COIT29225 *Neural Networks and Deep Learning*
Term 2 - 2024

Profile information current as at 29/07/2024 05:37 pm

General Information

Overview

Artificial Intelligence (AI) is becoming an important part of software development. Neural networks and Deep Learning are the main contributors to the recent advances in applications of Artificial Intelligence. Deep Learning enables computers to learn complicated concepts by building them out of a hierarchy of simpler ones. Deep Learning techniques have been successfully applied to a broad field of applications such as computer vision, image and video recognition, natural language processing, and medical diagnosis. This unit introduces you to the fundamentals of Deep Learning and how it can solve problems in many areas. In this unit, you will learn the architecture of neural networks and algorithms, including the latest Deep Learning techniques. You will learn to develop conventional neural networks such as multilayer perceptrons, and convolutional neural networks. You will use software to train and deploy neural networks. You will also identify practical applications of Deep learning by exploring recent case studies.

Details

Career Level: *Postgraduate*
Unit Level: *Level 9*
Credit Points: *6*
Student Contribution Band: *8*
Fraction of Full-Time Student Load: *0.125*

Pre-requisites or Co-requisites

Pre-requisite: COIT20277 Introduction to Artificial Intelligence
Important note: Students enrolled in a subsequent unit who failed their pre-requisite unit, should drop the subsequent unit before the census date or within 10 working days of Fail grade notification. Students who do not drop the unit in this timeframe cannot later drop the unit without academic and financial liability. See details in the Assessment Policy and Procedure (Higher Education Coursework).

Offerings For Term 2 - 2024

- Online

Attendance Requirements

All on-campus students are expected to attend scheduled classes – in some units, these classes are identified as a mandatory (pass/fail) component and attendance is compulsory. International students, on a student visa, must maintain a full time study load and meet both attendance and academic progress requirements in each study period (satisfactory attendance for International students is defined as maintaining at least an 80% attendance record).

Website

This unit has a website, within the Moodle system, which is available two weeks before the start of term. It is important that you visit your Moodle site throughout the term. Please visit Moodle for more information.

Class and Assessment Overview

Recommended Student Time Commitment

Each 6-credit Postgraduate unit at CQUniversity requires an overall time commitment of an average of 12.5 hours of study per week, making a total of 150 hours for the unit.

Class Timetable

Regional Campuses
Bundaberg, Cairns, Emerald, Gladstone, Mackay, Rockhampton, Townsville

Metropolitan Campuses
Adelaide, Brisbane, Melbourne, Perth, Sydney

Assessment Overview

1. **Practical Assessment**
Weighting: 30%
2. **Practical Assessment**
Weighting: 35%
3. **Project (applied)**
Weighting: 35%

Assessment Grading

This is a graded unit: your overall grade will be calculated from the marks or grades for each assessment task, based on the relative weightings shown in the table above. You must obtain an overall mark for the unit of at least 50%, or an overall grade of 'pass' in order to pass the unit. If any 'pass/fail' tasks are shown in the table above they must also be completed successfully ('pass' grade). You must also meet any minimum mark requirements specified for a particular assessment task, as detailed in the 'assessment task' section (note that in some instances, the minimum mark for a task may be greater than 50%). Consult the University's Grades and Results Policy for more details of interim results and final grades.

CQUniversity Policies

All University policies are available on the CQUniversity Policy site.
You may wish to view these policies:

- Grades and Results Policy
- Assessment Policy and Procedure (Higher Education Coursework)
- Review of Grade Procedure
- Student Academic Integrity Policy and Procedure
- Monitoring Academic Progress (MAP) Policy and Procedure – Domestic Students
- Monitoring Academic Progress (MAP) Policy and Procedure – International Students
- Student Refund and Credit Balance Policy and Procedure
- Student Feedback – Compliments and Complaints Policy and Procedure
- Information and Communications Technology Acceptable Use Policy and Procedure

This list is not an exhaustive list of all University policies. The full list of University policies are available on the CQUniversity Policy site.

Previous Student Feedback

Feedback, Recommendations and Responses

Every unit is reviewed for enhancement each year. At the most recent review, the following staff and student feedback items were identified and recommendations were made.

Feedback from Teaching Evaluation

Feedback
It is better to use code to illustrate the lecture content.

Recommendation
For individual weeks, we can add Python code to explain relevant machine learning algorithms.

