Feature Point Correction and Image Merging for Enhanced Branch Detection in Vineyard Drone Photography

ID: 60010

Authors: **YuJie Wu, Naoki Morita, Kenta Morita, Md Saidi Muhammad Ashraf Naim**

Presenter: YuJie Wu

E-mail: wyj13357889606@gmail.com

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Personal Profile

Name: YuJie Wu

E-mail: wyj13357889606@gmail.com

Graduated from Changzhou Technician College in Jiangsu Province, majoring in computer science and technology,2017.

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

Introduction

Vineyard Management Challenges

Brief overview of the complexities in managing vineyards effectively.

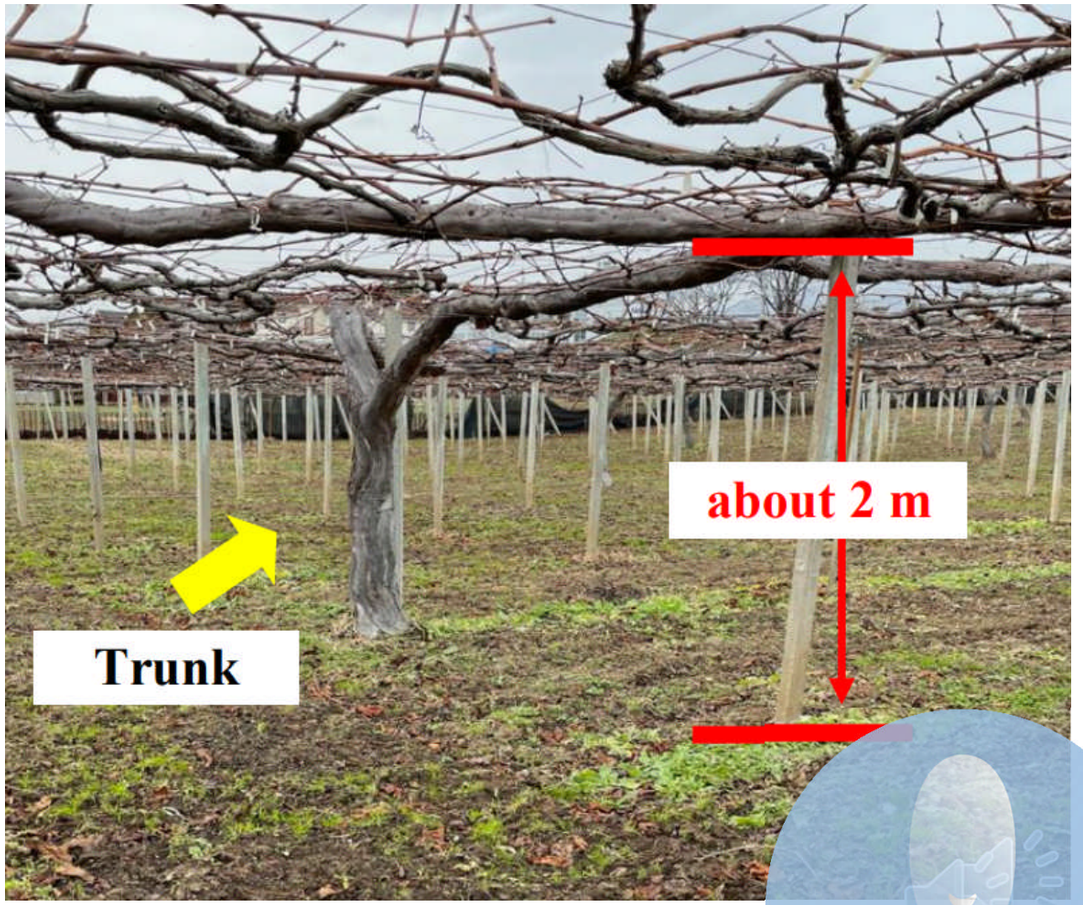


Figure1. Photograph of a grapevine in a vineyard in Japan.

