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Architecture Analysis of Rice Panicle using Deep Learning

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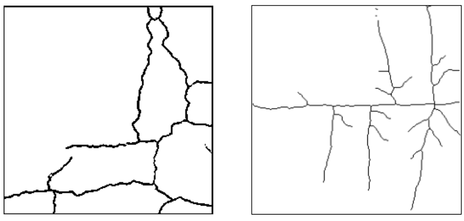
1 - Motivation

- Plant phenotyping involves the analysis of observable traits in plants, crucial for tasks like **breeding** and **yield optimization**.
- Rice panicle phenotyping [1] includes examining ecological features such as **panicle length** and **branch count**.
- Traditional methods for trait measurement and junction detection are **labor-intensive** and **time-consuming**.

Visual similarities between concrete cracks and rice panicles.

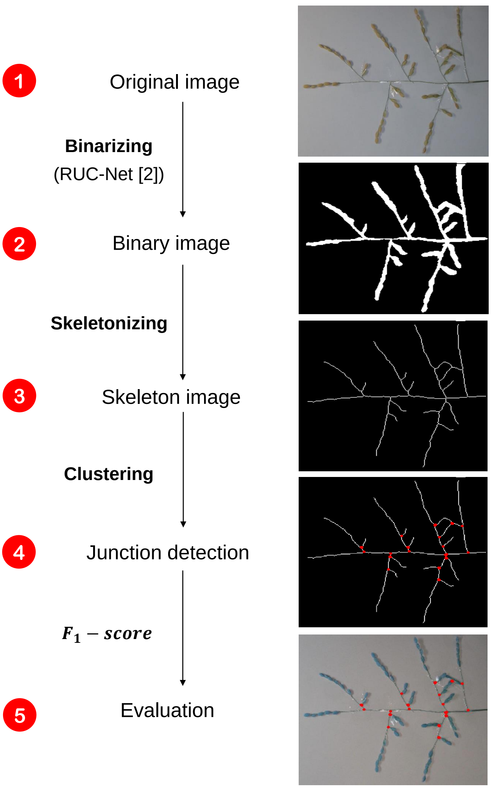


Concrete crack | Rice panicle

- We propose a cross-domain vision-based approach to **automatically detect rice panicle junctions**.
- Our method capitalizes on **similarities between concrete cracks and rice panicles**.

2 - Method

- We utilize a crack detection Deep Learning model named **RUC-Net** [2], together with **Clustering** and **Skeletonization** algorithms to effectively extract the desired junctions.
- The image processing procedure consists of the following steps:



Rice panicle junction detection process.

3 - Results

- We evaluate the accuracy of our proposed method using the $F_1 - score$, which is the harmonic mean of **precision** and **recall**.
- Obtained results show the optimal algorithm for each step.

Method	F_1	Precision	Recall
CN	**0.6946**	**0.7633**	**0.6491**
BWMORPH	0.6818	0.7022	0.6862
DBSCAN	0.6930	0.6447	0.5085

Quantitative results of participating Clustering algorithms.

Method	F_1	Precision	Recall
Z.S.	**0.6946**	**0.7633**	**0.6491**
Gradient	0.6304	0.7017	0.5824

Quantitative results of participating Skeletonization algorithms.

70%

4 - Conclusion

Contribution

Our proposed method, compared to **P-TRAP** [1], offers advantages in automatically detecting rice panicle junctions, addressing a crucial need in plant phenotyping.

Novelty

A **cross-domain** image-based approach utilizing Deep Learning and Machine Learning.

Future Work

- Fine-tuning participating algorithms for better accuracy.
- Extending to rice grains/spikelets detection.

Bibliography

[1] F. AL-Tam, H. Adam, A. d. Anjos, M. Lorieux, P. Larmande, A. Ghesqui`ere, S. Jouannic, and H. R. Shahbazkia, "P-trap: a panicle trait phenotyping tool," BMC Plant Biology, vol. 13, no. 1, p. 122, Aug 2013.
[2] G. Yu, J. Dong, Y. Wang, and X. Zhou, "Ruc-net: A residual-unet-based convolutional neural network for pixel-level pavement crack segmentation," Sensors, vol. 23, no. 1, 2023.

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