Australia's National Science Agency

Next Generation AI and Emerging Technologies Graduates Program

Tackle real world challenges with foundational skills in artificial intelligence and emerging technologies. Become a career-ready specialist in your field.

The Next Generation of Graduates

The Next Generation Graduates Program is leading the charge in upskilling Australia's workforce in AI and emerging technologies. With at least 480 generous scholarships available nation-wide, the program is paving the way for the future tech specialists to revolutionise the industry.

Comprising two streams, Artificial Intelligence (AI) and Emerging Technologies, this program provides Honours and postgraduate students from any project background, the unique opportunity to collaborate with universities, industry specialists and CSIRO, Australia's national science agency, to solve the world's greatest problems.

Research projects in this program are guided by academics, researchers, industry professionals, and government specialists who serve as subject matter experts at the forefront of their fields.

Students will engage with a national cohort of peers from diverse disciplines. This cohort-driven learning approach fosters critical thinking, develops cross-cutting skills, and encourages collaborative solutions.

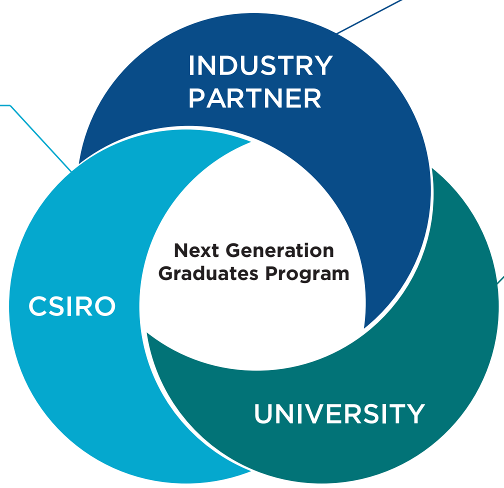
The program endeavours to equip our students with entrepreneurial thinking and skill sets that are key to boosting breakthrough innovation. They will be placed at partner institutions for a period of their candidature, allowing them to gain first-hand experience in understanding the practical implications of their research.

Work on areas of national interest

The Australian Government has identified a list of technologies that are critical to the national interest[1] including AI, cyber security, quantum technology, blockchain and advanced robotics, and has acknowledged a shortage of tech workers.

By providing in-depth training and facilitating collaboration among students, researchers, and industry professionals, our program helps build a competitive and capable workforce that will drive the growth of the Australian tech sector.

What does the Next Generation Graduates Program offer to students?



CSIRO:

- International technology network
- Innovation courses and workshops
- Cohort learning experience
- Generous stipends and allowances

Industry partner:

- Exposure to real-world challenges
- Practical work experience
- Access to data, technology, equipment and expertise
- Generous scholarship top-up

University:

- Academic supervision
- Cutting-edge research opportunities
- Development of critical thinking skills

1 Department of Industry, Science and Resources. Action Plan for Critical Technologies, https://www.industry.gov.au/publications/action-plan-critical-technologies

Join our interdisciplinary community

Australia's leading digital research network

CSIRO's Data61 is the data and digital specialist arm of Australia's national science agency. We are home to one of the largest collections of research and development expertise in AI and data science in the world, and host cutting-edge facilities including the Mixed Reality Lab, Robotics Innovation Centre and AI4Cyber Enclave. Our research expertise includes AI, robotics, cybersecurity, modelling, and analytics.

We are solving Australia's greatest data-driven challenges through innovative science and technology.

We are at the forefront of digital science and innovation, leading both in developing new research as well as working across disciplines and sectors to apply technologies and drive impact. We are proud to lead the Next Generation Graduates Program.

Eligibility

To be eligible for a scholarship, applicants must be domestic students as per the Higher Education Support Act at the time of award. Domestic students include:

a. Australian citizens,

b. Australian permanent residents,

c. a person entitled to stay in Australia, or to enter and stay in Australia, without any limitation as to time; or

d. a New Zealand citizen.

Scholarships are available for students at Honours and all postgraduate levels across Australian universities.

Visit www.csiro.au/nextgen for participating universities and available projects.

Master of Philosophy (MPhil) and Doctor of Philosophy (PhD) scholarship holders must enrol in a full-time degree.

Commonwealth supported students enrolled in Honours and Coursework Masters programs are also eligible to apply for Next Generation Graduates Program scholarships.

Diversity drives innovation

We welcome applicants from all backgrounds, including those without a traditional science, technology, engineering and mathematics (STEM) background.

We help our students unlock their full potential and shape the future of AI and emerging technologies, with the understanding that diversity in thought and backgrounds is crucial for innovation.