1. Nirasaki-shi, Yamanashi, CUPOD FARM [Online]. Available from: https://www.cupidfarm.co.jp/ [accessed: 2023-12-1]

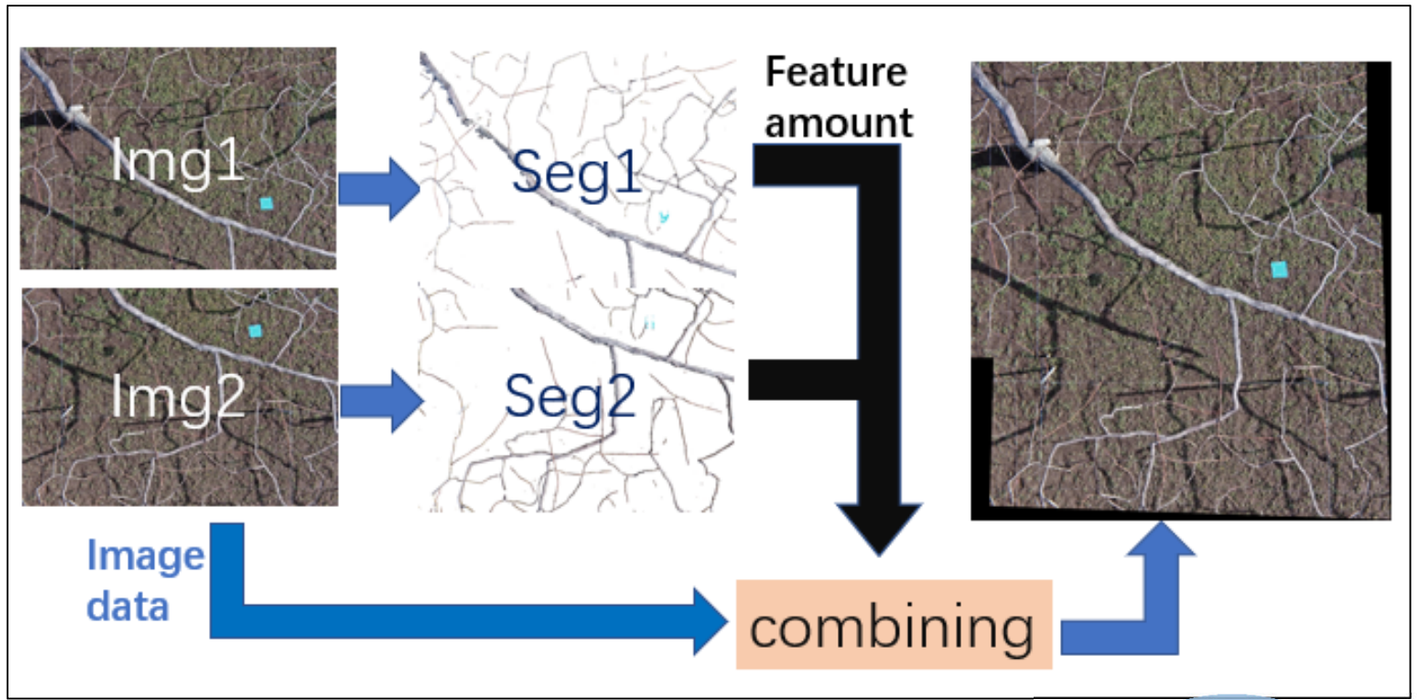
Introduction

Role of Drone Technology

Highlight the significance of drone technology in revolutionizing agricultural practices, particularly in vineyard monitoring.

Objective of the Study

To develop an improved method for feature point correction and image merging in vineyard drone photography.



1. Figure2 Method Proposed in Previous Research

Y. J. Wu, M. Wakao, N. Morita, and K. Morita, “A Method for Removing Shadows from Photos Taken with a Drone and Stitching the Photos Together,” in Proceedings of the GEOProcessing 2023: The Fifteenth International Conference on Advanced Geographic Information Systems, Applications, and Services, 2023.

