



Welcome to the inaugural University of Sydney **Digital Sciences Initiative (DSI)** newsletter. Digital Sciences refers to the interdisciplinary field that encompasses the study of digital technologies, their societal impact, and the scientific principles behind their development and application. The DSI's mission is to position the University of Sydney as a driving force for fundamental digital science and digital technology research by providing an ecosystem where researchers, industry, investors and policy makers can explore ideas, collaborate, and create; and to be a destination where a new generation of digital scientists, engineers, and entrepreneurs are mentored and trained.

It has been an exciting year to date. The DSI has supported a range of projects, including in early diagnosis of cardiovascular disease, the design of novel materials and manufacturing processes, and the development of innovative approaches to precision agriculture. The DSI has provided funding to help our researchers reach out to industry, organising industry engagement workshops and seeding collaborative projects aimed at addressing some of society's greatest challenges. We have successfully launched the DSI seminar series to share ideas and explore collaborations across institutions. We are also exploring innovative ideas to support a range of digital education initiatives, focusing on how we can deliver a broad spectrum of learning activities in the digital domain.

The DSI's research areas align with state and federal strategies to boost digital capability and skills. The NSW State Government 20-year R&D roadmap recognises the transformative potential of digital technologies. This provides fertile ground in which to accelerate the development, adaptation and uptake of digital technologies across all sectors of industry and society. We welcome participation in the DSI from colleagues across the University and hope that you will join us in exploring how we can continue to position the University as a global leader in the digital sciences.

Professor Stefan B. Williams
Director, Digital Sciences Initiative

DSI Themes and Missions

The focus of DSI research is on three *fundamental areas* of innovation that are transforming the digital landscape, complemented by a fourth theme examining the societal and economic impacts of these developments.

1. Data-centric Engineering - Computational modelling of physical systems, statistical analysis and the rapidly growing field of data-science to build data-driven models of complex engineering systems.

2. Cyber-Physical Systems - Robotics, machine learning and AI, telecommunications, computation, control and networking.

3. Digital hardware - Transforming the way that digital solutions can be deployed, from large-scale, distributed data centres through to innovation in photonics, quantum computing, MEMS technologies, FPGAs, edge computing and novel computing architectures.

4. Digital Society - The implications of technological changes on the requirements for skills development and the transformation of traditional economic activities, on the legal and regulatory environments required to maximise opportunities and minimise harms when managing the close interaction between people and digital systems.

DSI currently has five key research-oriented missions based on *applied technologies*:

1. Digital Health - Medical imaging, improvements in diagnostic practices and the use of data analytics to support health planning and personalisation in medicine.

2. Digital Agriculture - Automation and the use of data to improve operational efficiency and manage the availability of skilled labour, especially in agricultural processes.

3. Advanced Manufacturing and Materials - Innovation in manufacturing, including the development of additive manufacturing, novel micro- and nanofabrication, advanced micro-assembly and research on semiconductor materials, and the transformation of the way that goods are manufactured.

4. Defence - Defence technologies in areas such as autonomous systems, cyber-security, information warfare and situational awareness.

5. Digital transformation - Processes for integrating digital technologies, strategies, and practices across various aspects of an organisation, industry, or society to fundamentally change how they operate and deliver value.

We are in the process of developing a new focus area: **Digital Education** that will support a range of digital education initiatives and address the need to empower industry and academic stakeholders with information on rapidly developing and emerging topics in the digital space.

[View key DSI Missions and Stakeholders](#)



DSI Funding Opportunities

DSI offers several funding opportunities for researchers to explore fundamental developments in digital sciences, to engage with industry and the wider community, and to support our next generation of innovators through student internships and research fellowships.

[Explore DSI funding opportunities](#) or contact the [DSI Team](#) for more information.

DSI Research Pilot Project Grants

The key objective of the DSI Research Pilot Project scheme is to engage researchers across the University to conduct rapid feasibility studies on transformative ideas in the digital sciences, to consider legal and societal impacts and questions arising from digital innovation, and to develop these ideas into concepts or technologies that can attract further investment from government and/or industry. Our first round of projects kicked off in early 2023.