Our program is designed to bring together a community of creative thinkers from various disciplines, building a collaborative and inclusive environment for learning and discovery.

A preliminary program coursework has been developed to help candidates from different backgrounds achieve proficiency in key topics.

Key requirements

Scholarship holders must undertake industry placements with industry partner(s) of the program within which the student enrols.

Students must register and complete the coursework component of the Next Generation Graduates Program within the within the **first 12 months** of receipt of a scholarship.

Students who receive a scholarship are expected to undertake their training in Australia and endeavour to remain in Australia for two years following completion of their degree.

Key dates

Funded Next Generation Graduates Programs will continue to recruit students throughout the year until all available places have been filled. The coursework component of the program will run twice-yearly until 2025.

Tenure

The scholarship may be held for up to 3.5 years (full-time) for Research Doctorate (PhD) studies; up to two years for Research Masters studies (MPhil); and up to one year for Honours (Hons) and Coursework Masters (MSubject) studies.

Students who enrol in the one-year Honours and Coursework Masters programs may apply to a PhD program on completion of their initial program.

How to apply

Explore the currently recruiting opportunities and find information on how to apply on our website www.csiro.au/nextgen.

Scholarship highlights

DEGREE TYPE	PHD	MASTER OF PHIL-OSOPHY	MASTERS (RTP QUALIFIED PROGRAM)[1]	HONOURS AND COURSE-WORK MASTERS[2]
Research Duration	3.5 years	2 years	1 year	1 year
Partner placement	6 months	3 months	20 days	6 days
Stipend rate (p.a.)	$41,650	$41,650	$30,000	$10,000
Training (p.a.)	$5,000[3]	$5,000	$5,000	$5,000
Travel (total)	$5,000	$5,000	N/A	N/A
Thesis allowance (total)	$840	$420	N/A	N/A

1. Masters Programs at AQF9 where the second-year research component qualifies for an RTP (Research Training Program) scholarship
2. 1 EFTSL research project similar to Honours that is part of a coursework Masters degree
3. PhD training allowance is $5,000 per year for three years only.

Guiding principles

The Next Generation Graduates Program builds on these guiding principles:

Create cohorts of students

The program is rolled out in student cohorts, fostering peer support, collaboration, social learning and personalised feedback. This setup allows students to engage in collaborative teamwork, preparing them for interdisciplinary research across various organisations and institutions in the real world. Cohorts will be mentored by carefully selected specialists in the field.

Throughout the program, students will develop critical thinking, analytical and communication skills, and problem-solving abilities in a high-performance environment. This dynamic learning environment encourages the development of leadership and agile application of knowledge through skill-sharing and interactive workshops.

Facilitate interdisciplinary collaboration

Our coursework implements an interdisciplinary educational approach that integrates knowledge, concepts and methodologies from various disciplines to create a comprehensive understanding of complex contemporary issues.

This approach encourages critical thinking, the synthesis of evidence from diverse perspectives, and creative problem-solving.

By combining insights from multiple fields, students gain a richer understanding of the issues at hand and develop transferable skills that promote adaptability and innovation.

We provide a common foundation for all students – regardless of their background – through high quality teaching and support from our team. By bringing together students with diverse skill sets, our program facilitates collaboration between university projects, acquisition of cross-cutting skills, and peer-to-peer learning.

Activate experiential learning

Our program combines problem-based and project-based learning, encouraging students to tackle real-world challenges. We employ modern teaching models and a non-linear curriculum framework to facilitate and evaluate students' learning. This includes providing authentic real-world problems that inspire students to develop a solution-oriented mindset and sharpen their skills through comprehensive content and iterative assessments.

Students will receive personalised feedback on high-level research insights, conceptual knowledge, and specific mathematical principles, proofs, and programming efficiency.

The program culminates in a direct industry placement, enabling students to consolidate their experiences and apply their knowledge in practical situations. This inquiry-based experiential learning approach fosters motivation and engagement throughout the learning process.

Course overview

The coursework component of the Next Generation Graduates Program is designed to introduce future graduates to the key concepts that will be useful during their study and aims to cover a breadth of concepts and domains by developing knowledge and practical skills.

By exploring diverse topics including deep learning, computer vision, ethics, decision making under uncertainty, innovation, and entrepreneurship, this course stands out for its holistic approach to problem-solving with technology. It emphasises the integration of different streams of knowledge to tackle real world challenges – while taking into account the engineering, social-technical, and theoretical complexities involved.

