2.5.1 - Does your university as a body provide access on food security and sustainable agriculture and aquaculture knowledge, skills or technology to local farmers and food producers?

The research team at Imam Ja'afar Al-Sadiq University has worked extremely hard to empowers local farmers and food producers with the knowledge and abilities necessary for food security, sustainable farming, and aquaculture technologies. These efforts are part of a larger effort to create a sustainable food industry and environment. For instance, a researcher from the university has developed a modern deep learning framework in robot vision for automated bean leaves diseases detection.

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REGULAR PAPER

A modern deep learning framework in robot vision for automated bean leaves diseases detection

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Abstract
The bean leaves can be affected by several diseases, such as angular leaf spots and bean rust, which can cause big damage to bean crops and decrease their productivity. Thus, treating these diseases in their early stages can improve the quality and quantity of the product. Recently, several robotic frameworks based on image processing and artificial intelligence have been used to treat these diseases in an automated way. However, incorrect diagnosis of the infected leaf can lead to the use of chemical treatments for normal leaf thereby the issue will not be solved, and the process may be costly and harmful. To overcome these issues, a modern deep learning framework in robot vision for the early detection of bean leaves diseases is proposed. The proposed framework is composed of two primary stages, which detect the bean leaves in the input images and diagnosing the diseases within the detected leaves. The U-Net architecture based on a pre-trained ResNet34 encoder is employed for detecting the bean leaves in the input images captured in uncontrolled environmental conditions. In the classification stage, the performance of five diverse deep learning models (e.g., Densenet121, ResNet34, ResNet50, VGG-16, and VGG-19) is assessed accurately to identify the healthiness of bean leaves. The performance of the proposed framework is evaluated using a challenging and extensive dataset composed of 1295 images of three different classes (e.g., Healthy, Angular Leaf Spot, and Bean Rust). In the binary classification task, the best performance is achieved using the Densenet121 model with a CAR of 98.31%, Sensitivity of 99.03%, Specificity of 96.82%, Precision of 98.45%, F1-Score of 98.74%, and AUC of 100%. The higher CAR of 91.01% is obtained using the same model in the multi-classification task, with less than 2 s per image to produce the final decision.

Keywords Deep learning · U-Net architecture · Bean leaves diseases · Transfer learning · Robot vision · ResNet34 model

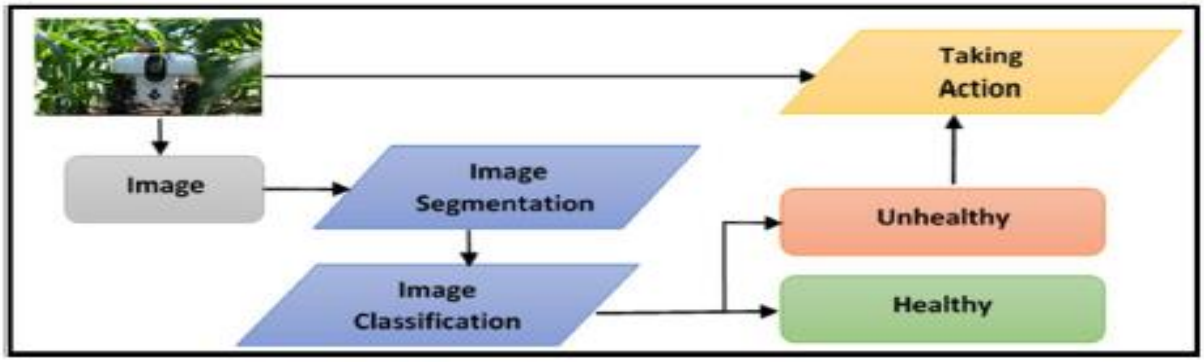

Fig. 1 The proposed method of identifying plants' healthiness and taking action

Every year, Imam Ja'afar Al-Sadiq University sponsors a number of lectures, events, or workshops to advance food and agriculture education, encourage ethical fish consumption, advance aquaculture environments and safety technologies, advance public health, the environment, and food safety, regulate the quality of agricultural and fishery products, and improve ethical conduct and the standard of environmental preservation within the industries.