Iowa State University: Agriculture Innovation Starts Here
TRANSFORMING THE WORLD OF DIGITAL AGRICULTURE

Game-changing agricultural technology (ag tech) advancements are being developed at Iowa State University under the direction of Dr. Matt Darr, Professor of Agriculture and Biosystems Engineering. Darr manages the Digital Ag Research Team at Iowa State University and teaches coursework in precision agriculture and agricultural machinery electronics.

Darr and his team of nearly 50 university professionals and graduate students are building, testing and creating machines and off-road vehicles that impact ag via technical advancements like machine learning, machine visioning, machine automation, data analytics, connected devices and artificial intelligence. They are also training tomorrow’s workforce.

“Today, we sit near the peak of inflated expectations as we see the promise and potential of highly distributed data, artificial intelligence and machine learning for a variety of applications in off-road vehicles,” Darr said.

At the same time, the peaks and valleys of discovery - encountered via the inevitable unknowns, extremes, data wrangling and a myriad of technical challenges - require perseverance but also set the table for engineers to showcase their ingenuity.

“It’s under these seemingly insurmountable challenges that engineers are at their best in creating solutions that drive customer and business value,” Darr said. “We have proven examples of how timely, well-organized and supply-chain specific data can increase daily productivity. Through work at Iowa State University, we have demonstrated how focused data insights at the right time to the right person can achieve significant productivity increases in large equipment supply chains.”

These data-based insights only position the customer to maximize output capacities for their machines and don’t increase manufacturing costs, vehicle weight, etc. To date, the program has created Iowa State IP and software that lives in more than 29 precision agriculture products sold globally. In addition, the group produces highly skilled graduate students and postdocs that are work-ready employees for its corporate partners. It has placed more than 60 students into direct, high-impact jobs
with corporate partners through its graduate and postdoc programs, and another 250 and counting through dedicated student training in tech-infused off-road machinery courses in this area. The group is by far the largest contributor to industry-based research at Iowa State, last year accounting for nearly 60% of the revenue generated by corporate partners at the institution.

The digital agriculture team has historically worked out of Iowa State’s BioCentury Research Farm, where there is ample space for both field and equipment testing, and data collection, however, the growth of the program and demand from corporate partners forced a strategic partnership and investment by Iowa State University Research Park. The result is additional program growth and a new facility situated in the middle of additional test plots where the team can collaborate and expand their footprint alongside research park tenant partners like John Deere, Sukup, and Vermeer Corporation.

The ISU Research Park is an innovation hub where like-minded scientists and entrepreneurs work feverishly to impact the world, and multiple ag-tech initiatives are in various stages of development. The Research Park has brought together a public-private partnership model to invest in a new state of the art facility for the research group that also contains shared communal space and multi-tenant rental office and high bay spaces, where the lines between research, industry, collaboration and workforce training are intentionally blurred.

“The cutting-edge work and innovation that Dr. Darr and his team are delivering to ISURP tenants are changing the way we imagine ag production for the future,” ISU Research Park President Rick Sanders said. “The Digital Ag ecosystem for large scale production agriculture is as robust here at Iowa State University as anywhere on the planet, thanks largely to Dr. Darr and his colleagues, and the companies that want to hire the next generation talent that is sitting on the edge of those innovations want to be as close to that team as possible, not only to take advantage of their research and development skillset but also because they are churning out some of the most highly skilled workforce in this space.”

That collaboration between Research Park tenants and the ISU Digital Ag team is indicative of the sharing and partnering that Darr emphasizes is critical to the development of machines and off-road vehicles that reach their potential, “Great machine vision teams that are interdisciplinary in nature tend to be the most successful,” Darr said. “Teams could include functional systems experts, embedding computer experts and machine learning experts working together to optimize the
overall solution.”

Creating a culture of data collection - where engineers and data scientists work in tandem to discover connections between machine systems, environments, and the connected world - is how successful machine learning is achieved.

“Collaboration, where each side is making design choices to better the whole, is the key to high-impact success,” Dr. Darr said.

As it relates to automation and machine learning, Dr. Darr believes advancements in sensor technologies can unlock opportunities that have historically been unavailable. Better sensors lead to better data.

Better data leads to better decision-making.

“Answering questions like ‘how should I adjust my machine to maximize product quality’ or ‘can I predict failure before it happens?’ holds great promise,” Dr. Darr said.

Value is gained by creating actionable improvements grounded in innovation but verified by data. Unorganized/raw data, however, is limited in value.

“Unrefined data has a treadmill effect,” Dr. Darr said. “Just collecting data offers no value to customers. Just like owning a treadmill but not using it provides no value to a consumer.”

There’s an urgent need for innovation and this is where Dr. Darr’s program and tenants in ISU’s Research Park are perfectly situated.

“The arms race to improve machine capacity is not going to wane,” Darr predicted. “We are living in a highly promising time, where data science, machine learning, and artificial intelligence are giving us engineering tools that the generations before us simply never had. How we use those tools to create innovation and impact will ultimately dictate the mark we leave on the industries and stakeholders that we serve.”
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