The coursework is structured around these six units of study:

- Data Centric Engineering (Core)
- Ethics, Innovation and User-Centred Design (Core)
- Probabilistic Machine Learning (Artificial Intelligence)
- Deep Learning (Artificial Intelligence)
- Cyber Security and Data Privacy (Emerging Technologies)
- IoT and Blockchain (Emerging Technologies)

The units are divided into three categories: Core, Artificial Intelligence (AI) and Emerging Technologies (ET). The Core category is mandatory for all students, while enrolment in AI or ET categories depends on the student's program stream. Figure 1 provides a high-level overview of the topics and timeframes covered in each category.

The coursework component is divided into two segments. Weeks one to four are designed for a broad audience, including students from Honours to PhD level, as well as those from multi-disciplinary backgrounds. During these four weeks, students will receive high-level learning in AI and emerging technologies to establish foundational skills.

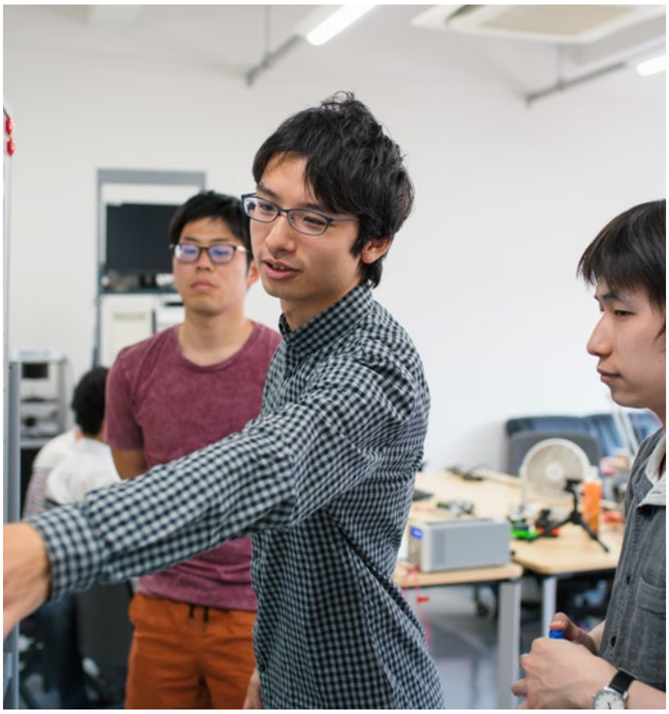
Weeks five to 11 are mandatory for MPhil and PhD candidates only and cover more complex topics. These seven weeks include a four-week-long project that is ideally linked directly to their future studies.

Interactive learning experience

Teaching for each unit will combine lectures, practical activities, and hands-on workshops. Lectures will cover the mathematical, computational, and foundational aspects for each topic, and will be motivated by real world problems in the AI and emerging technologies space.

The practical activities will be self-guided, providing students with clear instructions and a structured walk-through to consolidate and practice the techniques presented in the lectures. Workshops have been designed to bridge content between units and provide an environment where students can practice and analyse solutions to real-world scenarios.

Lecture, activity and workshop materials will be available to students online via Microsoft Teams.



