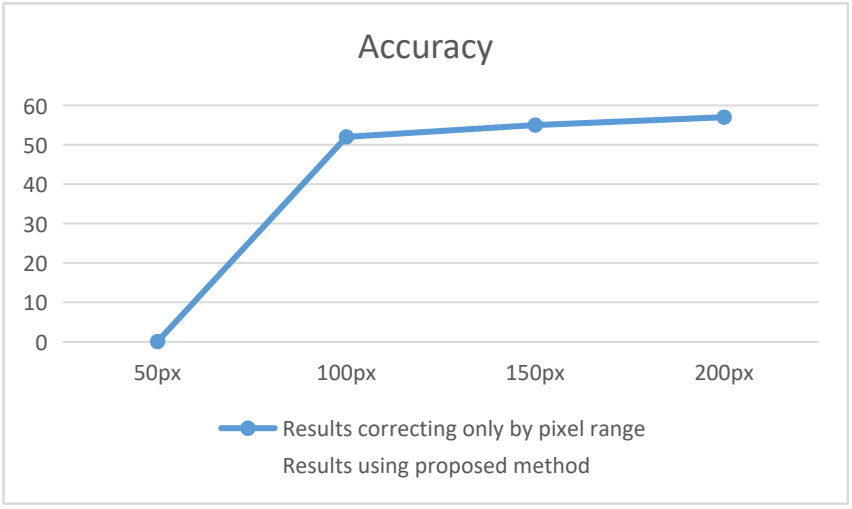
In this study, the radius threshold is set every 50px from 50px to 200px, and the angle is set every 20° from 20° to 60° for comparison.

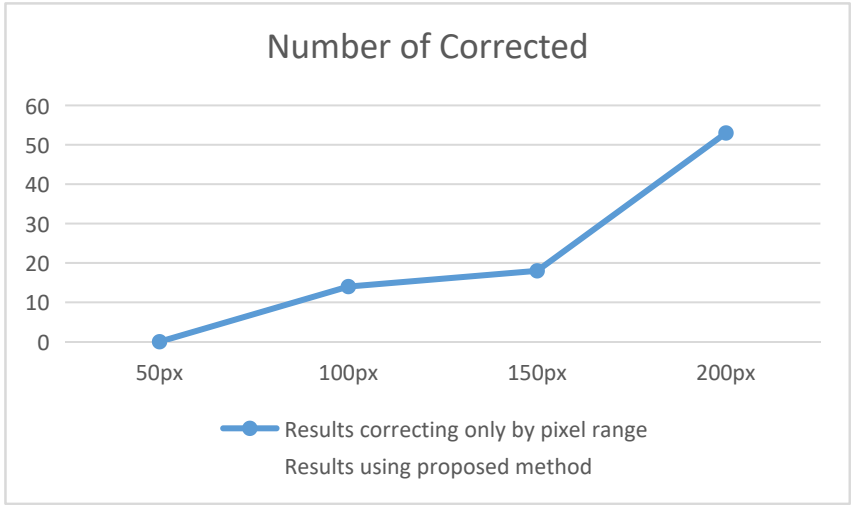
Experimental Results

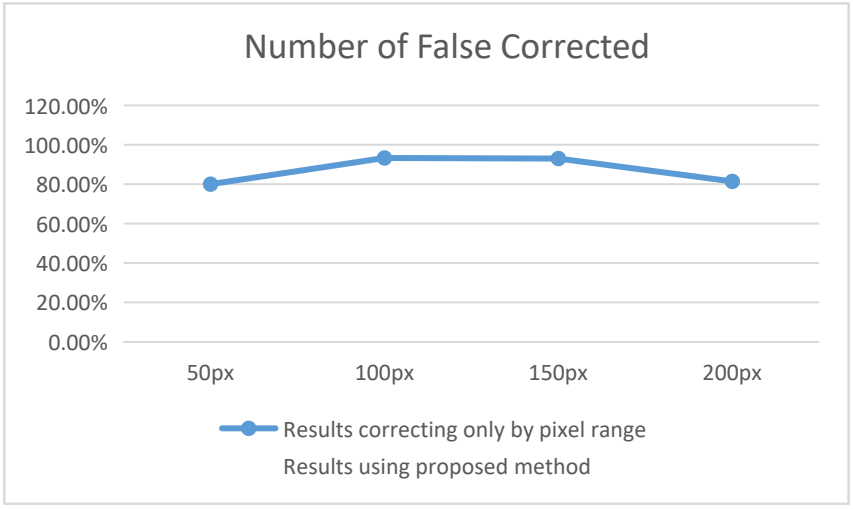
The numbers in the upper line of each row are the numbers of fruiting mother shoots that were successfully corrected. The numbers in parentheses are shoots that were corrected erroneously. The lower line in each row shows the accuracy.

