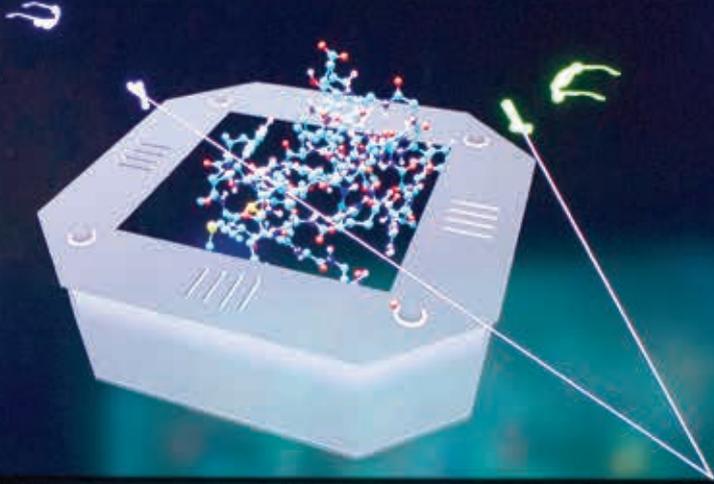




Curtin University



# EMBRACING DISRUPTIVE TECHNOLOGY

DIGITAL AND EMERGING TECHNOLOGY  
CAPABILITY STATEMENT

Make tomorrow better.

[curtin.edu/digital](https://curtin.edu/digital)

# ABOUT CURTIN UNIVERSITY

Curtin has become a leading institution for progressive research and collaboration. As we look to build on this momentum, we aim to strike a balance between demand-driven research, which solves defined problems for industry and society, and researcher-driven research, which is characterised by a desire to push the limits of understanding.

At the heart of both endeavours are strong academic and industry partnerships. We believe it is only through collaboration and research excellence that we can achieve impact and be ranked among the best in the world.

We are placed in the top one per cent of tertiary institutions worldwide, according to the 2019 Academic Ranking of World Universities, and the latest Excellence in Research Australia analysis ranked more than 95 per cent of our assessed research as world standard or above.

Digital technology is increasingly important across all industries. Curtin has steadily been building capacity in areas such as artificial intelligence, data science, virtual reality, robotics and the internet of things, and exploring their application across a variety of industries.

Building on our varied experience and unique capabilities, we are looking to extend our reputation as trusted experts in developing and employing the latest digital and emerging technology. Our unique expertise and capabilities have been applied to key projects with industry partners such as CISCO, Optus and CSIRO.

Partner with us on your next challenge, and leverage our experience, networks, facilities and research expertise as we work together to find innovative solutions and explore new possibilities.



# ENABLING A TECH-DRIVEN FUTURE

## RESEARCH CAPABILITIES

Our research expertise can solve the most complex challenges. Our strengths lie in a versatile network of academics with skills and experience in emerging and digital technology.

### ROBOTICS AND AUTOMATION

Curtin has a proven track record of innovation in robotics and automation, with novel research leading to new solutions in construction, healthcare and transport.

Our researchers worked with engineering company TENZA Equipment to develop a control algorithm for their crane load rotation device. Curtin's input created a robust solution for control and functionality, and created a safer and more productive crane that can be operated in a variety of weather conditions.

In the healthcare field, Curtin has pioneered new directions in robotics to improve the life of those recovering from injury and people with disabilities. Our Biorobotics Research Lab has developed a full hand orthosis that helps people with weak fingers manage everyday tasks, like grasping a cup or turning a door knob. Using similar engineering and design principles, a leg exoskeleton has been developed to allow people with spinal cord injuries to walk again. The exoskeleton uses a single motor to control the hip, knee and ankle joints, allowing fluid coordination and a natural walking gait. Our research is enabling the future of healthcare, and assuring better quality of life for those seeking treatment.

We're the first Australian university to trial a commercial driverless bus; technology which will be used to inform development of other autonomous vehicles. The bus uses remote sensors, stereo cameras and GPS systems to determine its path and navigate obstacles, and can travel up to 45km per hour on a pre-determined route. Automated vehicles are set to revolutionise health, communications, infrastructure and navigation technologies, creating safe, sustainable transport and better mobility options for people unable to drive.



## MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE

Artificial intelligence will continue to change the way the world does business and we're helping industry stay ahead of the curve. Our researchers working in Innovation Central Perth and the Optus-Curtin Centre for Excellence in Artificial Intelligence have specialised experience in applying artificial intelligence to business processes.

In collaboration with the Public Transport Authority, our researchers developed novel technology to detect escalator faults before serious damage occurs. Curtin researchers from Innovation Central Perth, a partnership led by Cisco with Curtin, Woodside Energy and CSIRO's Data61, developed a neural network that could identify mechanical faults by sound for close-to-real-time classification and notification of faults. The non-invasive and easily deployed system saves money on expensive repairs, and can be easily adapted for other machines across a variety of industries.