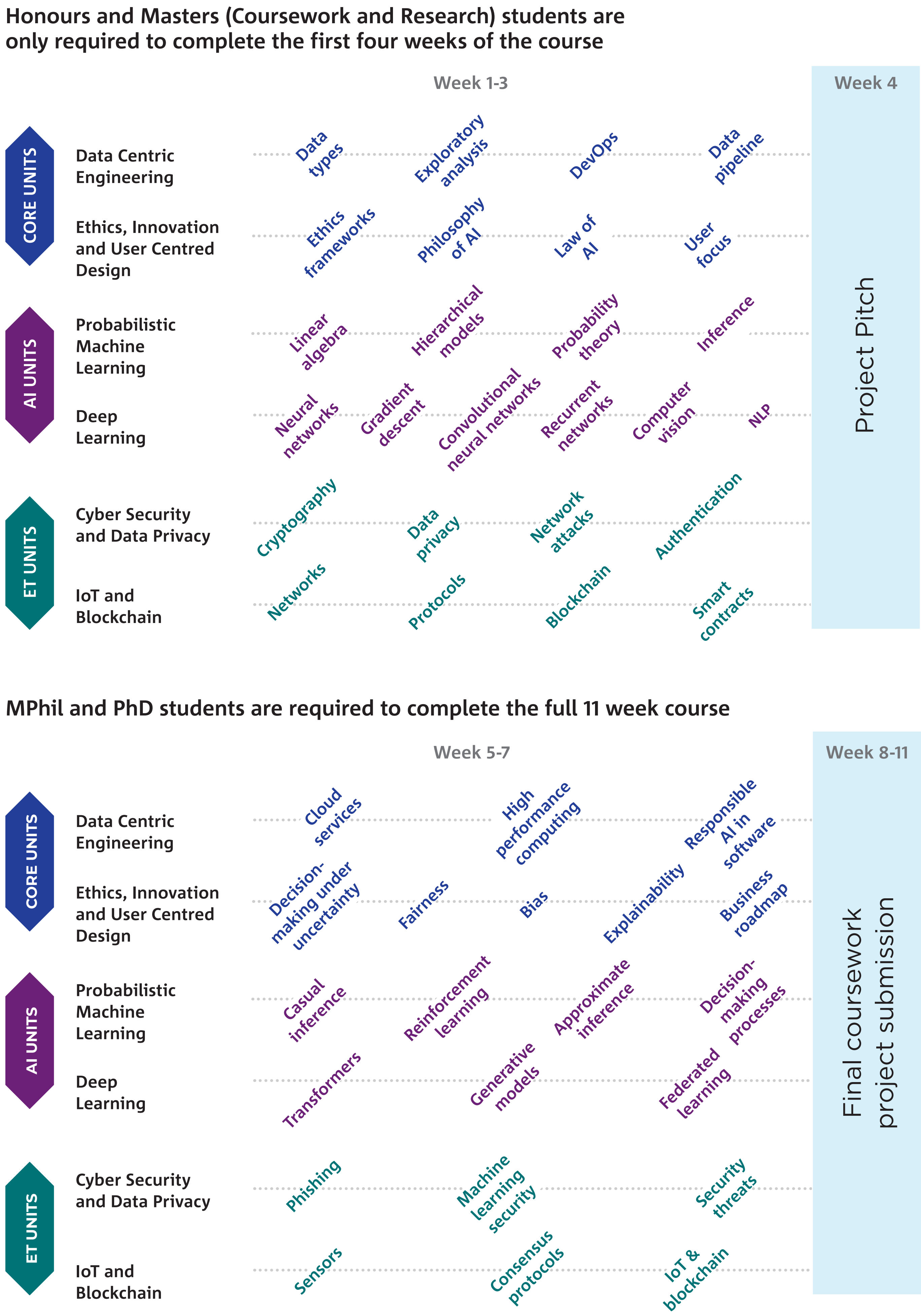


Figure 1 High level description of topics and timeframe

Pre-requisite knowledge and experience

Practical programming skills are crucial for solving real world problems in research and industry using AI. In these contexts, both data and underlying theoretical principles need to be translated into computer executable code to automate large scale and complex analytics. As such, the coursework and the future of the student's candidature require a beginner level of proficiency in programming, with a preference for the Python programming language.

> While a beginner level of programming proficiency is desired, applicants without prior programming experience are encouraged to apply. There are numerous online resources available to learn programming, enabling participants to develop the necessary skills to succeed in the course.

These resources include but are not limited to LearnPython.org[4], Learn Python the Hard Way[5], Dive Into Python[6], the Interactive Python Book[7].

In general, a beginner python programmer should:

- Be knowledgeable of the programming concepts including syntax, variables, data types, operations, functions. Particularly familiar with data types such as integers, strings and lists, including how to perform operations between them.
- Be able to handle script execution, operations, formatting, loops, and conduct code interpretation.
- Be able to write simple programs that perform operations using if-else and loops.
- Have a basic understanding on understanding on the use of libraries and modules.
- Use coding best practices, including writing readable and understandable code.
- Be able to debug code by printing the value of variables at varying points in code execution.

Time commitments

The curriculum and activities have been designed to provide a flexible and interactive experience. The majority of course content is accessible online and can be completed by student at their own pace, accounting for 82 per cent of the total course time.

The remaining 18 per cent involves live hybrid lectures, workshops and seminars, which will be recorded and made available later for students to view. The coursework is composed of lectures, workshops, self-paced practical activities, seminars, symposia, project work and reading.

Table 1 summarises the weekly time requirements in hours for each stream, with the AI stream combining the core and AI units, and the ET stream combining the core and ET units.

4. http://learnpython.org
5. https://learnpythonthehardway.org/book/
6. http://getpython3.com/diveintopython3/
7. https://runestone.academy/runestone/books/published/thinkcspy/index.html

Table 1. Weekly breakdown of time commitments in hours, including the percentage of activities delivered live in hybrid mode. Weeks one to four are mandatory for all students from Honours to PhD levels, while weeks five and onwards are for MPhil and PhD students only.