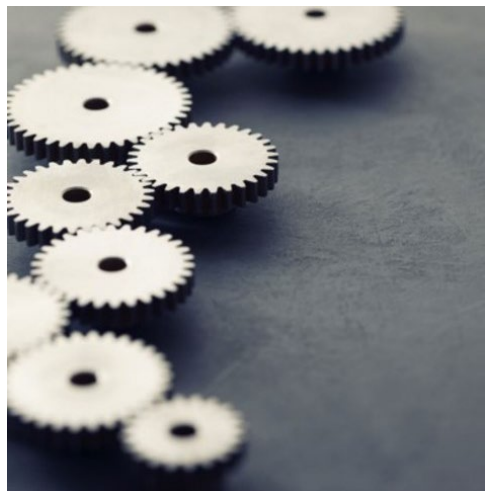
Recipients of the DSI Research Pilot Project Grants 2023

Academic Lead	Project Title
Dr. Sheryl Chang	<i>Digital epidemiology: Network-sensitive pandemic and opinion modelling with incomplete data</i>
Dr. Ali Hadigheh	<i>Digitalising corrosion monitoring of structures by coupling new multi-functional optical sensing systems, machine learning techniques and digital twin models</i>
Dr. Qiang Tang	<i>Frontiers on realizable regulatory studies of cryptocurrency</i>
Dr. Xianghai An	<i>Real-time anomaly detection in additive manufacturing processes using artificial intelligence</i>
Dr. Kanchana Thilakarathna	<i>Social Situational Awareness</i>
Dr. Anusha Withana	<i>Augmented-Human Research and Engineering</i>
Prof. Gwenaelle Proust	<i>Optimisation of processing parameters for the fabrication of refractory alloy components for space applications using laser powder bed fusion technology</i>
A/Prof. Daniel Dias-da-Costa	<i>Computer vision inspection of structures in post-disaster scenarios</i>

DSI Seed Funding

The purpose of the DSI Seed Funding is to identify key digital challenges facing industry and to stand up teams of researchers to undertake fundamental and applied research focused on addressing these issues. The program comprises three stages, designed to facilitate a workflow from initial concept exploration (*Stage 1*), through an initial scoping or feasibility study (*Stage 2*) and culminating in external grant development support (*Stage 3*) for the preparation of proposals or tenders for large scale collaborative funding opportunities. Our first round of [Call for Problem Statements](#) early this year has sparked considerable interest from

potential industry partners and our academics. We have worked with over a dozen industry partners to develop problem statements and workshop collaborative opportunities on topics ranging from Health, Food Retail, Defence, Energy and Aerospace.



Recipients of DSI Seed Project Grant Scheme 2022, Stage 1

Academic Lead	Project Title
Prof. Salah Sukkarieh	<i>Horticulture Digital Twin for Improving Farm Operations</i>
Prof. Salah Sukkarieh	<i>A Unique Phenotyping Robot for Precision Seed Selection and Seed Placement for the Vegetable Industry</i>
A/Prof. Zhiyong Wang	<i>Workshop on Space AI Agriculture</i>
Dr. San Seint Seint Aye	<i>Artificial Intelligence-Assisted High-Content Cell Imaging System</i>
Prof. Jennifer Whyte	<i>Project Analytics: The role of analytics in engineering decision making.</i>
Dr. Yao Wang	Artificial Intelligence enhanced high-content single cell technologies for mechano-medicine profiling.

Recipients of the DSI Stage 2 (Industry) Seed Funding Grants, 2023

Industry Partner	Project
Resonait Medical Technologies	<i>Developing novel medical devices to assist in the treatment of depression and other mental health concerns.</i>
GE (Aviation)	<i>AI-aided NLP and other methodologies to automate onboarding EMS parameter mapping into the GE data visualisation tool.</i>

Recipient of DSI Seed Project Grant Scheme 2022, Stage 3

Academic Lead	Project Title
Prof. Matthew Cleary	<i>Training Centre for Rocket Propulsion Systems and Launch Capabilities</i>
Prof. Fernando Calamante	<i>Training Centre for Medical Imaging</i>

[Learn more about our funded projects and updates](#)

We would like to take this opportunity to thank our industry partners for sharing their challenges with us to support emerging and large-scale partnership opportunities. We are always on the lookout for new Seed Funding opportunities and welcome applications for additional industry-led problem statements to be developed in collaboration with our extensive network of academic experts.



