Project Abstract

Project Title:	Improving Wheat Breeding Process' Efficiency, using AI and a Deep Scanning Model	
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The germplasm evaluation for Fusarium Head Blight (FHB) resistance in breeding programs is currently prone to human error and is time-consuming. Our overall goal for this project is to improve the FHB screening process's efficiency and accuracy, leading to a faster screening of breeding lines in the field and to improve the early detection in the lab, using innovative approaches combined with artificially intelligent (AI) technologies.

Project objectives

(1) Implement an intelligent Deep Scanning (DS) system to capture images from an optimum close-up to improve the FHB detection rates.
(2) Develop an algorithm/model using AI and DS data to enhance the Unmanned Arial Vehicle (UAV) reliability on FHB detection.
(3) Evaluate, calibrate, and validate the developed algorithm/model and improve the aerial-based phenotyping efficiency.

In the Deep Scanning **(**DS) system, cameras will collect detailed phenotyping data and information from all around the wheat spikes. In this system, the initial collected data will be used to optimize the close-up to capture quality images of the canopy both in the greenhouse and in the field. In this method, the DS system will provide multispectral images of every side of the target plants (1m row) to minimize occlusions and maximize the quality of images and the detection rate of the disease (FHB). A deep convolutional neural network (DCNN) will be developed and trained to detect the problematic areas from the location-tagged multi-view multispectral images of plants (DCNNs have been widely used for object-detection and image-recognition tasks).

We will also utilize a UAV with a multispectral camera to scan the plants and subsequently calibrate the collected images against the ground-based DS system. This comparison of the DS data and the UAV data will improve the algorithms to enhance the UAV reliability on FHB detection. The outcomes of this project will improve the efficiency, accuracy, and capability of breeding and pathology programs in screening wheat germplasm for FHB resistance. Later on, the techniques will be expanded to durum and barley.