WEEKS 1–4 ALL STUDENTS

AI STREAM	HOURS	% LIVE
Week 1	16	11%
Week 2	15	28%
Week 3	17	29%
Week 4	21	14%
Week 5	17	35%
Week 6	12	8%
Week 7	11	16%
Week 8	14	12%
Week 9	15	20%
Week 10	12	0%
Week 11	15	20%
TOTAL	165	18%

ET STREAM	HOURS	% LIVE
Week 1	15	11%
Week 2	15	28%
Week 3	16	13%
Week 4	21	14%
Week 5	15	27%
Week 6	12	25%
Week 7	11	33%
Week 8	14	12%
Week 9	15	20%
Week 10	12	0%
Week 11	15	20%
TOTAL	161	18%

Core units

Data Centric Engineering

The development of AI and Emerging Technology systems in the real-world requires dealing directly with complex, heterogeneous, multimodal, and disorganised data. The implementation and deployment of these systems involves challenges which can only be tackled in a principled manner by following best practices from an engineering perspective – allowing efficient processing of large and incomplete datasets, deploying robust code, and scaling the processing capabilities in the cloud. This unit integrates the fundamentals from data science and engineering: It introduces basic data structures and data modelling, discusses techniques of data pre-processing, and analyses real-world datasets.

Students will handle data within a wide range of applications which are data intensive. They will master practical tools on data-driven models of engineering systems, engaging in collaboration activities and live workshops.

From an engineering perspective, this unit covers the most significant data engineering concepts and principles, such as DevOps, site-reliability engineering, cloud services, and engineering design patterns.

Learning outcomes

a. Identify formats and data structures, including spatial temporal data, longitudinal data, and unit record data

b. Differentiate between a variety of techniques for pre-processing data

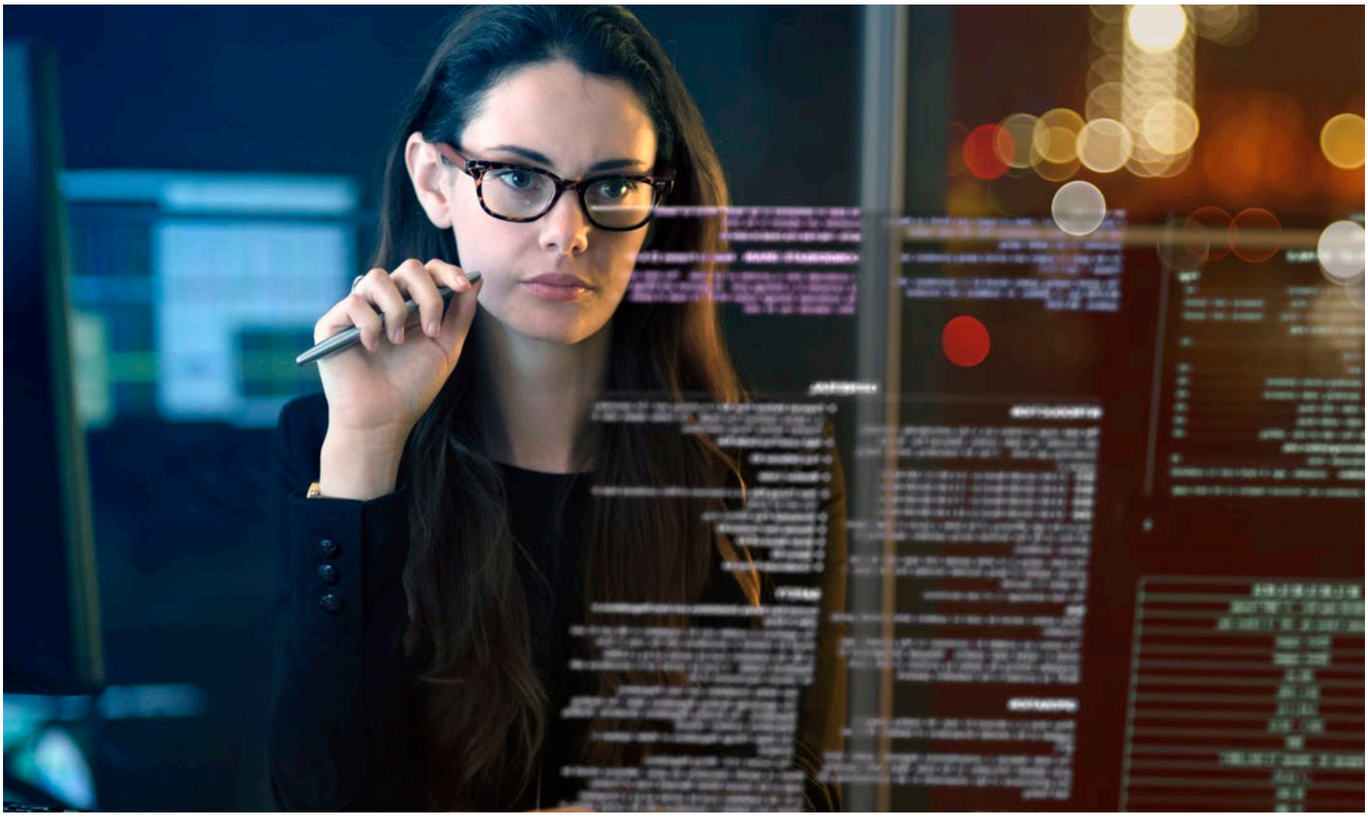
c. Develop data processing pipelines, involving data acquisition, pre-processing, and reporting

