

The Robots are Coming – for your Food!

AKA: Collaborative Teams of Heterogeneous Robots for Agricultural Applications

Girish Chowdhary,

Assistant Professor, Agricultural and Biological Engineering, Coordinated Science Lab, Institute for Genomic Biology, Aerospace Engineering, UIUC; Co-Founder EarthSense Inc.

Abstract:

What if a team of collaborative autonomous robots grew your food for you? In this talk, I will demonstrate some key technological advances that are bringing this future a lot nearer! Equipment manufacturers have been automating large agricultural equipment – tractors, harvesters, and even excavators; but automating large equipment only addresses a part of the agricultural labor crisis. Large equipment cannot be used in wet, muddy, and uneven fields; it cannot be used when the crop canopy grows; and it is expensive. Furthermore, practices like blanket spraying, tilling, and the increasing size of equipment are leading to critical sustainability problems: Herbicide resistant weeds, soil compaction, increasing carbon footprints, and pesticide runoff are just a few of these problems.

The focus of this talk is on new robotics technologies for enabling a breakthrough class of field equipment: Collaborative Teams of Heterogeneous Agricultural Robots that are orders of magnitude cheaper and lighter than existing mechanized or manual options. These robots represent an entire new class of useful agricultural equipment that does not damage the plant even if they drive over it, enabling a whole new level of precision in agriculture. I will discuss three key enablers of this technology: 1. Low cost design through 3-D printing, off-the-shelf sensors, and Lithium Polymer batteries; 2. Robust and accurate navigation and control under leafy canopies where GPS is ineffective with LIDARs and vision fused with adaptive Model Predictive Control, and 3. Low-cost onboard phenotyping through deep-learning enabled machine vision. Along with the technical details, my goal is also to present an overview of the state-of-the-art in this technology and where breakthroughs are needed. I will show interesting videos of our small robots doing useful things in agricultural fields.

Speaker Bio:

Girish Chowdhary is an assistant professor at the University of Illinois at Urbana-Champaign, and the director of the Distributed Autonomous Systems laboratory at UIUC. He holds a PhD (2010) from Georgia Institute of Technology in Aerospace Engineering. He was a postdoc at the Laboratory for Information and Decision Systems (LIDS) of the Massachusetts Institute of Technology (2011-2013), and an assistant professor at Oklahoma State University's Mechanical and Aerospace Engineering department (2013-2016). He also worked with the German Aerospace Center's (DLR's) Institute of Flight Systems for around three years (2003-2006). Girish's ongoing research interest is in theoretical insights and practical algorithms for adaptive autonomy, with a particular focus on field-robotics. He has authored over 90 peer reviewed publications in various areas of adaptive control, robotics, and autonomy. On the practical side, Girish has led the development and flight-testing of over 10 research UAS platform. UAS autopilots based on Girish's work have been designed and flight-tested on six UASs, including by independent international institutions. Girish is an investigator on NSF, AFOSR, NASA, ARPA-E, and DOE grants. He is the winner of the Air Force Young Investigator Award, and the Aerospace Guidance and Controls Systems Committee Dave Ward Memorial award. He is the co-founder of EarthSense Inc., working to make ultralight agricultural robotics a reality.