For more information, please contact the [DSI Team](#)

DSI Members- Recent Achievements

ARC Future Fellows

Dr Chang Xu - *Deep Adder Networks on Edge Devices*

[Dr. Xu's](#) research focuses on the efficiency of deep neural networks used in Artificial Intelligence (AI), reducing the cost of training and deploying them in real-world applications while improving their generalisation and robustness.

A/Prof. Dries Verstraete - *Energy Source Durability for Electric Vertical Take Off and Landing Aircraft*

[A/Prof. Verstraete](#) aims to optimise a fuel cell/battery/ultracapacitor triple hybrid energy system for electric Vertical Takeoff and Landing (eVTOL) aircraft. His research will address energy source durability and longevity through interdisciplinary approaches, leading to cost-competitive long-range rapid response air ambulance eVTOL operations

ARC Linkage Project

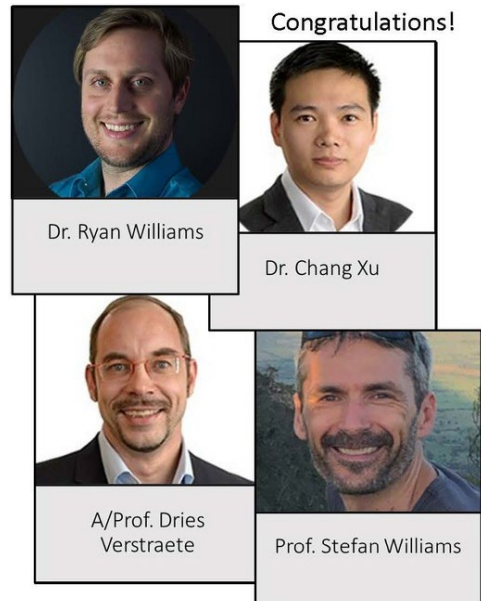
[Prof. Stefan Williams](#) was successful with two [Linkage projects](#) in the 2022 Rounds 1 and 2. The [first project](#) is in partnership with Reach Robotics, Norwegian University of Science and Technology, Woods hole Oceanographic Institution, Geo Oceans Pty. Ltd. and looks at using visual methods for advanced automations of underwater manipulations with the aim of increasing the autonomy of subsea robotic systems engaged in intervention and inspection tasks such as those essential in offshore industries, scientific exploration and defence.

The [second project](#), in partnership with Greybits Engineering and Fathom Pacific Pty Ltd, aims to develop self-supervised machine learning techniques for the analysis of marine imagery to enable fast and reliable quantitative estimates of marine environmental health that is needed for scientific studies, design and management of protected areas, and regulatory compliance of industrial activity in the ocean.

Medical Research Future Fund

[Dr. Ryan Sullivan](#) from the Digital Health Imaging group led a successful MRFF \$3M Critical Research Infrastructure grant to expand the Australian Imaging Service (AIS), partnering with the Australian Cancer Research Foundation (ACRF) and the Australian Centre of Excellence in Melanoma Imaging & Diagnosis (ACRF ACEMID). AIS-SHIELDS will implement secure national infrastructure for privacy preserving analysis of sensitive imaging and health data, including Natural Language Processing and Federated Learning platforms. This infrastructure will be available to all University researchers as it is rolled out.

Dr. Sullivan was also part of the team involved in the successful MRFF \$6M Brain Cancer Infrastructure grant, which will build on AIS to implement a large-scale histological image repository and with integrated AI for training and testing of cutting edge diagnostic systems.



Other Funding Awarded

Vonwiller Foundation

Philanthropic donation to support data analytics for Coronary Heart Disease (CIs: Figtree, Grieves, Kim, Zhou) \$1M and Precision Agriculture (CIs: Sukkarieh, McBratney, Bishop) \$1M

Data61 AI and Emerging Technologies

Prototype Warfare (CI: Verstraete, Partners: DSTG, UTS) \$1.2M

Meta - Towards Trustworthy Products in AR, VR, and Smart Devices and Security Research

User-centric 3D spatial data sharing in metaverse (CI: Thilakarathna and Zomaya) \$75k USD

Rio Tinto Aluminium

Stochastic Modelling for Bulk Handling in Aluminium Processing (CI: Einav, Marks, Guillard, Cleary) \$1.05M. This project demonstrates a strong collaboration established with the Data Centric group members with the DSI.