d. Explain the importance of documenting the data processing pipeline

e. Generate exploratory analysis of real-world datasets

f. Understand software development principles including site reliability, DevOps and engineering design patterns

g. Deploy machine learning models on cloud services and high-performance computing clusters.



Ethics, Innovation and User-Centred Design in Technology

Emerging Technologies and AI are already having impacts on the world around us. When new technologies are developed and deployed without ethical frameworks and fairness principles, unintended effects can disproportionately affect at-risk groups. The best AI-based solutions to real-world problems are developed with the user in mind, involve thinking out of the box, combine innovative ideas and tools while maintaining a commitment to responsible innovation.

This unit provides the breadth of knowledge that will allow students to familiarise themselves with the ethical questions involved in developing and deploying socio-technical systems – while keeping track of latest techniques, frameworks and building a viable roadmap for responsible AI and Emerging Technology projects.

Students will be guided by industry specialists and guest speakers to apply these concepts (with other fields of learning) in two debates, three activities and one live workshop. Student will need to show how their practical projects are aligned with AI ethical frameworks.

Learning outcomes

a. Recall the ethical concerns of AI and Emerging Technologies

b. Identify and explain the characteristics for each type of ethical concern including fairness, accountability, transparency, interpretability, privacy, and workforce shift

c. Examine the ethical implications of technology in society, considering both expected and unexpected outcomes

d. Quantify and measure fairness in predictive algorithms, employing different definitions of fairness

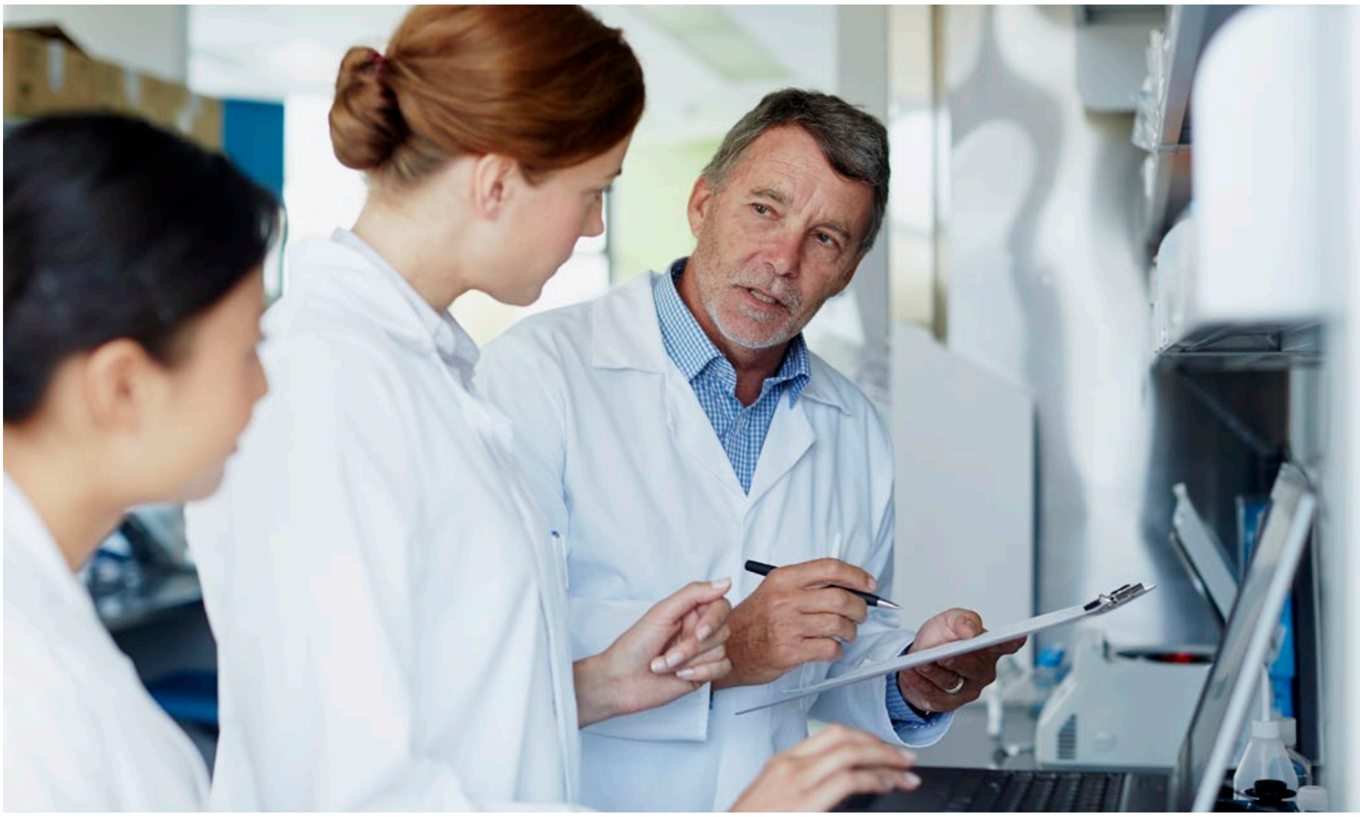
e. Devise frameworks that balance both ethical concerns and positive impact of technology