Problem

Figure 3. Feature Point Pairs from Two Overlapping Aerial Photographs

Challenges in Current Methods

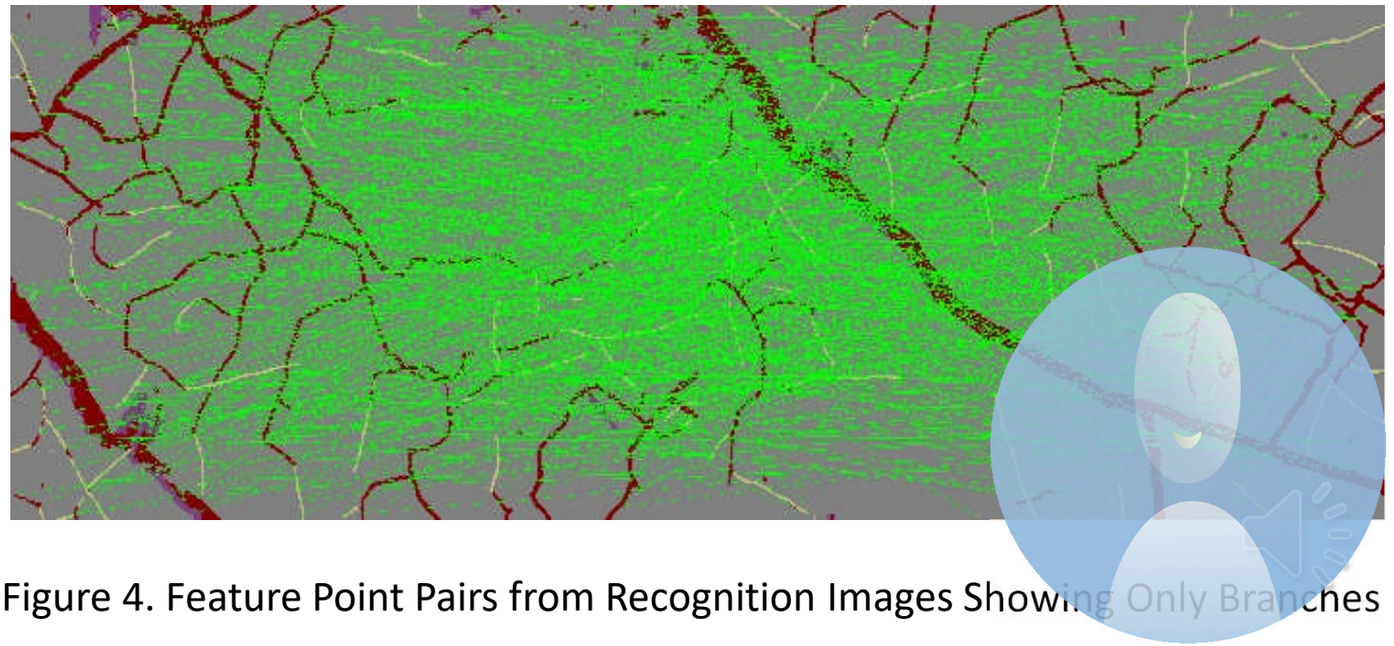


Figure 4. Feature Point Pairs from Recognition Images Showing Only Branches

Challenges in Current Methods

1.Accuracy in Feature Point Detection

1. Difficulty in precise feature point pairing across overlapping images.
2. Common issue of one-to-many feature point pairings leading to inaccuracies.

2.Image Merging Limitations

1. Ineffective image stitching fails to preserve original branch structure.
2. Results in a loss of crucial vine growth information, impacting analysis accuracy.

3.Impact on Vineyard Management

1. Hinder comprehensive monitoring and accurate capture of vine growth.
2. Impedes optimal management and decision-making processes in vineyards.