Feedback from Self-Reflection

Feedback
The content can be further enriched by adding extended materials on image analysis using OpenCV libraries.

Recommendation
Adding appropriate new materials on using OpenCV for image analysis applications.

Unit Learning Outcomes

On successful completion of this unit, you will be able to:

1. Formulate a neural network and deep learning problem applying the concepts and theory of classical and deep learning techniques
2. Design deep learning solutions to problems in pattern recognition and image analysis
3. Build a software application implementing neural networks using a high level programming language
4. Evaluate the performance of the deep learning techniques used in the software application
5. Investigate the application of intelligent systems in socially innovative applications.

The Skills Framework for the Information Age (SFIA) standard covers the skills and competencies related to information and communication technologies. SFIA defines levels of responsibility and skills. SFIA is adopted by organisations, governments and individuals in many countries. SFIA is increasingly being used when developing job descriptions and role profiles. SFIA can be used by individuals for creating personal skills profile. The Australian Computer Society (ACS) recognises the SFIA and provides MySFIA for ACS members to build a skills profile.
This unit contributes to the following workplace skills as defined by SFIA 7 (the SFIA code is included):
Software design (SWDN)
Programming/software development (PROG)
Testing (TEST)
Application Support (ASUP).

Alignment of Learning Outcomes, Assessment and Graduate Attributes

— N/A Level ◦ Introductory Level • Intermediate Level • Graduate Level ◦ Professional Level ◦ Advanced Level

Alignment of Assessment Tasks to Learning Outcomes

Assessment Tasks	Learning Outcomes				
	1	2	3	4	5
1 - Practical Assessment - 30%	•	•			
2 - Practical Assessment - 35%	•	•	•		•

Assessment Tasks	Learning Outcomes				
	1	2	3	4	5
3 - Project (applied) - 35%			•	•	•

Alignment of Graduate Attributes to Learning Outcomes

Graduate Attributes	Learning Outcomes				
	1	2	3	4	5
1 - Knowledge	◦	◦	◦		
2 - Communication		◦			◦
3 - Cognitive, technical and creative skills		◦	◦	◦	
4 - Research			◦	◦	◦
5 - Self-management				◦	
6 - Ethical and Professional Responsibility			◦		
7 - Leadership			◦		
8 - Aboriginal and Torres Strait Islander Cultures					

Alignment of Assessment Tasks to Graduate Attributes

Assessment Tasks	Graduate Attributes							
	1	2	3	4	5	6	7	8
1 - Practical Assessment - 30%	◦	◦	◦					
2 - Practical Assessment - 35%	◦	◦	◦	◦		◦	◦	
3 - Project (applied) - 35%	◦		◦	◦	◦	◦	◦	

Textbooks and Resources

Textbooks

COIT29225

Prescribed

Neural Networks and Deep Learning
Edition: 1st (2018)
Authors: Charu C. Aggarwal
Springer
Gewerbestrasse , Cham , Swissland
ISBN: 978-3-319-94462-3

View textbooks at the CQUniversity Bookshop

IT Resources

You will need access to the following IT resources:

- CQUniversity Student Email
- Internet
- Unit Website (Moodle)
- Python 3.7 or higher
- TensorFlow and Keras
- Anaconda3 2019.10 or 2020.02

Referencing Style

All submissions for this unit must use the referencing style: Harvard (author-date)
For further information, see the Assessment Tasks.

Teaching Contacts

Michael Li Unit Coordinator
m.li@cqu.edu.au

Schedule

Week 1 - 08 Jul 2024

Module/Topic	Chapter	Events and Submissions/Topic
Advanced APIs of Python Programming - Numpy, Scipy, Matplotlib, Pandas, and Data Visualization	Lecture Notes	

Week 2 - 15 Jul 2024

Module/Topic	Chapter	Events and Submissions/Topic
An Introduction to Neural Networks	Textbook Chapter 1	

Week 3 - 22 Jul 2024

Module/Topic	Chapter	Events and Submissions/Topic
Machine Learning with Shallow Neural Networks	Textbook Chapter 2	

Week 4 - 29 Jul 2024

Module/Topic	Chapter	Events and Submissions/Topic

Deep Neural Networks and Learning Algorithms (1)	Textbook Chapter 3	

Week 5 - 05 Aug 2024

Module/Topic	Chapter	Events and Submissions/Topic
Deep Neural Networks and Learning Algorithms (2)	Textbook Chapters 3&4	

