

THE 6TH CIGR INTERNATIONAL CONFERENCE 2024

ICC JEJU, KOREA

PROGRAM BOOK



CIGR 2024

DIGITAL
AGRICULTURE



MAY
19-23



Day 2, May 21 (Tue.) | Scientific Program

S7-4 Technical Section 7: Information Technology

08:30 - 09:45 Halla B (3F)

Chair(s): TAE-HYOUNG TOMMY GIM (Seoul National University)

S7-4-01

08:30-08:45

Development of a detection model for seedling weeds at different growth stages

Author HARIN JANG (Seoul National University)

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CHANG-HYUP LEE (Seoul National University)
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GYUMIN KIM (Seoul National University)
GHISEOK KIM (Seoul National University)

S7-4-02

08:45-09:00

WeedNet: An accurate and robust weed management framework for enhanced small object detection

Author ZHEWANG ZHANG (Chonnam National University)

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ANQI LIU (Chonnam national University)
ÖMER FARUK INCE (Chonnam national University)

S7-4-03

09:00-09:15

~~On-field grading of strawberries with deep learning-based occlusion handling~~

Author SIJAN KARKI (GYEONGSANG NATIONAL UNIVERSITY)

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S7-4-04

09:15-09:30

Deep learning-based phenotyping data fusion: detecting basil's drought stress responses using 3D-CNN

Author YUJIN JEON (Kyunghee University)

S7-4-05

09:30-09:45

Development of internal and external quality measuring technology of chestnuts using spectroscopy, RGB images, and deep learning

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WeedNet: An Accurate and Robust Weed Management Framework for Enhanced Small Object Detection

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Abstract

This research addresses the critical challenge of weed management in agriculture through an innovative pipeline leveraging customized YOLOv7^[1] and Slicing Aided Hyper Inference (SAHI)^[2] algorithms. The focus on small weed detection is facilitated by the lightweight SAHI library, enhancing object detection and instance segmentation. Morphological operations within detection bounding boxes refine weed masks, enabling precise localization.

We estimate weed growth points using the center of gravity, further enhancing accuracy. Leveraging RGBD sensors provides absolute depth information, allowing us to determine the world coordinates of weed growth points. This spatial precision enables targeted interventions such as laser ablation or spray-based treatments, thereby optimizing crop productivity.

Our dataset, generated in diverse field conditions, validates the efficacy of the proposed approach. Results demonstrate an 87.5% accuracy for weed detection. The estimation of weed growth points achieves a remarkable 94% accuracy, showcasing the effectiveness of our methodology in advancing precision agriculture practices. This research contributes to the optimization of resource utilization and environmental sustainability in weed management.

Keywords: Weed Detection, small object detection, weed growth point estimation, slicing aided hyper inference, YOLOv7.

Acknowledgments

This work was supported by Korea Institute of Planning and Evaluation for Technology in Food, Agriculture and Forestry(IPET) through the Open Field Smart Agriculture Technology Short-term Advancement Program, funded by Ministry of Agriculture, Food and Rural Affairs(MAFRA)(32203703) and through the Advanced Production Technology Development Program, funded by Ministry of Agriculture, Food and Rural Affairs(MAFRA)(31809403).

Reference

- [1] Wang C Y, Bochkovskiy A, Liao H Y M. YOLOv7: Trainable bag-of-freebies sets new state-of-the-art for real-time object detectors[C]//Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition. 2023: 7464-7475.
- [2] Cagatay Akyon F, Onur Altinuc S, Temizel A. Slicing Aided Hyper Inference and Fine-tuning for Small Object Detection[J]. arXiv e-prints, 2022: arXiv: 2202.06934.