NSW Defence Innovation Network (DIN)

Edge AI in Multiple UAVs for ISR and Communications is a multi-university and industry collaboration lead by University of Sydney (CI: T J Lim and Thilakarathna). The project is investigating distributed machine learning algorithms for deployment in multi-UAV ISR and communication-centric applications that account for physical constraints such as payload, manoeuvrability and energy and minimize probability of detection.



DSI Seminar Series



The DSI has started a seminar series for our academics to present their research and interests to colleagues and encourage discussions and networking across the university community and within missions.

We have a great list of speakers lined up to discuss recent advances in the Digital Sciences. This includes academic staff from across the institution as well as key external stakeholders who will provide updates on their research program in this area. Talks to date have included:

- [Prof. David Fletcher](#) on *Digital Science in Healthcare: CFD, FEA, SPH, FSI and beyond* on the 16 August 2023
- [Prof. Ian Manchester](#) gave a talk on *Data-Centric Engineering: A Robotics-Centric Perspective* on Wednesday 6 Sept 2023.

Upcoming talks in this series include

- [Dr. Jonathan K. Kummerfeld](#) on *Collaborative Human-AI Systems for Databases, Diplomacy, and more*, Wednesday 13 Sept 2023, 12pm-1pm, J12 Board Room 124, Computer Science Building
- [Prof. Geordie Williamson](#) on *Can AI help mathematicians solve tough problems?* Wednesday 27 Sept 2023, 12pm-1pm, Carslaw Seminar Room 351, F07

Keep updated with all our future events [here](#).

We are seeking expressions of interest from researchers to talk about their exciting research. If your work is related to Digital Sciences and Technology or has an impact in this field, we would like to hear from you. If you would like to present your research in this series or subscribe to the email list, please contact the [DSI Team](#).

Dr. Jonathan K.
Kummerfeld

Spotlight



Early Career Researcher Spotlight

Your academic journey

I started here, at The University of Sydney, completing my Bachelor of Science (Advanced) (Honours) between 2006 and 2009. Through the Talented Student Program and Vacation Scholar Program I had the

opportunity to do research with many faculty members, leading to seven publications. My honours advisor, James Curran, also taught my first programming course, which was really a data science course before the term existed.

After graduating, I went to the US for 12 years, first as a PhD student at the University of California, Berkeley (2010-2016), then as a Postdoc at the University of Michigan (2016-2022), and finally as a Visiting Scholar at Harvard University (2021-2022). Over that time, I worked with a range of leading researchers, establishing collaborations that continue today.

I returned to Sydney in 2022 to take up a position as Senior Lecturer in the School of Computer Science and received an ARC DECRA Fellowship (2023-2025).

What are your major research focus areas?

I work on Natural Language Processing, a huge field (it's more than just ChatGPT!) that crosses over between Computer Science, Linguistics, and Statistics. My lab is particularly focused on research questions that explore new ways for people to use and collaborate with AI systems.

One theme of my work, and the focus of my DECRA, is systems that generate code. Today we interact with computers using our hands (keyboards + mice), eyes (screens), and ears (speakers). If we could also speak and have computers generate code in response it would change what we can do and how quickly we can do it. For example, we could open a spreadsheet and create a complex visualisation by describing what we want, or we could get information from database by asking questions. [read more](#)

Events



3rd Asia-Pacific International Conference on Additive Manufacturing

A highly successful [3rd Asia-Pacific International Conference on Additive Manufacturing \(APICAM\)](#) co-ordinated by Materials Australia, was hosted at the University of Sydney campus from 21-23 June 2023. The conference was [co-chaired](#) by our DSI Advanced Manufacturing and Materials mission lead [Prof. Gwenaelle Proust](#) (USyd), along with Prof. Sophie Primig (UNSW).

Materials Australia Silver Medal for outstanding contributions to the advancement of metallurgy and materials science was awarded to Prof. Ma Qian (RMIT, 2022) and our very own Pro-Vice-Chancellor (Research Infrastructure) and DSI member [Prof. Simon Ringer](#) (USYD, postponed from 2020, due to COVID).

Sydney Manufacturing Hub, a Core Research Facility at the University of Sydney, played a key role in organising and running the conference that attracted over 350 local and international delegates, attending 260 high quality technical presentations in 13 symposia across 5 streams. APICAM will return to RMIT in Melbourne in 2025.