Vacation Week - 12 Aug 2024

Module/Topic	Chapter	Events and Submissions/Topic

Week 6 - 19 Aug 2024

Module/Topic	Chapter	Events and Submissions/Topic
Unsupervised Learning Algorithms	Lecture Notes	**Assignment 1 - Complex data analysis and machine learning** Due: Week 6 Friday (23 Aug 2024) 11:45 pm AEST

Week 7 - 26 Aug 2024

Module/Topic	Chapter	Events and Submissions/Topic
Convolutional Neural Networks (1)	Textbook Chapter 8 - Part 1	

Week 8 - 02 Sep 2024

Module/Topic	Chapter	Events and Submissions/Topic
Convolutional Neural Networks (2)	Textbook Chapter 8 - Part 2	

Week 9 - 09 Sep 2024

Module/Topic	Chapter	Events and Submissions/Topic
Deep Learning - practices and applications	Textbook Chapter 8 - Part 3 & Lecture Notes	

Week 10 - 16 Sep 2024

Module/Topic	Chapter	Events and Submissions/Topic
Restricted Boltzmann Machines	Textbook Chapter 6	**Assignment 2 - Regression/Classification** Due: Week 10 Friday (20 Sept 2024) 11:45 pm AEST

Week 11 - 23 Sep 2024

Module/Topic	Chapter	Events and Submissions/Topic
Recurrent Neural Networks	Textbook Chapter 7& Lecture Notes	

Week 12 - 30 Sep 2024

Module/Topic	Chapter	Events and Submissions/Topic
Recent Advances in AI Technology	Lecture notes and supplementary material	

Review/Exam Week - 07 Oct 2024

Module/Topic	Chapter	Events and Submissions/Topic
		Assignment 3 - Image Classifcation Due: Review/Exam Week Friday (11 Oct 2024) 11:45 pm AEST

Exam Week - 14 Oct 2024

Module/Topic	Chapter	Events and Submissions/Topic
Exam Week		

Term Specific Information

Unit Coordinator: Michael Li
North Rockhampton campus, CQU
Phone: 07 49306337
E-mail: m.li@cqu.edu.au
Assessment policy note: re-attempts of assessments are not allowed.

Assessment Tasks

1 Assignment 1 - Complex data analysis and machine learning

Assessment Type
Practical Assessment

Task Description
For this assignment, you are required to showcase your understanding from weeks 1 through 6 by addressing real-world challenges using machine learning algorithms. You will design and implement the software solutions that need to use python programming skills, including the use of the built-in python advanced libraries (such as NumPy, SciPy, Matplotlib and Scikits, etc.) for performing various tasks including data visualization Further specifics about the assignment can be found on the course webpage.
Please note:re-attempts of this assessment are not allowed.

Assessment Due Date
Week 6 Friday (23 Aug 2024) 11:45 pm AEST
Online via Moodle

Return Date to Students
Week 8 Friday (6 Sept 2024)
Online via Moodle

Weighting
30%

Assessment Criteria

1. Understanding the problem
2. Build a solution with appropriate learning algorithm.
3. Show the performance evaluation using appropriate metrics.
4. Write a report and demonstrate how to write research papers.

Referencing Style

- Harvard (author-date)

Submission
Online

Learning Outcomes Assessed

- Formulate a neural network and deep learning problem applying the concepts and theory of classical and deep learning techniques
- Design deep learning solutions to problems in pattern recognition and image analysis

Graduate Attributes

- Knowledge
- Communication
- Cognitive, technical and creative skills

2 Assignment 2 - Regression/Classification

Assessment Type
Practical Assessment

Task Description
In this assignment, we'll evaluate your grasp of the concepts taught during weeks 4-7. You'll encounter two challenges that can be addressed using regression and classification techniques. It's essential to comprehend the issues and select the suitable algorithm for resolution using the provided benchmark dataset. More specifics can be found on the course webpage.
Please note:re-attempts this assessment are not allowed.

Assessment Due Date
Week 10 Friday (20 Sept 2024) 11:45 pm AEST
Online via Moodle

Return Date to Students
Week 12 Friday (4 Oct 2024)
Online via Moodle

Weighting
35%

Assessment Criteria

1. Read the dataset properly and clean up if needed.
2. Solution design for the problems.
3. Use appropriate libraries and show good programming practices.
4. Cross validation and classification accuracy
5. Report to present the key findings and learning.