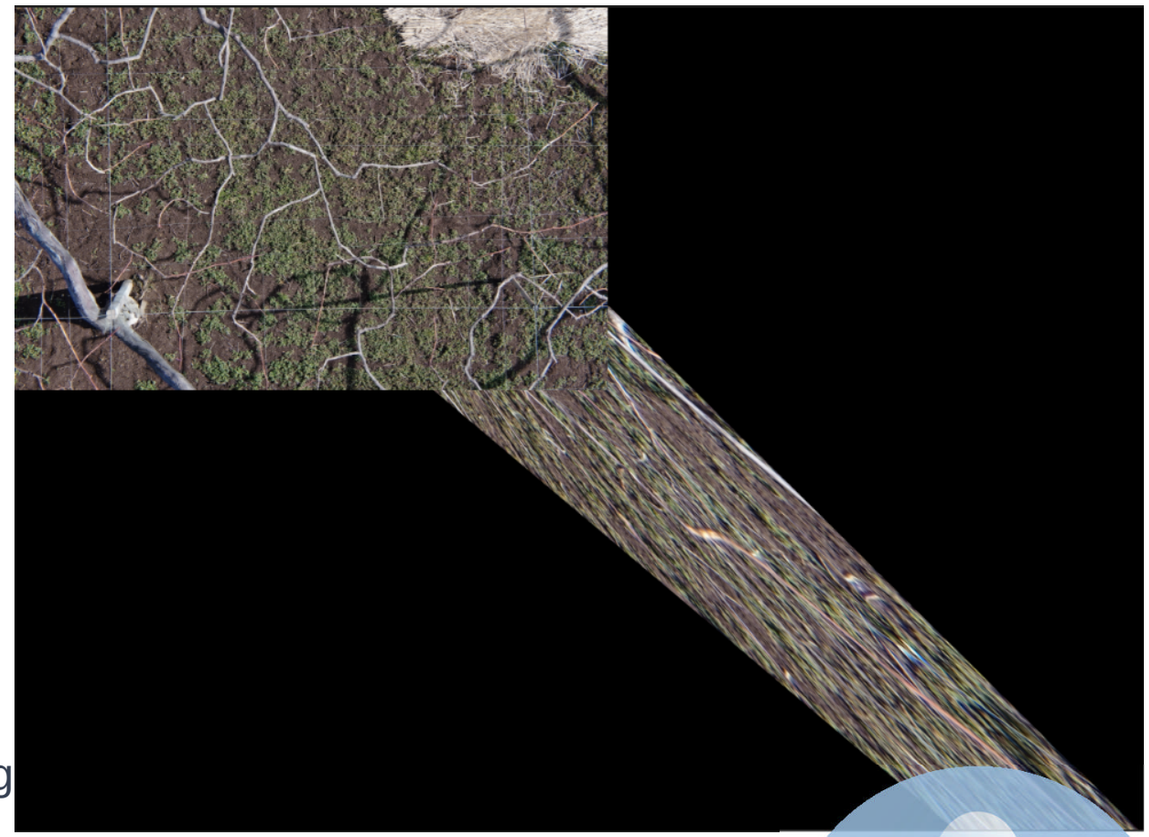
