EC601 Fall 2021—Detection and elimination of shadows in multispectral images

Zachary Halvorson (zthalv@bu.edu)

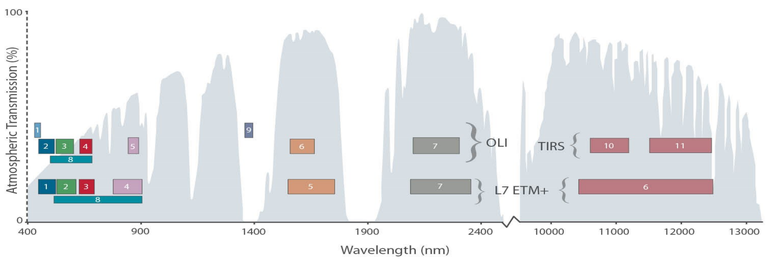
Boston University College of Engineering

MOTIVATION

- Drone-based agricultural photography is a valuable tool for research and industrial crop management
- Shadows (from buildings, trees, and/or clouds) influence camera readings, and thus, final plant health metrics
- The goal of this project is to develop a pipeline for standardized batch processing of drone aerial photographs

BACKGROUND

- Multispectral imaging refers to the use of wavelength filtered optical sensors to acquire measurements as images over spectral bands
- Ranges from UV to NIR, with some satellite systems expanding into long wavelength IR



- Shadows have distinct spectral characteristics, pointing to unique methods for detecting and eliminating shadows when compared to RGB images only

PROJECT STRUCTURE

Pipeline successfully implemented:

1. File selection and output preparation
2. Image alignment pre-processing
3. Shadow detection by false color RG(NIR) image

$$Ratiomap = \frac{Saturation - Intensity}{Saturation + Intensity}$$

4. Shadow elimination using binary shadow mask
5. Normalized Difference Vegetation Index computed for a plant health metric

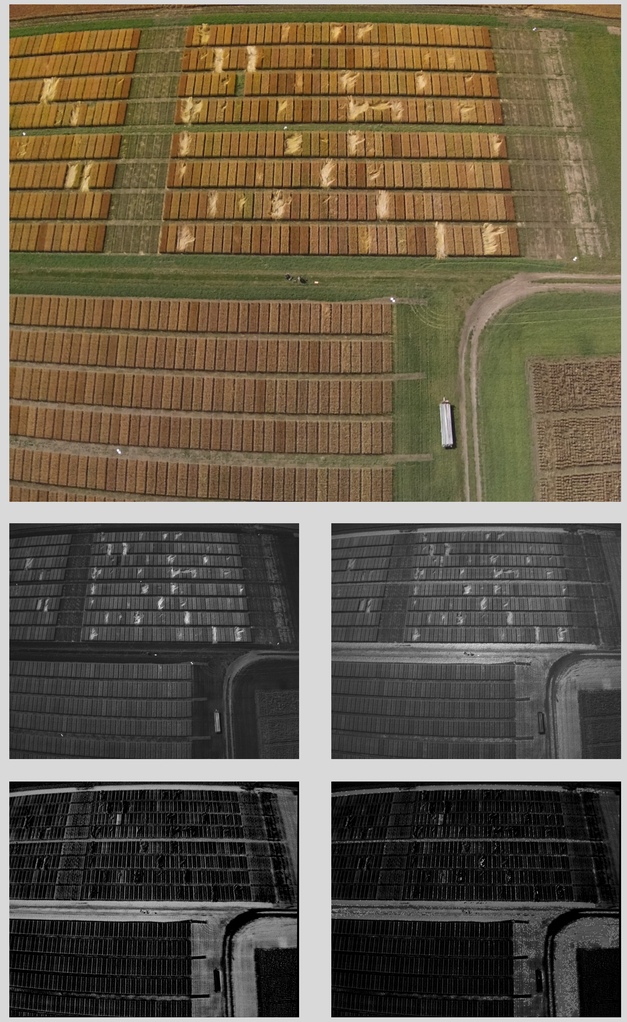
$$NDVI = \frac{NIR - Red}{NIR + Red}$$

6. Output collage creation for comparison and record keeping

FUTURE WORK

- There remains many opportunities to test other shadow detection and elimination algorithms
- Refinement of the pre-processing steps (image alignment, cropping on desired regions, etc.)
- Automatic thresholding for shadow mask
- Creation of a GUI to eliminate the need for running the python program from the command line
- Cloud-based architecture to allow users to upload images for batch processing

EXAMPLE IMAGES



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