

## Digital farm

### Combining sensors, field robotics, data analytics, precision agriculture, supply chains and logistics

#### Expertise

Digital technology is transforming agriculture. The University of Sydney is driving development in all aspects of the digital transformation, creating opportunities to collect and process data to drive improved decision-making throughout the breeding, production, supply and consumption process chains in both plant and animal industries.

Our international leaders in digital agriculture come together from a range of disciplines to work together, with expertise covering:

- plant science, animal science, soil science, agronomy, spatial statistics, farm production, supply logistics and business management
- site-specific crop and pasture management
- spatial livestock management and herd-specific genetic management
- animal-specific health, welfare and production management
- robotic/autonomous sensing, control, learning and systems engineering for agriculture
- digital data acquisition, delivery, fusion and analysis for agriculture
- data analytics for planning and optimisation of agricultural supply chains

#### Tools and methodologies used

Digital agriculture at the University of Sydney is an entirely unique group in Australia, where researchers come together from different disciplines to combine their deep expertise in agriculture, science, engineering and data science.

#### Our researchers use technologies such as:

- proximal sensing of soil and plants using visible, infrared and gamma spectroscopy, electromagnetic induction, LiDAR
- remote sensing – from UAVs to global platforms
- sensors for spatial data on crop yield, animal movement, vehicle position, elevation, weather, soil moisture.

#### We have expertise in the following data analytics:

- spatial statistics and geostatistics
- predictive analytics and machine learning
- sample design for on-farm surveys of soil, plant and animal
- experimental design and analysis for on-farm experimentation and implementation
- image processing
- process modelling



# AgTech and Food: Industry Capabilities

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### Industry links

**The Horticulture Innovation Centre for Robotics and Intelligent Systems (HICRIS)** is Australia's first horticultural robotics learning and development hub funded by HIA and the University of Sydney. It is driven by industry's determination to adopt on-farm technologies, ramp up export capacity and develop future leaders in non-traditional new areas of horticulture. HICRIS It aims to increase farm efficiencies through new monitoring tools for managing Australian tree crops, and evaluating and testing autonomous sensing, decision and action systems in vegetable industries.

**FutureDairy** funded by Dairy Australia, DeLaval, NSW DPI and the University of Sydney, has been operating for 13 years helping Australian dairy farmers optimise the outputs from, and use-efficiency of land, labour and water resources. It has led to the development of intensified pasture-based dairy systems, automatic milking systems (AMS), the co-development of the robotic rotary with DeLaval (AMR) as a solution for large herds; and the integration into the management of large herds with voluntary cow traffic in a pasture-based AMS.

**Precision Agriculture Laboratory** continues the pioneering work on precision agriculture which begun with funding from the University of Sydney in 1995. Its mission is developing excellent precision agriculture science and training, leading agricultural industries towards increased capabilities and incorporating practical, sustainable precision agriculture management techniques in the production chain. Its range of outputs are used to raise efficiencies and profitability in the business of farming through data-driven decision making.

### Our experts

**Professor Salah Sukkarieh (Research Capability Coordinator):** research, development and commercialisation of field robotic systems in logistics, commercial aviation, aerospace, education, environmental monitoring, agriculture and mining.

**Associate Professor Brett Whelan (Research Capability Coordinator):** improving the efficiency of crop management in terms of input and water use within fields and farms by understanding the natural variability in crop production potential and identifying site-specific management responses.

**Associate Professor Tihomir Ancev:** environmental, natural resource and agricultural economics.

**Dr Asher Bender:** applying data science to robotics in agriculture to understand subtle relationships.

**Associate Professor Thomas Bishop:** modelling the variation of environmental properties in space and time.

**Dr Anna Chlingaryan:** novel machine learning and data fusion algorithms for implementation in ag.

**Associate Professor Cameron Clark:** turning sensor derived farm data into useful information for farmers.

**Professor Benjamin Eggelton:** physics focussing on nonlinear optics and all-optical signal processing.

**Professor Behnam Fahimia:** management science, in particular logistics and supply chain management.

**Professor Sergio (Yani) Garcia:** integration of dynamic modelling and field experiments to analyse farm systems.

**Associate Professor Luciano Gonzalez:** improving farm management of livestock systems and sustainability.

**Professor Alex McBratney:** theoretical, methodological and applied aspects of soil resource assessment.

**Professor Budiman Minasny:** the causes, controls and mapping of soil distribution over space and time.

**Dr Richard Murphy:** high-resolution imaging across a range of natural resource applications.

**Dr Mario Pedraza:** measuring soil diversity and applications in site-specific crop management.

**Dr James Underwood:** outdoor robot operation using multimodal sensing, data fusion and mapping.

### For further enquiries contact:

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