Results correcting only by pixel range

50px	100px	150px	200px
0 (0) 80. 0%	52 (14) 93. 3%	55 (18) 93. 0%	57 (53) 81. 4%





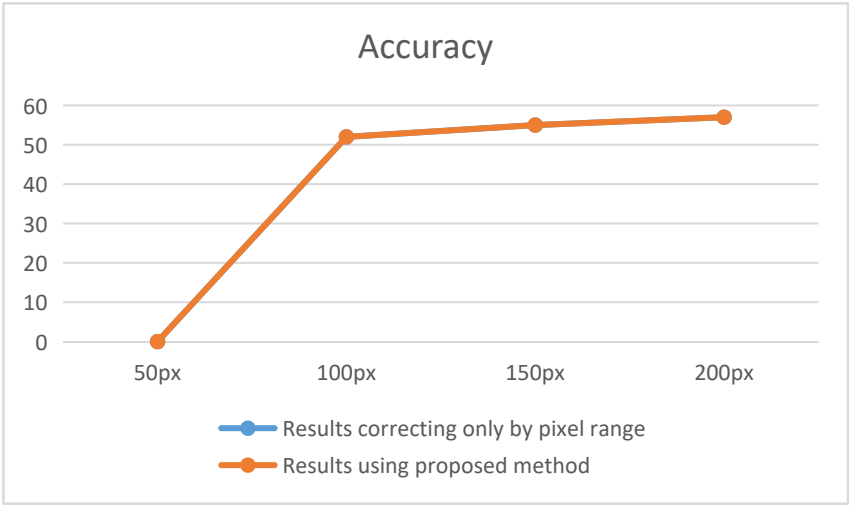


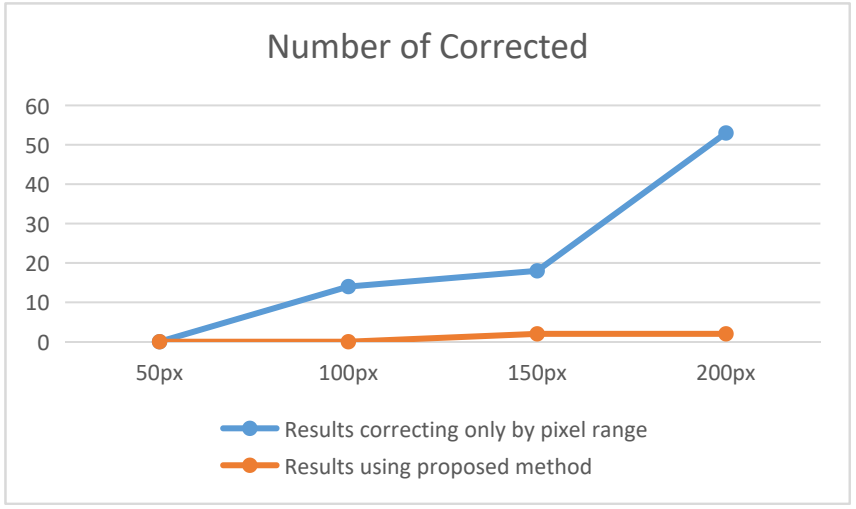
Experimental Results

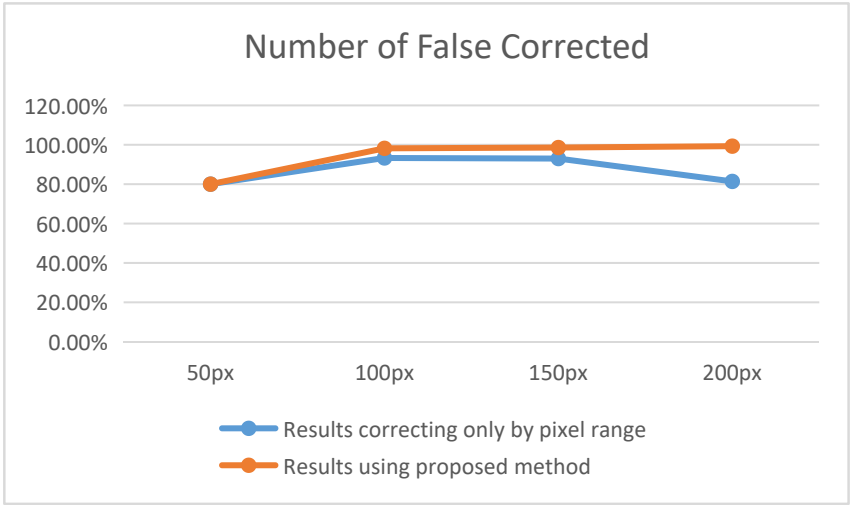
The numbers in the upper line of each row are the numbers of fruiting mother shoots that were successfully corrected. The numbers in parentheses are shoots that were corrected erroneously. The lower line in each row shows the accuracy.

Results using proposed method

	50px	100px	150px	200px
20°	0 (0) 80. 0%	44 (0) 95. 4%	47 (2) 95. 8%	49 (2) 96. 5%
40°	0 (0) 80. 0%	50 (0) 97. 5%	53 (2) 97. 9%	55 (2) 98. 6%
60°	0 (0) 80. 0%	52 (0) 98. 2%	55 (2) 98. 6%	57 (2) 99. 3%







Thank you for listening!