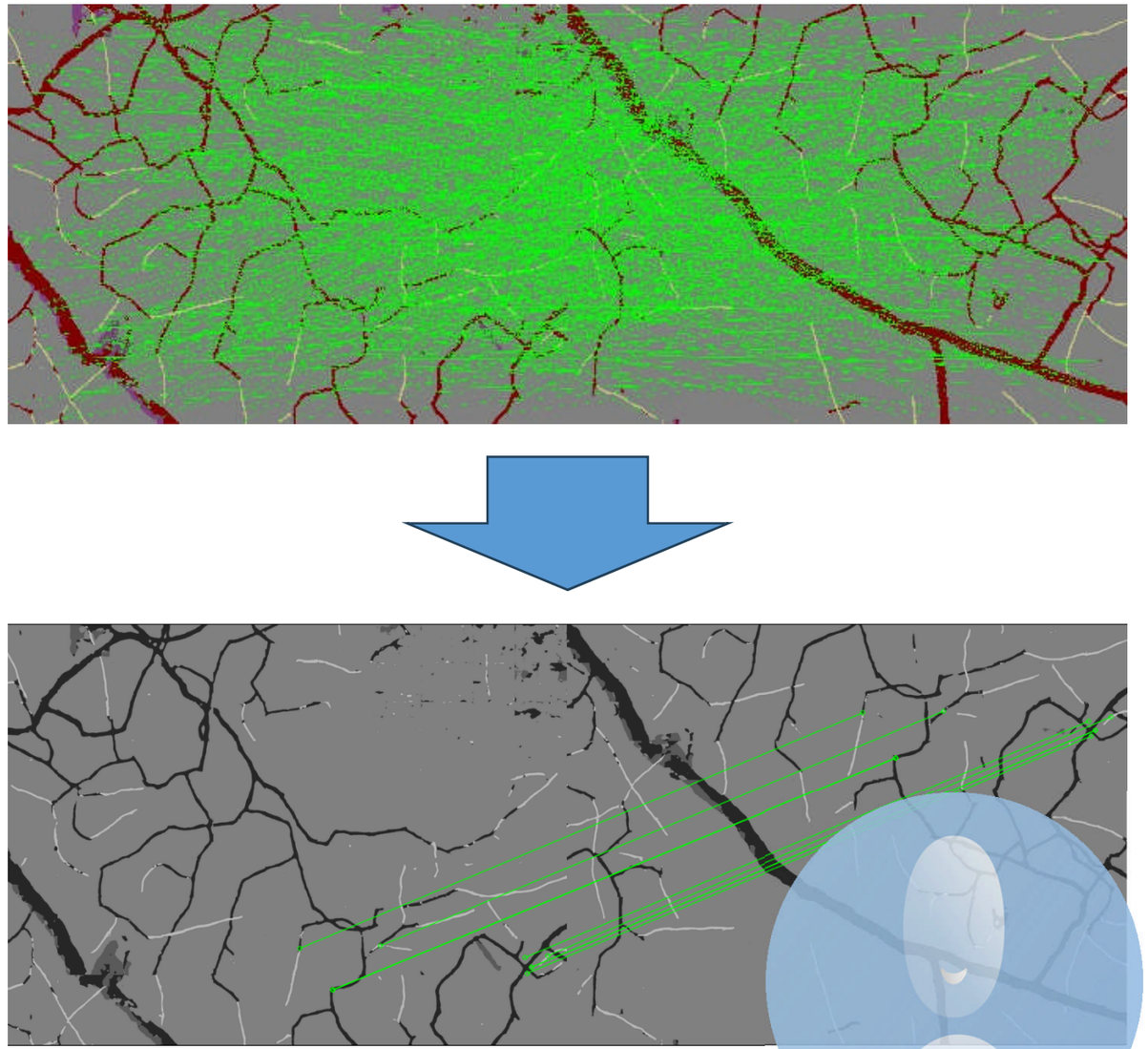