A world-first smartphone app developed by Curtin researchers helps improve the care of people with dementia. The app, acquired by PainChek Ltd in 2016, uses artificial intelligence to detect and quantify pain based on a patient's facial expressions. It provides an accurate and reliable means for professionals and family members to assess pain and improve care. Dementia is the second leading cause of death in Australia, and with the number of people living with dementia set to reach more than 536,000 by 2025 (Dementia Australia), tools that help manage the condition such as PainChek will increase in demand. The technology is also being assessed for infants and other non-verbal patients.

The Desert Fireball Network uses a network of 50 optical cameras across Australia to detect possible meteorites. To boost the system's accuracy and detect faint meteor streaks, researchers used machine learning to train the system. After learning from thousands of images, the system became more accurate and much faster than manual image sorting. Our meteor tracking algorithm can now detect a variety of events, from meteors and supernovae to space junk, with potential defence applications.

## IMMERSIVE MEDIA

Our experience using virtual reality, augmented reality and large-scale displays can help you realise new business opportunities.

Underpinning our immersive media capabilities is the expertise and equipment hosted in the Curtin HIVE (Hub for Immersive Visualisation and eResearch), which enable meaningful interpretation, presentation and communication of data. Our HIVE systems, including the Tiled Display, Cylinder, Wedge, Dome, Hologram Table and a wide range of virtual reality and augmented reality headsets, use immersive technologies to find solutions to real-world challenges.

For example, the HIVE team has developed a virtual reality cooking simulation that can be used by a quadriplegic patient to help improve upper limb function and regain more independence. Virtual reality is immersive and imaginative, and is ideal for providing a motivating and low-risk rehabilitation environment.



Curtin is investigating how virtual reality could enable 'travel' to remote and inhospitable environments. Topographic data from the HiRISE Mars satellite has been used to create a realistic depiction of the Martian environment that can be explored using virtual reality. Photogrammetry technology and high-performance computing is also being used to reconstruct the culturally significant shipwreck HMAS Sydney II from underwater images. These technologies can be used to monitor large, hard to access structures like mining and petroleum assets, or any remote area for training and investigative purposes.

Our Consumer Research Lab uses large-scale displays to present 360-degree images and videos to immerse consumers in different retail environments. Combined with biometric measures such as facial expression and skin conductance analysis, the project examines the effect of store design and atmospherics that engage touch and smell. Our studies in this space are providing useful knowledge about consumer behaviour.

Augmented reality has exciting future applications in the medical field. Our researchers have investigated how headset software can display information about a patient in real-time that could be used during surgery or consultations. For example, a patient's information and surgical requirements could be overlaid over the physical environment as a doctor performs surgery, making the procedure quicker and safer.



## CYBERSECURITY

As society becomes increasingly digital, so too do our security threats. Alongside capable partners, Curtin intends to develop the next generation of best practice cybersecurity, security strategy and secure digital systems.

Denial of service attacks, which swamp a server or website and cause it to crash, are increasingly common. Curtin has developed powerful statistical techniques to detect and neutralise these attacks while keeping the online service running. Our Probability Engine for Identifying Malicious Activity addresses the real threat of cyber security attacks, which can cause significant economic and reputational damage to organisations.

## INTERNET OF THINGS AND SENSOR TECHNOLOGY

The internet of things is set to revolutionise how we interact with the world around us, with sensor data enabling more efficient and intuitive technologies. We're researching the next generation of sensors and exploring how they will be used to create an informed and connected future.

Through Innovation Central Perth, Curtin is working with National Energy Resource Australia to develop and deploy sensor technology in the energy and resources supply chain. The partnership explores how best practice in data management

and the widespread deployment of internet of things technology can improve productivity and create cost efficiencies. Specific areas of investigation include maintenance schedules and managing aging infrastructure.

Our Perth campus is a living laboratory for our researchers. Smart buildings and internet of things technology enable research into sensor systems and provide insight into how buildings are used and their structural integrity. For example, researchers can tap into live air conditioning, structural monitoring, wi-fi use and occupancy data. With more and more buildings connected via the internet of things, our experience with these systems and using the data can be utilised to gain a competitive advantage.

Curtin is a core partner of SmartSat CRC, Australia's biggest space industry research and development collaboration. Bringing together industry and research organisations, SmartSat CRC aims to develop advanced telecommunications and smart satellite systems for real-time connectivity, surveillance and sensing capability over land and sea. This partnership builds upon Curtin's existing research strengths, including global navigation satellite systems (GNSSs). We are currently developing new methods and efficient algorithms for GNSS attitude determination, which has applications in navigation of space platforms, unmanned vehicle guidance, vessel docking and precision farming.



# STRATEGIC PARTNERSHIPS

## DATA SCIENCE

Our researchers use cutting-edge technology to make sense of data, and are keen to collaborate with interested organisations. Underpinned by the Curtin Institute for Computation boasting 150 researchers active in simulation, modelling, optimisation, data analytics and visualisation, the centre is supported by a core group of 12 data scientists helping to optimise research codes and data flows.

