IMPORTANT: Four winter project positions are available under Dr Nan Ye's supervision. Successful applicants will be able to undertake any of the four projects listed below after consultation with Dr Nan Ye.

UQ Winter Research Project 1 Description

Project title:	**Solving Differential Equations using Neural Networks (project 1 of 4)**
Project duration, hours of engagement & delivery mode	4 weeks – 20-36hrs per week. Applicant will be required on-site for the project.
Description:	"Science is a differential equation." – Alan Turing Differential equations offer a powerful modelling tool for understanding our world. They have diverse applications in domains including fluid flow, electromagnetism, epidemiology. However, many differential equations are difficult to solver, whether analytically or numerically. Neural networks have recently been shown to be promising efficient approximate solutions. This project will explore some ideas in this direction.
Expected outcomes and deliverables:	• Develop skills for implementing neural network for solving differential equations. • Develop skills in using existing tools • Develop skills in research design, implementation, experimentation, and communication. • A report documenting the work done and the findings.
Suitable for:	Essential: knowledge of differential equations and neural networks Desirable: knowledge of numerical methods for solving differential equations
Primary Supervisor:	Nan Ye
Further info:	Email nan.ye@uq.edu.au for any inquiry on the project.

UQ Winter Research Project 2 Description

Project title:	**Few-shot learning for noisy data (project 2 of 4)**
Project duration, hours of engagement & delivery mode	4 weeks – 20-36hrs per week. Applicant will be required on-site for the project.
Description:	Machine learning algorithms often assume data is correctly labelled, but in practice the labelling process is often error-prone, and it is reported that the ratio of corrupted labels range from 8%-38.5% in various real-world datasets. This project aims to explore novel algorithms that can learn from a few nosily labelled examples on a new task by exploiting models that have been trained on some other tasks.
Expected outcomes and deliverables:	• Develop a general understanding of general robust approaches for learning from noisily labelled data • Develop empirical and/or theoretical understanding of the robustness of various machine learning algorithms, and develop new robust machine learning algorithms • Develop skills in research design, implementation, experimentation, and communication. • A report documenting the work done and the findings.
Suitable for:	Essential: knowledge of machine learning, strong programming skills. Desirable: knowledge of deep learning
Primary Supervisor:	Nan Ye
Further info:	Email nan.ye@uq.edu.au for any inquiry on the project.

UQ Winter Research Project 3 Description

Project title:	**Physics-Informed Machine Learning with Noisy Data (project 3 of 4)**
Project duration, hours of engagement & delivery mode	4 weeks – 20-36hrs per week. Applicant will be required on-site for the project.
Description:	Physics-informed machine learning exploits physical knowledge to guide model learning from data. This has attracted increasing interest recently, as in many domains, physical knowledge such as differential equations are available as prior constraints on the model. However, physics-informed machine learning can be sensitive to the noise in the data. This project aims to study the effect of noise and explore methods on alleviating the effect of noise for physics-informed machine learning.
Expected outcomes and deliverables:	• Develop an understanding of physics informed machine learning. • Develop skills for implementing physics informed machine learning approaches. • Develop skills in research design, implementation, experimentation, and communication. • A report documenting the work done and the findings.
Suitable for:	Essential: knowledge on deep learning and differential equations
Primary Supervisor:	Nan Ye
Further info:	Email nan.ye@uq.edu.au for any inquiry on the project.

UQ Winter Research Project 4 Description

Project title:	**Making robots learn by trial and error (project 4 of 4)**
Project duration, hours of engagement & delivery mode	4 weeks – 20-36hrs per week. Applicant will be required on-site for the project.
Description:	Have you ever picked up a skill without any trial and error? Perhaps rarely, if not no. This project explores algorithms that robots can be used to learn skills like walking and swimming by trial and error. This has been extensively studied in an area of artificial intelligence called reinforcement learning (RL). The successful applicant of this project will apply some state-of-the-art RL algorithms to robot learning using fast and accurate simulators. There will be opportunity to develop new algorithms if time permits.
Expected outcomes and deliverables:	• Gain knowledge on some state-of-the art RL algorithms and a robotics simulator. • Develop the ability to implement RL-based AI for robot learning. • Develop skills in research design, implementation, experimentation, and communication. • A report documenting the work done and the findings.
Suitable for:	Essential: knowledge of deep learning, strong programming skills Desirable: knowledge of Markov decision processes and reinforcement learning
Primary Supervisor:	Nan Ye
Further info:	Email nan.ye@uq.edu.au for any inquiry on the project.