ITTC Workshop on Propulsion Systems and Launch Capabilities

The 2nd Co-design Workshop for the Industrial Transformation Training Centre (ITTC) on Propulsion Systems and Launch Capabilities was held in the Sydney Knowledge Hub on Monday 21 August. The centre proposal is being led by [Matthew Cleary \(AMME\)](#) and is supported by the Digital Sciences Initiative with a collaboration between the Data-centric Engineering, Defence and Advanced Manufacturing and Materials missions.

The workshop, which followed an earlier workshop held in April was well supported by industry, government and the defence sector with over 80 attendees (online and in person) The three industry panel sessions and the plenary focused on issues critical to the establishment of a sovereign propulsion and launch industry to support strategic defence and space needs.

If you are interested in learning more about the training centre or becoming involved please contact [Matthew Cleary](#) or [Kelisha Lyndon](#)

AI for Good Global Summit, Geneva

[Prof. Salah Sukkarieh](#) presented his work at the [AI for good global summit](#) in Geneva (5-7 July 2023) to a global audience and had a Digital Agriculture stand up and running. The event went extremely well leading to lots of important contacts that would support both the collaboration efforts and potential funding. Importantly there were EU commission and government officials that will be there at the next EU visit with UN FAO in Rome. The next trip will be more of a focus on Ag Engineering / Robotics with Prof. Sukkarieh chairing two sessions for the UN on mechanisation, robotics and AI.

[Learn more](#)



Industry Collaboration Workshop

[Dr. San Seint Seint Aye](#), one of the recipients of the [DSI Stage 1 seed grant](#), hosted a very successful workshop on **3D Bioprinting and Bioimaging analysis** at the Charles Perkins Centre (CPC) on 23 August 2023.

The workshop included presentations by [A/Prof. Khoon Lim](#), Dr. Xiao Kuang (Harvard Medical School) and Dr. Ann-Na Cho (Macquarie University). Representatives from AXT Pty Ltd showcased bioprinters and latest methods/tools for tissue engineering solutions that can help develop inspire future tissue engineering solutions and stimulate possible collaboration with leading researchers and industry partners. The one-day workshop was concluded with hands on demonstrations and lab tours that were well received.

Upcoming Events

DSI Seminar Series

- **Collaborative Human-AI Systems for Databases, Diplomacy, and more**
Presented by [Dr. Jonathan K. Kummerfeld](#)
Wednesday 13 Sept 2023, 12pm-1pm, J12 Board Room 124, Computer Science Building
- **Can AI help mathematicians solve tough problems?**
Presented by [Prof. Geordie Williamson](#)
Wednesday 27 Sept 2023, 12pm-1pm, Carlsaw Seminar Room 351, F07

Mathematical Challenges in AI seminar series is being organised by the [Sydney Mathematical Research Institute \(SMRI\)](#). Upcoming speakers in this series include:

- Greg Yang (xAI): September 13, 10-11 am
- Sadhika Malladi (Princeton University): September 28, 8-9 am
- Neel Nanda (Deep Mind): October 12, 8-9 pm
- Paul Christiano (Alignment Research Center): October 26, 9-10 am
- Francois Charton (Meta AI): November 23, 7-8 pm

For more details and Zoom links, please click [here](#)

Save the date

[Modern Manufacturing Expo \(20-21 September 2023\)](#) - The Expo is designed to progress excellence and innovation in manufacturing and will highlight the leading-edge products, equipment, technologies and software to help Australian Manufacturers to take advantage of new and emerging equipment and technologies.

[South By South-west Festival \(15-22 October 2023\)](#). The SXSW Sydney will be held for the first time outside of the United States and will feature ground-breaking technologies and ideas that are changing the way we live our lives.

[Indo Pacific EXPO 2023 \(7-9 November 2023\)](#) - International Maritime Expo is the region's premier commercial maritime and naval defence exposition, connecting Australian and international defence, industry, government, academia and technology leaders, in the national interest. The event is expecting over 25K visitors, >700 exhibitors from a mixture of large company primes, government, defence, universities and SMEs.

[16th Australian Space Forum \(6 December 2023\)](#) - The Forum provides the perfect opportunity to stimulate ideas, share information about emerging technologies and network with influential space sector leaders and the broader community.

Engage with the DSI Team

Learn more about how we can help you to engage with key external stakeholders by contacting our friendly team at dsi@sydney.edu.au. If you would like to be added to our seminar series email list or to find out more about any of the above DSI funding opportunities, please register your interest [here](#).



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