Grain is currently the most productive agricultural sector in Australia. While Australia has a reputation for quality produce, low rainfall and geographic spread generally result in our productivity and yield per hectare sitting below international competitors. To boost grain production, our researchers captured the characteristics and activities associated with a harvest season, and created a rigorous mathematical model. Over 60 inputs can be set to match a specific farm's operations, from the number of hectares under each crop to truck speeds. Grain growers can now use this decision support tool to run 'what if' scenarios and plan their harvest logistics.

Australia's resources sector earns A\$205 billion in exports every year, and is underpinned by effective asset maintenance. Industry maintenance practices are ripe for a digital overhaul that will bring developments in computational methods, statistics, applied mathematics and artificial intelligence to determine how maintenance is conducted. The ARC Training Centre

for Transforming Maintenance through Data Science brings together researchers from Curtin, UWA and CSIRO and industry partners Alcoa, BHP and Roy Hill to develop new maintenance practices, with support from CORE Innovation Hub and the Minerals Research Institute of Western Australia. This work lays a foundation for future automation by embedding data science practices in everyday maintenance and pioneering new maintenance optimisation strategies.

Finding cost-effective and innovative solutions to supply chain and logistics challenges is integral to all industries. With round-the-clock operation, Woodside requires cost-effective solutions for resupplying remote facilities, such as offshore rigs. Researchers from the Curtin Institute for Computation created mathematical models to generate ideal vessel routes in any operating scenario, optimising fuel consumption while ensuring cargo delivery and offtake requirements were completed. This resulted in a fleet reduction and significant savings for Woodside.

The computing power of the Pawsey Supercomputing Centre enables research exploring the beginning of the universe. It hosts the world's only real-time, supercomputing service dedicated to telescopes used in astronomy research, including Curtin's Murchison Widefield Array, an important precursor for the global Square Kilometre Array project. The centre provides crucial processing power for the Murchison Widefield Array and supports the future of space research and data science.

Collaboration is key to Curtin's emerging and digital technology research strategy, showcased by our portfolio of diverse, global partnerships across industry, government and other research institutions.

## INNOVATION CENTRAL PERTH

Innovation Central Perth is an industry and research collaboration centre at Curtin University, led by Cisco and in partnership with Woodside and CSIRO's Data61. With more than 80 researchers, links to advanced facilities and a global industry network, the centre brings together start-ups, industry experts, developers and researchers in an open environment to create ground-breaking technology solutions.

[icentralau.com.au/Perth](http://icentralau.com.au/Perth)

## CISCO CURTIN CENTRE FOR NETWORKING

Curtin and Cisco have partnered to create the Centre for Intent-Based Networking. The centre is helping organisations automate routine tasks, generate analytics and improve security through intent-based networks. Partnered with internet of things sensor technology, intent-based networks can help accelerate digital transformation in many industries, such as manufacturing, mining and utilities.

## DATA61

CSIRO's Data61 is Australia's leading data innovation group that aims to create Australia's data-driven future. In collaboration with Data61, Curtin is exploring the future of digital agriculture, including food supply forecasting, crop pathogen impact and applying blockchain technology to the supply chain.

## PAWSEY SUPERCOMPUTING CENTRE

The centre is a joint venture between Western Australia's public universities and CSIRO, providing high-powered computing facilities to Curtin researchers and partners. It provides important infrastructure to support research, including supercomputers, cloud computing, data storage and visualisation. The centre's most powerful computer Magnus can perform a quadrillion calculations per second.

[pawsey.org.au](http://pawsey.org.au)

## OPTUS-CURTIN CENTRE FOR EXCELLENCE IN ARTIFICIAL INTELLIGENCE

Formed in 2018, the centre leverages Curtin's research, teaching and learning capabilities, and Optus' technology and infrastructure capabilities to explore the future of artificial intelligence in Australia. Researchers are focusing on applying artificial intelligence to 5G networks, drone technology and regional telecommunications.

[curtin.edu/optusAI](http://curtin.edu/optusAI)

## WA DATA SCIENCE INNOVATION HUB

The WA Data Science Innovation Hub is a WA Government initiative supported by Curtin University that aims to keep WA at the forefront of data science. The hub takes a leading role in increasing the uptake, education, training and awareness of data science in WA, and driving digital innovation in industry. Other key partners include Bankwest, Mets Ignited and National Energy Resources Australia.

[wadsih.org.au](http://wadsih.org.au)



Image: Pawsey Supercomputing Centre

## ACCESS OUR EXPERTISE

We're keen to work with emerging and established organisations via consultative, collaborative and other bespoke relationships.

Our partner agreements range from transactional contractual activities to joint partnering and enduring relationships. An important part of our partnership development is developing a clear understanding of core values and how value can be generated for each partner.

Curtin also offers executive education, professional development and postgraduate courses to help build expertise within your organisation.

Get in touch to discuss your idea, business challenge or opportunity.

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