AMSI Online: Honours and Masters Subject Guide

SUBJECT NAME

Semester 2, 2026

Administration and contact details

Host department	School of Mathematics and Physics
Host institution	The University of Queensland
Name of lecturer	Nan Ye
Phone number	+61 7 334 69095
Email address	nan.ye@uq.edu.au
Homepage	https://yenan.github.io
Name of honours coordinator	Gabriele Tartaglino Mazzucchelli
Phone number	+61 7 336 58839
Email address	g.tartaglino-mazzucchelli@uq.edu.au
Name of masters coordinator	Xin Guo
Phone number	+61 7 334 69728
Email address	xin.guo@uq.edu.au

Subject details

Handbook entry URL	
Subject homepage URL	https://programs-courses.uq.edu.au/course.html?course_code=STAT3007 and https://programs-courses.uq.edu.au/course.html?course_code=STAT7007
Honours student hand-out URL	
Teaching period (start and end date):	27/07/2026-30/10/2026
Exam period (start and end date):	7/11/2026-21/11/2026
Contact hours per week:	5 hours
ACE enrolment closure date:	
Lecture day(s) and time(s):	TBD
Description of electronic access arrangements for students (for example, LMS)	Student will be provided with accounts to access UQ's Blackboard LMS.

Subject content

1. **Subject content description**

   Deep learning has become a much sought-after game-changing technology that has enabled breakthroughs in applications such as intelligent virtual assistants, medical diagnosis, recommender systems, and autonomous driving. This course provides a comprehensive and rigorous coverage of deep learning from both applied and theoretical perspectives. Students taking this course will understand how, why and when the algorithms work, and be able to effectively apply deep learning methods to practical problems. This course begins with the basics of machine learning, followed by a broad coverage of deep neural networks, including some major deep neural network architectures, optimization of network parameters, and applications in classification, regression and reinforcement learning. This course is suitable for both students who want to build data-driven enabling applications with deep learning, and students who want to develop a solid foundation for doing research in deep learning in particular, and machine learning or artificial intelligence more broadly. To maximise the learning outcomes, students are expected to have a solid foundation in statistics, calculus, linear algebra, and programming. Python will be used for this course.

2. **Week-by-week topic overview**

   Tentative schedule

Course Overview & Machine Learning Basics
Week 1. Introduction. Regression. Classification
Week 2. PCA. Statistical learning. Model selection.
Neural Networks Basics
Week 3. Perceptron. Adaline. Hopfield Networks.
Week 4. Gradient-based learning. MLPs. Automatic differentiation.
Deep Architectures
Week 5. Convolutional neural networks
Week 6. Recurrent neural networks
Optimization for Deep Learning
Week 7. Optimization basics. Initialization and Input Transformation. Batch normalization. Adaptive learning rate.
Improving Generalization
Week 8. Regularization. Adversarial examples and adversarial training.
Week 9. Activation functions. ResNet, HighwayNet, DenseNet. Attention.

Unsupervised Learning
Week 10. Autoencoders. Variational auto-encoder. Generative Adversarial Networks (GANs). Diffusion Models.
Reinforcement Learning
Week 11. Reinforcement learning
Miscellaneous Topics
Week 12. Graph neural networks. Neural differential equation solvers. Discrete optimization.
Week 13. Foundation models. Review

3. **Assumed prerequisite knowledge and capabilities**

Students are assumed to have solid foundation in statistics, calculus, linear algebra, and programming.

At UQ, the assumed prerequisites are (STAT2004 Statistical Modelling & Analysis or STAT2203 Probability Models & Data Analysis or equivalent) + programming experience (for example, MATH2504 or CSSE2002 or equivalent).

4. **Learning outcomes and objectives**

Students will learn the fundamental theories, algorithms and models of deep learning. Students will be required to undertake a project chosen in consultation with the course coordinator, which will lead to a seminar and report. The various assessment tasks aim to develop independence in gaining knowledge and applicable skills, capabilities in using advanced software for machine learning and deep learning, critical thinking and verbal and written communication skills.

After successfully completing this course you should be able to:

LO1. Understand and explain the intuition, ideas and theory of deep learning algorithms and models
LO2. Assess whether a deep learning algorithm is effective and appropriate for an application
LO3. Propose suitable deep learning solutions and implement them for real world problems
LO4. Effectively explain deep learning solutions in the form of oral presentations and reports
LO5. Develop deep learning solutions to substantial problems through collaborative work

AQF specific Program Learning Outcomes and Learning Outcome Descriptors (if available):

AQF Program Learning Outcomes	Associated AQF Learning Outcome

addressed in this subject	Descriptors for this subject
Knowledge	K1, K2
Skills	S1, S2, S3, S4, S5
Application of Knowledge and Skills	A1, A2, A3, A4

Learning Outcome Descriptors at AQF Level 8

Knowledge

K1: coherent and advanced knowledge of the underlying principles and concepts in one or more disciplines

K2: knowledge of research principles and methods

Skills

S1: cognitive skills to review, analyse, consolidate and synthesise knowledge to identify and provide solutions to complex problem with intellectual independence

S2: cognitive and technical skills to demonstrate a broad understanding of a body of knowledge and theoretical concepts with advanced understanding in some areas

S3: cognitive skills to exercise critical thinking and judgement in developing new understanding

S4: technical skills to design and use in a research project

S5: communication skills to present clear and coherent exposition of knowledge and ideas to a variety of audiences

Application of Knowledge and Skills

A1: with initiative and judgement in professional practice and/or scholarship

A2: to adapt knowledge and skills in diverse contexts

A3: with responsibility and accountability for own learning and practice and in collaboration with others within broad parameters

A4: to plan and execute project work and/or a piece of research and scholarship with some independence

5. Learning resources

Lecture slides will be provided before each week's lecture.

Theory and programming exercises will be provided before each week's practicals, with solutions released at the end of the week.

6. Assessment breakdown

Exam	30%
Assignment 1	15%
Assignment 2	15%
Project	40%

Assignment due dates	Exam date (approximate)
Tentative dates	Between 7/11/2026-21/11/2026

Assignment 1: Week 6 Assignment 2: Week 11 Project • Proposal: Week 7 • Seminar: Week 13 • Report: between 9/11/2026-13/11/2026 • Reflective essay: one day after report due date	

Institution honours program details

Weight of subject in total honours assessment at host department	n/a
Thesis/subject split at host department	n/a
Honours grade ranges at host department	n/a
H1	Enter range %
H2a	Enter range %
H2b	Enter range %
H3	Enter range %

Institution masters program details

Weight of subject in total masters assessment at host department	n/a
Thesis/subject split at host department	n/a
Masters grade ranges at host department	n/a
H1	Enter range %
H2a	Enter range %
H2b	Enter range %
H3	Enter range %