f. Describe the creative process for generating innovative solutions to real world problems

g. Identify the aspects of a solution that will provide value to a stakeholder and tailor the solution/product to their needs

h. Generate a concise yet informative pitch as a project description for stakeholders

i. Plan the development of a multi-disciplinary project, centred on AI or Emerging Technology



AI units

Probabilistic Machine Learning

Machine learning has gained traction as a powerful solution to complex problems using data. This unit presents an increasingly popular type of machine learning – probabilistic machine learning – where quantities of interest are represented as random variables. By developing a strong link between statistics and computer science, probabilistic machine learning provides a framework for quantification of uncertainty – a crucial component for decision making in unstructured and stochastic environments.

While this innovate approach for mathematical modelling has been around for decades, it has recently gained attention due to increased computing capacity and advances in theoretical and practical approaches that make the implementation of these complex and computationally intensive procedures a reality. This unit covers the core aspects of probabilistic machine learning, including modelling, inference and decision making, providing an overall understanding of the general framework used in realistic scenarios.

Concepts learned from this unit will be applied in live workshop experiences and developed within the main project as part of the coursework.

Learning outcomes

a. Recognise the value of probability theory in machine learning and the associated benefits for quantification of uncertainty

b. Explain the difference between deterministic mathematical modelling and machine learning incorporating probability

c. Distinguish different performance metrics for uncertainty aware (both predictive and model-based) machine learning systems

d. Differentiate between machine learning models and algorithms for inference

e. Synthesise deep disciplinary knowledge to produce and select probabilistic machine learning models best suitable for specific problems.

Deep Learning

The rise of neural networks as a flexible modelling tool, combined with powerful optimisation routines in high dimensional spaces, has resulted in an explosion of advanced computer vision and natural language processing, revolutionising many domain applications. Deep learning models are present throughout the internet and are responsible for search optimisation, recommender systems, image search and categorisation, language translation, and generative models among many others.

This unit covers the structural components of any computational system which uses deep learning, diving deeper into specific model structures that have recently proved very successful in specific applications, such as convolutional neural networks, recurrent neural networks, and transformers.

Students will engage in several collaboration activities and multiple industry-led workshops to explore these ideas with their cohort and subject-matter specialists.

Learning outcomes

a. Differentiate between deep learning and other types of machine learning models

b. Develop bespoke deep learning models to predict outcomes in both regression and classification

c. Outline the benefits and drawbacks of using deep learning models and differentiate in what context they should or shouldn't be used

d. Explain how data is used to train deep learning models

e. Identify the variety of existing deep learning models, outlining their hyperparameters and attribute their influence to learning ability and performance.

Emerging technologies units

Cyber Security and Data Privacy

As our world becomes inundated with data, ensuring that every individual's privacy is preserved and that computational systems are kept secure is becoming a top priority for government and private institutions.

This unit provides foundational knowledge on cyber security and data privacy, exploring the different types of security threats across network layers of engineering systems and discussing encryption and data-protection algorithms. As an important connection with other units in this coursework, there will be specific emphasis on the use of AI and machine learning as tools within resilient and secure computer systems.