Referencing Style

- Harvard (author-date)

Submission
Online

Submission Instructions
Online via Moodle

Learning Outcomes Assessed

- Formulate a neural network and deep learning problem applying the concepts and theory of classical and deep learning techniques
- Design deep learning solutions to problems in pattern recognition and image analysis
- Build a software application implementing neural networks using a high level programming language
- Investigate the application of intelligent systems in socially innovative applications.

Graduate Attributes

- Knowledge
- Communication
- Cognitive, technical and creative skills
- Research
- Ethical and Professional Responsibility
- Leadership

3 Assignment 3 - Image Classifcation

Assessment Type
Project (applied)

Task Description
For this assignment, you're tasked with creating an application based on the content from weeks 8-12. Leveraging Convolutional Neural Networks (CNN) and Deep Learning, which are commonly used for image-related challenges, this assignment will allow you to tackle industry-standard issues and demonstrate your problem-solving capabilities in real-world scenarios. Utilise well-recognised libraries such as TensorFlow and Keras, and feel free to employ cloud technologies for your solutions. Conclusively, document the accuracy comparisons and, if possible, surpass the existing accuracy levels. Then, compile your findings into a research paper for submission. Comprehensive guidelines can be found in the Project Specification document on the course's webpage.

Assessment Due Date
Review/Exam Week Friday (11 Oct 2024) 11:45 pm AEST

Online via Moodle

Return Date to Students

Online via Moodle

Weighting
35%

Assessment Criteria

1. Problem analysis and choose correct algorithms.
2. Correct design of the CNN and learning parameters
3. Correct use of machine learning libraries
4. Document the findings and key contributions
5. Good programming practice and produce industry standard code.

Referencing Style

- Harvard (author-date)

Submission
Online

Submission Instructions
Online Via Moodle

Learning Outcomes Assessed

- Build a software application implementing neural networks using a high level programming language
- Evaluate the performance of the deep learning techniques used in the software application
- Investigate the application of intelligent systems in socially innovative applications.

Graduate Attributes

- Knowledge
- Cognitive, technical and creative skills
- Research
- Self-management
- Ethical and Professional Responsibility
- Leadership

Academic Integrity Statement

As a CQUniversity student you are expected to act honestly in all aspects of your academic work.

Any assessable work undertaken or submitted for review or assessment must be your own work. Assessable work is any type of work you do to meet the assessment requirements in the unit, including draft work submitted for review and feedback and final work to be assessed.

When you use the ideas, words or data of others in your assessment, you must thoroughly and clearly acknowledge the source of this information by using the correct referencing style for your unit. Using others' work without proper acknowledgement may be considered a form of intellectual dishonesty.

Participating honestly, respectfully, responsibly, and fairly in your university study ensures the CQUniversity qualification you earn will be valued as a true indication of your individual academic achievement and will continue to receive the respect and recognition it deserves.

As a student, you are responsible for reading and following CQUniversity's policies, including the **Student Academic Integrity Policy and Procedure**. This policy sets out CQUniversity's expectations of you to act with integrity, examples of academic integrity breaches to avoid, the processes used to address alleged breaches of academic integrity, and potential penalties.

What is a breach of academic integrity?
A breach of academic integrity includes but is not limited to plagiarism, self-plagiarism, collusion, cheating, contract cheating, and academic misconduct. The Student Academic Integrity Policy and Procedure defines what these terms mean and gives examples.

Why is academic integrity important?
A breach of academic integrity may result in one or more penalties, including suspension or even expulsion from the University. It can also have negative implications for student visas and future enrolment at CQUniversity or elsewhere. Students who engage in contract cheating also risk being blackmailed by contract cheating services.

Where can I get assistance?
For academic advice and guidance, the Academic Learning Centre (ALC) can support you in becoming confident in completing assessments with integrity and of high standard.

What can you do to act with integrity?

Be Honest
If your assessment task is done by someone else, it would be dishonest of you to claim it as your own

Seek Help
If you are not sure about how to cite or reference in essays, reports etc, then seek help from your lecturer, the library or the Academic Learning Centre (ALC)

Produce Original Work
Originality comes from your ability to read widely, think critically, and apply your gained knowledge to address a question or problem