Figure 5. Merging Result Using Feature Point Pairs from Figure 4

Proposed Solution

1. **Innovative Approach**
    1. Introduction of a novel method for feature point correction and image merging.
2. **Key Objectives**
    1. Improve accuracy and reliability of branch detection in vineyard drone photography.
3. **Technological Advancements**
    1. Utilization of advanced algorithms and cutting-edge technology.
4. **Addressing Challenges**
    1. Solution aimed at mitigating issues related to shadowing and overlapping branches.
5. **Setting New Standards**
    1. Proposing a new benchmark for precision in agricultural drone imagery analysis.

Implementation Details



1.Feature Point Alignment

1. Utilization of translational movement characteristics for precise feature point alignment in overlapping images.

2.Selection Criteria

1. Emphasis on parallel alignment for selecting feature point pairs, improving image merging accuracy.

3.Computational Efficiency

1. Simplified approach to reduce computational complexity compared to traditional methods.

4.Technological Advancements

1. Integration of advanced algorithms to optimize image clarity and vine growth analysis.

5.Impact on Vineyard Management

1. Enhanced precision in agricultural monitoring, setting new standards in vineyard imagery analysis.

Experimental Setup

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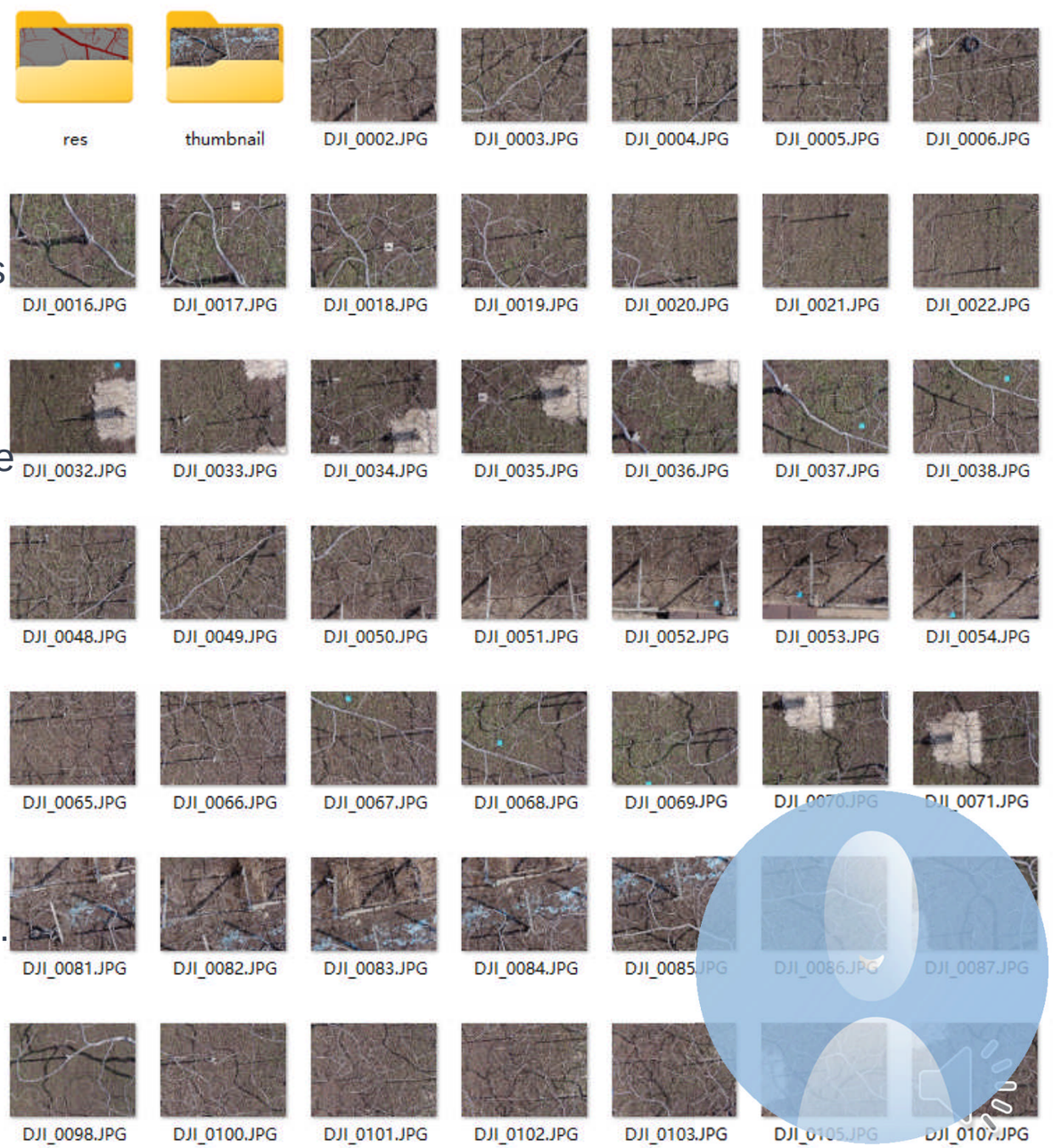