Students apply their theoretical knowledge and develop practical experience engaging in a series of personal activities and group workshops, including a live debate about the future of data privacy.

Learning outcomes

a. Critically reflect upon what data privacy is and the security risks in real-world situations, including re-identification and encryption

b. Understand how privacy is treated in various data protection regulations and how they are applied in real-world scenarios

c. Interpret and discuss a variety of privacy risk mitigation techniques, including their advantages and disadvantages, and how each technique can be applied to data

d. Understand the relationships between AI and data privacy

e. Identify and explain security threats in the software, network, and web layer of computer systems

f. Recognise the cyber-attack features in protocols, systems and applications

g. Build, process and analyse cyber-security datasets using machine learning algorithms including their performance evaluation and visualisation.

Internet of Things and Blockchain

Most electronic devices and activities including transactions are now becoming fully connected to the internet.
The concepts of Internet of Things (IoT) and blockchain have been gradually introduced within the community through smart homes and devices, crypto-currency and automation.

This unit covers the fundamental concepts and techniques that underpin IoT and blockchain, including definitions, structure, layers and platforms. This unit will allow students to explore examples of blockchain and IoT applications and identify the challenges, security vulnerabilities and research directions associated with their design and implementation.

Students will develop their knowledge and practical skills by working through individual activities and attending a workshop which fosters collaboration and cross-cutting skills.

Learning outcomes

a. Distinguish between a cloud/internet solution versus a cyber physical / IoT system

b. Understand the layers of the network stack, common networking protocols, and a REST API

c. Understand IoT architectures and how IoT can enable Industry 4.0 solutions

d. Explain the principles, elements and applications of blockchain technology

e. Develop a simple, smart contract using Solidity

f. Comprehend the features of blockchain technology that can address IoT challenges

g. Design blockchain-based IoT applications

h. Identify the challenges of adopting blockchain for IoT applications, including security vulnerabilities, privacy and research directions.

Coursework assessments

Completion of the coursework will be determined by pass or fail. Passing the coursework is mandatory to continue the scholarship.

Attendance and active participation in all live activities is an important aspect of successfully completing the coursework.

Honours and Masters (both by coursework and by research) students are required to complete only Assignment One (A1) in week four, whereas MPhil and PhD students are required to also complete Assignment Two (A2) between week eight and 11.

The final mark will be calculated based on a combination of participation and performance on assessments, as described below:

Honours and Masters:

Final mark = 0.2 • (Attendance and Participation) + 0.8 • A1

MPhil and PhD:

Final mark = 0.2 • (Attendance and Participation) + 0.3 • A1 + 0.5 • A2

The assessment design of this coursework sets it apart from traditional university programs. Instead of having a separate assessment for each unit, assessments in this course combine knowledge from all four units. This means that students in the AI or ET stream will complete only one assessment, despite being enrolled in four units.

After each assessment, students will receive both verbal and written feedback from teaching staff, as well as have some activities reviewed by their peers and chief investigators from the Next Generation Graduates Program.

Assignment One (A1)

Students will collaborate in project groups to develop a technology-driven solution in the format of a short video and report, to address human or environment issues.

The objective of this assignment is to foster a holistic design thinking approach that extends beyond the technical specifications of a project. This task will require students to analyse the broader implications of their solutions, identify potential mitigation strategies, and communicate their ideas effectively. Furthermore, working in groups will encourage idea sharing and promote project-based thinking in a cohort environment, aligned with the Next Generation Graduates Program's vision.

Assignment Two (A2) – MPhil and PhD students only

This assignment is a comprehensive project that builds on skills developed in the first assignment, and integrates all elements covered in the coursework units. Working in pairs, students will develop a proof of concept for an AI or emerging tech solution to a real-world problem applying design thinking principles to critically analyse broader implications of their solutions, and identify mitigation strategies, while communicate ideas effectively.

This assessment allows students to choose their own project scope and group assignments, offering an opportunity to work on research topics that align with their future studies and the Next Generation Graduates Program they are enrolled in. If students are not enrolled in the same program, they will be encouraged to collaborate and find a topic that is related to both programs, which will enable peer-to-peer learning and cross-disciplinary thinking in multi-disciplinary teams to solve these real-world challenges.

The deliverables for this assignment include a poster presentation and a report that includes associated proof of concept materials. These will be presented at an in-person event where each student will give a presentation based on their poster. This event will mark the conclusion of the coursework.

As Australia's national science agency, CSIRO is solving the greatest challenges through innovative science and technology.

CSIRO. Unlocking a better future for everyone.

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