Photo GRID: A Graphic Tool to Process Aerial Images for High-Throughput Phenotyping

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Problems

Aerial images have shown their great potential in high-throughput phenotyping, being able to save considerable manual work in the field investigation and accelerate the breeding process. However, to define the area of interest (AOI) from an image, it usually requires intensive time and effort from researchers. The existing analytical software either ask users to draw the area manually or request stringent-defined files before carrying out any further analyses. In this work, we're presenting a python package, GRID (GReenField Image Decoder), that is designed to alleviate above challenges in this type of analyses.

Objectives

Precision

Define area of interest with less background noise including shaded areas.

Efficiency

Increase the efficiency by providing several built-in algorithms that are commonly used in image analyses.

Interactive

Wrap the workflow into an intuitive graphical user interface (GUI). From this GUI, users can interactively preview the results given different settings in real-time.

Methods/Interface

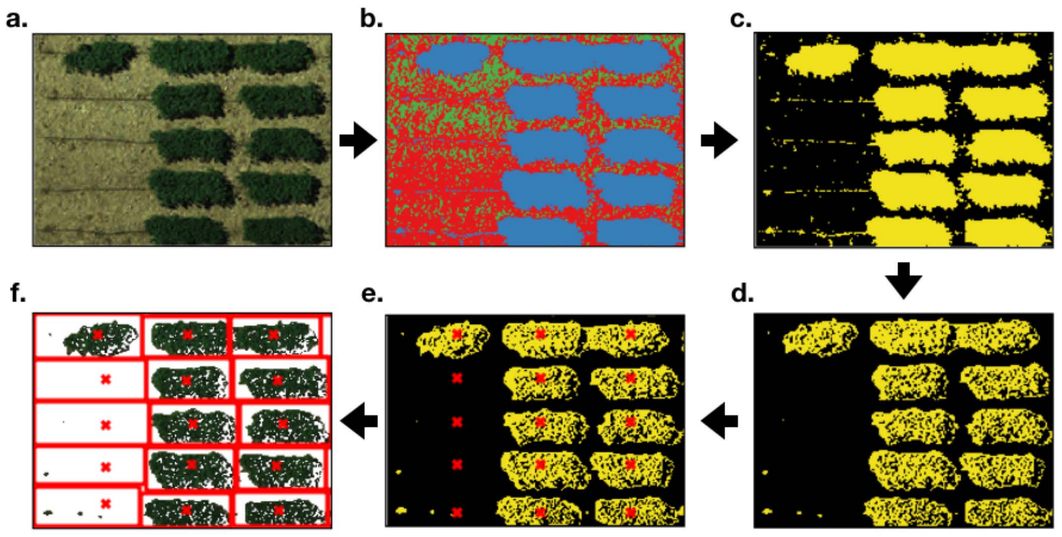

Figure 1a. Raw image of alfalfa canopy; **1b.** Pixel-wise clustering by k-mean clustering; **1c.** Assign clusters as vegetation area based on the cluster centers; **1d.** Remove background noise and shaded area by 2-d convolutional operations; **1e.** Find all the local maxima by comparisons of neighboring values; **1f.** Dynamically expand the boundaries from its local maximum point.

Figure 2. Interface of GRID.

Results / Conclusions

To show the performance of GRID, we used number of AOI pixels as predictions on alfalfa biomass from an aerial image (fig. 1a). The AOI defined manually (in QGIS) took around 6 hours to finish and have mild accuracy (R^2=0.47). Whereas one made by GRID only took seconds and produced much more accurate results (R^2=0.7). Hence, GRID can not only save researchers' time but achieve more convincing results.

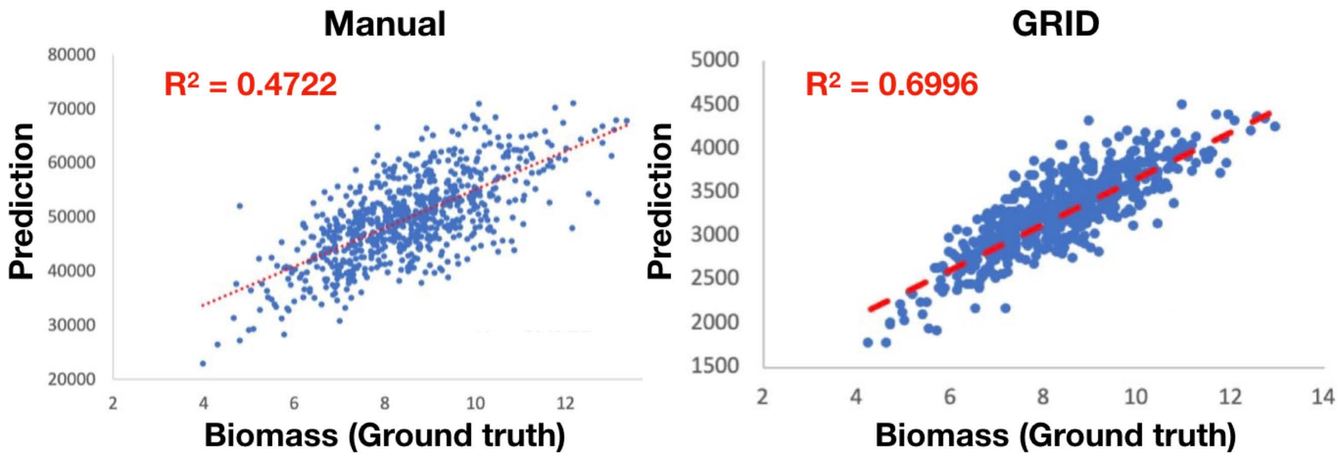

Figure 3. Correlation between alfalfa biomass and prediction learned from manually-defined (Left) and GRID-defined AOI (Right).

Reference

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