Editorial Preface

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Humankind is now challenged by the unprecedented compounding crises of pandemic, climate change, and food crisis. Smart farming could alleviate the food crisis by increasing the crop yields through the use of information and communication technologies (ICT). This is also in line with the United Nation's Sustainable Development Goal (SDG) 2 : Zero Hunger, i.e. to end hunger, achieve food security and improved nutrition, and promote sustainable agriculture. This special issue aims to share with the readers the latest advancements in the smart farming technologies, focusing on Artificial Intelligence (AI) and Internet-of-Things (IoT). Farming related data that are collected through IoT can be processed, analysed, and made full use of by AI. Through this special issue, we envision how AI-empowered IoT can possibly change the landscape of farming.

The first paper is on the classification of leaf diseases using a Convolutional Neural Network (CNN). Implementing AI effectively in smart farming poses several challenges. One particular challenge involves optimizing algorithms to accurately classify plant diseases. In this paper, the authors propose a CNN specifically designed for leaf disease classification. The CNN framework utilizes the Depthwise Separable Convolution (DWS) technique, which involves two stages : depthwise and pointwise feature extractions. Comparison with the traditional approach reveals that the proposed model outperforms the conventional CNN model in terms of recall, F1 score, and test accuracy.

The second paper also leverages on the power of AI in image classification, but on a different application. The authors have developed an application that is capable of classifying the ripeness of oil palm fresh fruit bunches (FFBs). The paper proposes a YOLOv5s model for detecting and classifying oil palm FFB ripeness. Their study shows that with label smoothing and image augmentation techniques such as Mosaic and Cut-Out, the performance of YOLOv5s can be further improved. The proposed technique can be implemented on a mobile device, enabling remote monitoring of the harvesting process in oil palm estates. The harvesting process of palm fruits can become more efficient and less labour intensive as a result.

The third paper is more concerned with food safety. Its objective is to develop a portable and cost-effective scanner capable of real-time detection of melamine, a harmful substance added to agricultural staples and animal feed in order to increase the protein level. The authors have conducted experiments at the frequency ranges of 220-330 GHz, 2 THz, 2.26 THz, and 4 THz. They have assessed the properties and response of melamine and its mixtures using the Fourier-transform infrared spectroscopy (FTIR) and ultra-performance liquid chromatography (HPLC) techniques. The ultimate goal is to implement a portable detection system of melamine.

The fourth paper is about the implementation of a wireless sensor network (WSN) for plants monitoring in smart agriculture. This work aims to enhance the WSN coverage and conserve the battery power of the wireless transceivers. To be specific, the authors have formulated the WSN topology as an optimization problem, and then applied the Adaptive Differential Evolution (ADE) algorithm to solve the problem.

As the Chinese saying goes, "casting a brick to attract jade". We hope that these four articles can induce more research works in smart farming.