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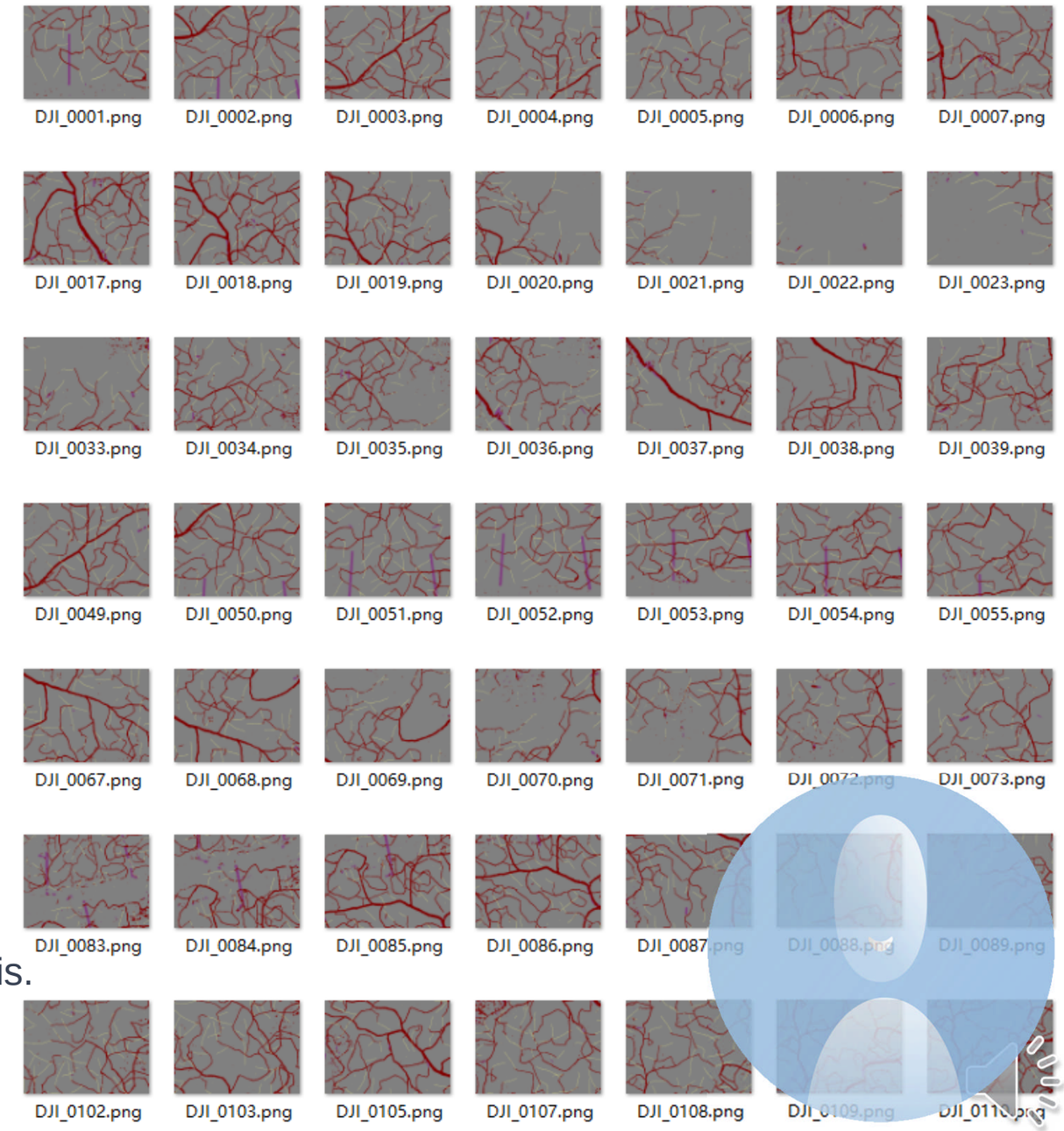

Results and Discussion

Trunk No.	No Misalignment	1-2 Branches	3-4 Branches	More	Merging Rate
1	14	47	54	67	7.69%
2	21	128	68	105	6.52%
3	21	97	50	109	7.58%
4	24	104	77	122	7.33%

RESULTS BY THE CONVENTIONAL METHOD

Trunk No.	No Misalignment	1-2 Branches	3-4 Branches	More	Merging Rate
1	159	10	6	7	87.36%
2	310	3	8	1	96.27%
3	269	4	2	2	97.11%
4	313	3	3	8	95.72%

RESULTS BY THE PROPOSED METHOD

Conclusion and Future Work

1.Algorithmic Efficiency

1. Explore enhancements in algorithm efficiency for feature point detection and image analysis.

2.AI and Machine Learning Integration

1. Investigate the use of artificial intelligence and machine learning to automate and refine the branch detection process.

3.Scalability and Adaptability

1. Assess the method's scalability and adaptability across various crops and environmental conditions.

4.Technological Advancements

1. Potential for new technologies to further improve precision agriculture practices.

Thank you for listening!