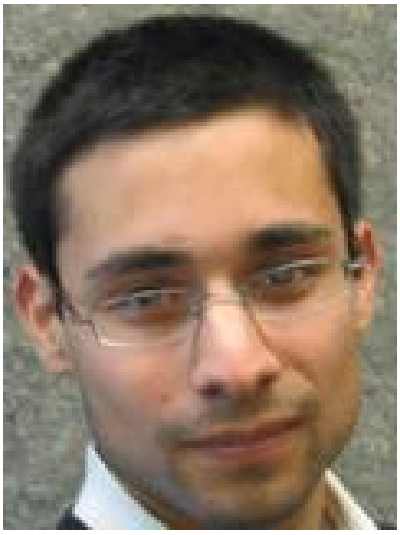

Anthony earned a Bachelors of Science in Chemical Engineering from the University of California, Santa Barbara, in July 2013 and a Master's of Science and Engineering in Remote Sensing from the Department of Agricultural and Biological Engineering at Purdue University in December 2014. Anthony's research focuses on converting raw UAS imagery into metrics of plant growth and health that may be used for plant breeding, crop modeling, and other types of agronomic research. After completing his PhD, Anthony looks forward to working as CEO of Progeny, a Purdue-based startup focused on helping agronomic researchers learn how to use low-cost drones and hardware to collect plant growth and health metrics 4 times faster and 10 times more precisely than they previously could on foot.

Agricultural & Biological ENGINEERING

Dissertation Defense

Speaker: Anthony Hearst

Title: Remote Sensing of Soybean Canopy Cover, Color, and Visible Indicators of Moisture Stress Using Imagery from Unmanned Aircraft Systems

Major Professor(s): Dr. Dharmendra Saraswat

Date: Wednesday, April 10, 2019

Time: 11:00 AM – 2:00 PM

Location: AGAD 128

Abstract:

Crop improvement is necessary for food security as the global population is expected to exceed 9 billion by 2050. Limitations in water resources and more frequent droughts and floods will make it increasingly difficult to manage agricultural resources and increase yields. Therefore, we must improve our ability to monitor agronomic research plots and use the information they provide to predict impacts of moisture stress on crop growth and yield. Towards this end, agronomists have used reductions in leaf expansion rates as a visible 'plant-based' indicator of moisture stress. Also, modeling researchers have developed crop models such as AquaCrop to enable quantification of the severity of moisture stress and its impact on crop growth and yield. Finally, breeders are using Unmanned Aircraft Systems (UAS) in field-based High-Throughput Phenotyping (HTP) to quickly screen large numbers of small agronomic research plots for traits indicative of drought and flood tolerance. Here we investigate whether soybean canopy cover and color time series from high-resolution UAS ortho-imagery can be collected with enough spatial and temporal resolution to accurately quantify and differentiate agronomic research plots, pinpoint the timing of the onset of moisture stress, and constrain crop models such as AquaCrop to more accurately simulate the timing and severity of moisture stress as well as its impacts on crop growth and yield. We find that canopy cover time series derived from multilayer UAS image ortho-mosaics can reliably differentiate agronomic research plots and pinpoint the timing of reductions in soybean canopy expansion rates to within a couple of days. This information can be used to constrain the timing of the onset of moisture stress in AquaCrop resulting in a more realistic simulation of moisture stress and a lower likelihood of underestimating moisture stress and overestimating yield. These capabilities will help agronomists, crop modelers, and breeders more quickly develop varieties tolerant to moisture stress and achieve food security.