

Weed Recognition System for Low-Land Rice Precision Farming Using Deep Learning Approach



Olayemi Mikail Olaniyi, Emmanuel Daniya,
Ibrahim Mohammed Abdullahi, Jibril Abdullahi Bala,
and Esther Ayobami Olanrewaju

Abstract Precision farming helps to achieve maintainable agriculture, with an objective of boosting agricultural products with minimal negative impact on the environment. This paper outlines a deep learning approach based on Single Shot multibox Detector (SSD) to classify and locate weeds in low-land rice precision farming. This approach is designed for post-emergence application of herbicide for weed control in lowland rice fields. The SSD uses VGG-16 deep learning-based network architecture to extract a feature map. The adoption of multiscale features and convolution filter enables the algorithm to have a considerable high accuracy even at varying resolutions. Using SSD to train the weed recognition model, an entire system accuracy of 86% was recorded. The algorithm also has a system sensitivity of 93% and a precision value of 84%. The trained SSD model had an accuracy of 99% for close-up high definition images. The results of the system performance evaluation showed that the trained model could be adopted on a real rice farm to help reduce herbicide wastage and improve rice production with low chemical usage.

Keywords Precision agriculture · Deep learning algorithm · SSD · Google TensorFlow · Low-land rice

O. M. Olaniyi (✉) · I. M. Abdullahi · E. A. Olanrewaju
Department of Computer Engineering, Federal University of Technology, Minna, Nigeria
e-mail: mikail.olaniyi@futminna.edu.ng

I. M. Abdullahi
e-mail: amibrahim@futminna.edu.ng

E. A. Olanrewaju
e-mail: esteey22@gmail.com

E. Daniya
Department of Crop Production, Federal University of Technology, Minna, Nigeria
e-mail: emma.daniya@futminna.edu.ng

J. A. Bala
Department of Mechatronics Engineering, Federal University of Technology, Minna, Nigeria
e-mail: jibril.bala@futminna.edu.ng

© Springer Nature Switzerland AG 2021
T. Masrour et al. (eds.), *Artificial Intelligence and Industrial Applications*,
Advances in Intelligent Systems and Computing 1193,
https://doi.org/10.1007/978-3-030-51186-0_27