Figure/images

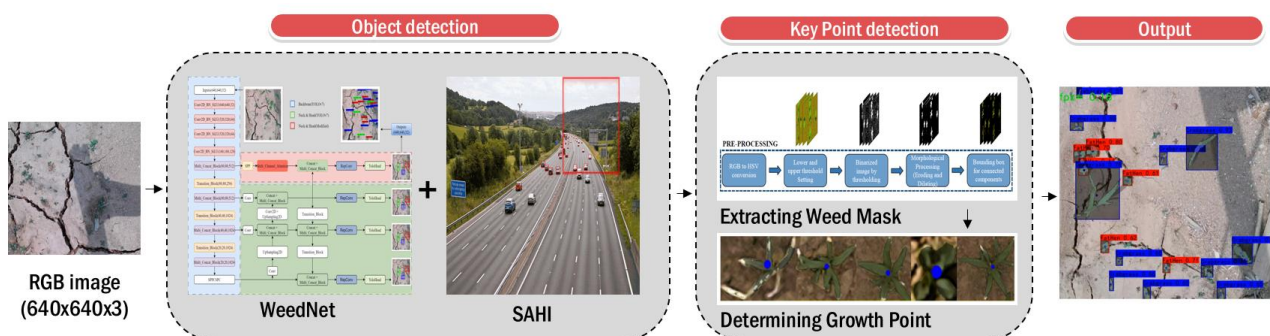


Fig. 1 Overview of the methodology

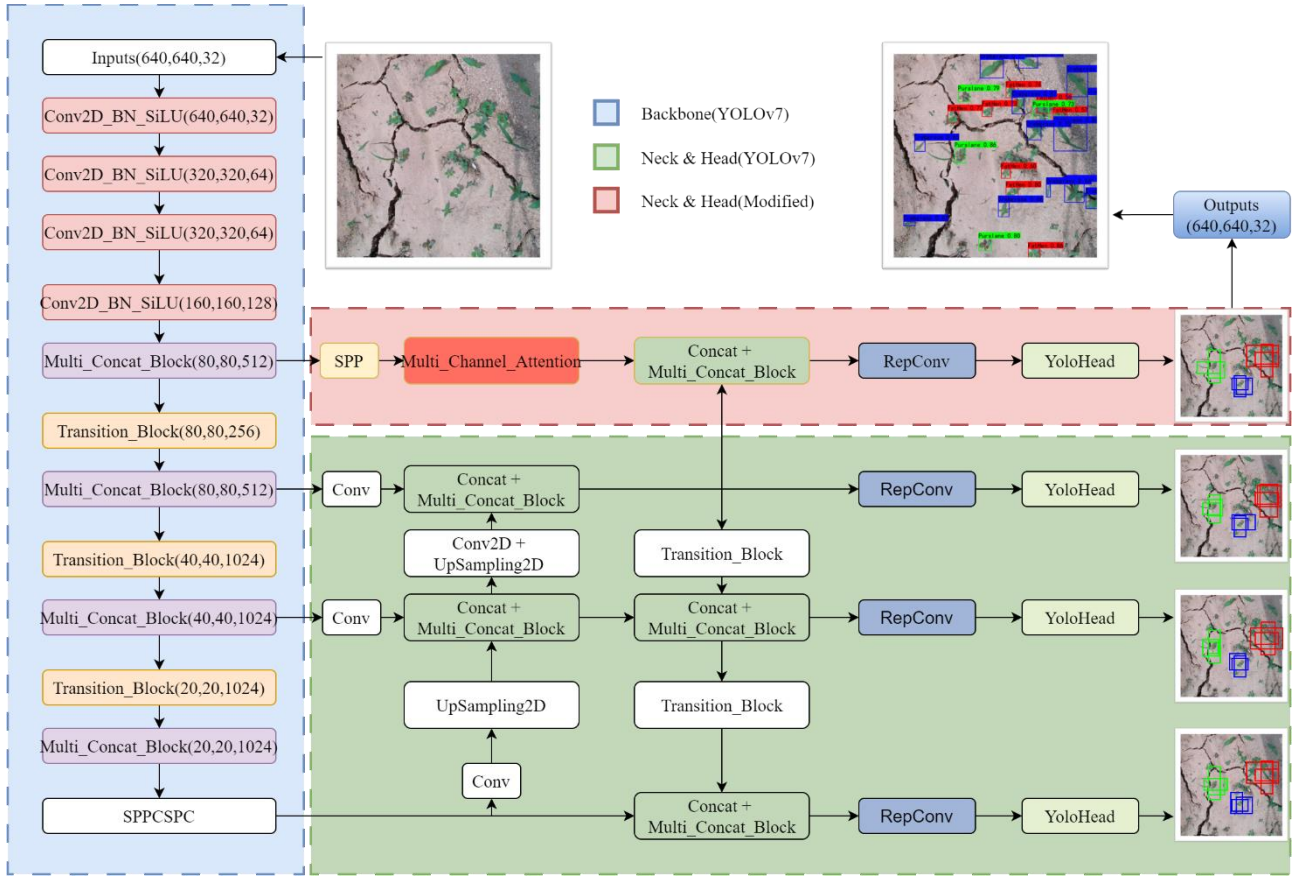


Fig. 2 Network architecture of WeedNet