NRI: INT: COLLAB: An autonomous insect Sense, Identify, and Manage Platform (SIMPL) to advance crop protection strategies

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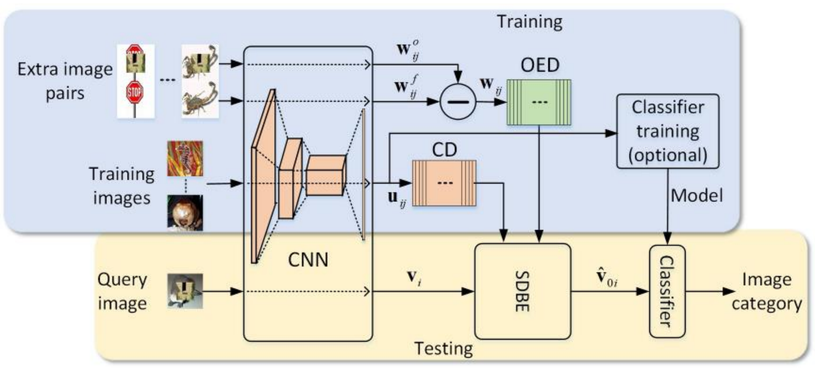
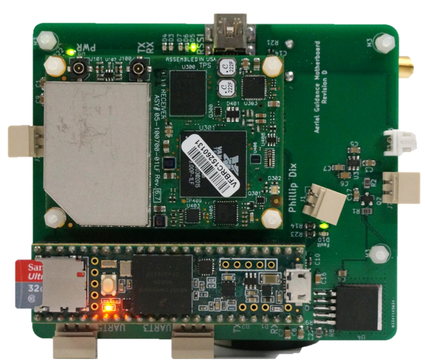
https://www.k-state.edu/precisionag/





Challenges: U.S. farmers spend $15.2 billion worth of pesticides to control pest and maximize yield. To sustainably intensify food production to feed a growing population, we need to limit the environmental impact of chemicals while increasing farm profitability by making these applications more efficient. C*urrent management* s*cenarios involve manual scouting of less than 5% area to make decision for rest 95%, which results in fraction of areas receiving justified amount of pesticide, while others lose yield due to delayed timing and damage by pests, and other's receive a superfluous spray.*

Scientific Impact: Proposed project will provide functional sub-systems for autonomous platforms to conduct crop production operations. Sub-systems like scalable computer vision system to sense, identify and geo-locate insect pests; application system with embedded sensing and control; communication with multi-agents; data transmission and display; and robust safety systems communication will accelerate foundational research and systems involving multi-robot mission architecture to execute whole field operation to harness economic and agronomic advantages.

Solutions and Products: We propose a new object detector by leveraging deep features learned in high-level layers. The proposed learning scheme can not only learn individual objects and local contexts but also their relationships by building a multi-scale deep feature learning network. Thus, better detection performance is achieved.

Robust autonomous platform for agricultural operations with innovative liquid application system utilizing computer vision as decision tool.

Very few commercial robotic systems available for production agriculture. One of the major reasons for this lack of success is the biological nature of the objects being handled, the dynamic and complex application environments, and varied crops and operations involved. Functional system will optimize crop input, and provide high spatial data for ML and AI algorithms for predictive ag.

Broader Impacts

A team of engineers and entomologists to work collaboratively in agricultural automation research and education. The developments within this project will have a major impact on enhancing the engineering programs, specifically in the computer vision, controls, mechatronics and robotics classes at Kansas State University and beyond!

This novel and original concept of knowledge of spatial insect incidence and severity and coordinated approach to conduct directed spray brings insect management to a new level. This creative idea of exploiting the strengths autonomous system will achieve all-season efficient and cost effective spraying of field crops significantly reducing chemical use.

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Industry Partner: TOPCON Precision Agriculture, TeeJet Technologies