Lettuce Deficiency Detection Utilizing Deep Learning

CSE 478

Neural Network and Fuzzy Systems lab

Project Report

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Chapter Two

0.1 Background Study

Jinzhu et al [3] study collected images of lettuce from different growth stages, including nutrient-deficient groups, and performed feature extraction analysis using traditional algorithms (k-nearest neighbor, support vector machine, random forest) and lightweight deep-learning models (ShuffleNet, SqueezeNet, MobileNetV2) .The experiment showed that the random-forest algorithm with color feature extraction had the best recognition results, with an accuracy rate of 97.6% .The deep-learning models also achieved high accuracies, with ShuffleNet performing the best at above 99.8% .The proposed method could quickly identify trace element deficiencies in lettuce and provide technical support for disease patrol robots in plant factories .

Hamidon et al [2]The study started with seed germination and seedling growth process to acquire lettuce images for detecting defective lettuce seedlings.Data curation procedures were performed, including cleaning, splitting, augmentation, and format conversion.Several state-of-the-art deep learning algorithms were used for seedling detection, including CenterNet, YOLOv5, YOLOv7, and faster R-CNN.Their accuracy was not good as well.

Valenzuela et al [5]The system consisted of two parts: digital image processing for feature extraction and a backpropagation artificial neural network for self-learning classification. The authors collected 253 images, using 70% for training, 15% for validation, and 15% for testing.The developed system has achieved a minimum relative error of 0.051 in classifying the quality of lettuce. The methodology of the paper includes image acquisition, image processing, artificial neural network, and crop quality classification.

Rodrigo & ARSP [4] proposed a method to identify nutrient deficiencies in greenhouse lettuce using explainable AI. The method was based on a combination of a YOLOv3 object detection model and the TensorFlow Inference Engine. The YOLOv3 model was trained to detect three common nutrient deficiencies in greenhouse lettuce: calcium, nitrogen, and magnesium. The TensorFlow Inference Engine was used to provide explainable results by mapping the predictions of the YOLOv3 model to a local knowledge base of deficiencies. The author evaluated the proposed method on a custom dataset of greenhouse lettuce images and achieved a mean average precision of 75.53%.

Jinzhu and Peng [3] proposed a machine vision-based approach to identify trace element deficiencies in lettuce plants. They discussed the challenges of identifying trace element deficiencies in lettuce plants and explained how the proposed method addressed these challenges. The proposed method was evaluated on a dataset of lettuce images, and it achieved an accuracy of 99.8%. The proposed method used a combination of traditional algorithms and lightweight deep-learning models to identify trace element deficiencies in lettuce plants, including KNN, SVM, and random forest.

Hamidon and Ahamed (2022) [1] proposed a CNN to detect tip-burn stress on lettuce in indoor farms. The CNN achieved 98% accuracy on the test set, outperforming other state-of-the-art methods. This method had the potential to be used to develop a real-time system for detecting tip-burn stress on lettuce, which could have helped farmers reduce crop losses.

References

[1] Munirah Hayati Hamidon and Tofael Ahamed. Detection of tip-burn stress on lettuce grown in an indoor environment using deep learning algorithms. *Sensors*, 22(19):7251, 2022.

[2] Munirah Hayati Hamidon and Tofael Ahamed. Detection of defective lettuce seedlings grown in an indoor environment under different lighting conditions using deep learning algorithms. *Sensors*, 23(13):5790, 2023.

[3] Jinzhu Lu, Kaiqian Peng, Qi Wang, and Cong Sun. Lettuce plant trace-element-deficiency symptom identification via machine vision methods. *Agriculture*, 13(8):1614, 2023.

[4] ARSP Rodrigo. *Deficiency Identification of Greenhouse Lettuce using Explainable AI*. PhD thesis, 2021.

[5] Ira C Valenzuela, John Carlo V Puno, Argel A Bandala, Renann G Baldovino, Robert G De Luna, Anton Louise De Ocampo, Joel Cuello, and Elmer P Dadios. Quality assessment of lettuce using artificial neural network. In *2017IEEE 9th International Conference on Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment and Management (HNICEM)*, pages 1–5. IEEE, 2017.