**UNSW Course Outline**

# COMP9414 Artificial Intelligence - 2024

Published on the 21 May 2024

## General Course Information

**Course Code :** COMP9414
**Year :** 2024
**Term :** Term 2
**Teaching Period :** T2
**Is a multi-term course? :** No
**Faculty :** Faculty of Engineering
**Academic Unit :** School of Computer Science and Engineering
**Delivery Mode :** In Person
**Delivery Format :** Standard
**Delivery Location :** Kensington
**Campus :** Sydney
**Study Level :** Postgraduate
**Units of Credit :** 6

<u>Useful Links</u>

<u>Handbook</u> <u>Class Timetable</u>

## Course Details & Outcomes

### Course Description

COMP9414 is an introductory course on Artificial Intelligence covering fundamental topics such as autonomous agents, problem solving, optimisation, logic, knowledge representation, reasoning under uncertainty, vision, language processing, machine learning, neural networks and

reinforcement learning. The course is taught with an orientation towards machine learning and with a view to practical applications of Artificial Intelligence using Python. Some AI applications that make use of foundational concepts will be demonstrated in lectures and tutorials.

# Course Aims

The course aims to provide a foundation for further studies in AI such as COMP4418 Knowledge Representation and Reasoning, COMP9417 Machine Learning and Data Mining, COMP9517 Computer Vision, COMP9434 Robotic Software Architecture, and COMP9444 Neural Networks and Deep Learning. Postgraduate students with more programming experience may consider enrolling in COMP9814, which is the same as the undergraduate AI course COMP3411 (offered in Term 1).

# Course Learning Outcomes

| Course Learning Outcomes |
| --- |
| CLO1 : Demonstrate understanding of the foundations of AI and fundamental AI techniques |
| CLO2 : Choose appropriate AI techniques to solve given problems and implement standard AI algorithms |
| CLO3 : Demonstrate practical skills in utilizing AI toolkits in realistic application areas |
| CLO4 : Evaluate the risks of applying AI in business and industry |

| Course Learning Outcomes | Assessment Item |
| --- | --- |
| CLO1 : Demonstrate understanding of the foundations of AI and fundamental AI techniques | • Assignment 2<br>• Assignment 1<br>• Exam |
| CLO2 : Choose appropriate AI techniques to solve given problems and implement standard AI algorithms | • Assignment 2<br>• Assignment 1<br>• Exam |
| CLO3 : Demonstrate practical skills in utilizing AI toolkits in realistic application areas | • Assignment 2<br>• Assignment 1<br>• Exam |
| CLO4 : Evaluate the risks of applying AI in business and industry | • Assignment 2<br>• Assignment 1<br>• Exam |

# Learning and Teaching Technologies

Moodle - Learning Management System

# Assessments

## Assessment Structure

| Assessment Item | Weight | Relevant Dates |
|---|---|---|
| Assignment 2<br>Assessment Format: Individual | 25% | Start Date: Not Applicable<br>Due Date: Week 5: 24 June - 30 June |
| Assignment 1<br>Assessment Format: Individual | 25% | Start Date: Not Applicable<br>Due Date: Week 9: 22 July - 28 July |
| Exam<br>Assessment Format: Individual | 50% | Due Date: TBA - Exam Period |

## Assessment Details
### Assignment 2

Assessment Overview

This programming assignment is marked based on its correctness and on programming style and critical analysis. Students can work on the assignment individually or along with a classmate from the same tutorial. In terms of assessment of correctness and style, there will be no differences in works made by 1 or 2 students. However, for the analysis and discussion, both students must participate. It is the student's responsibility to ensure that the submitted code runs on the school environment using the version of Python installed in the labs.

Weighting:

Results 12.5%

Discussion 12.5%

Feedback:

Students will receive feedback from tutors during the discussion session. In these sessions, students will demonstrate their code understanding while tutors will provide additional comments on individual students' solutions.

Course Learning Outcomes

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## Assignment 1

### Assessment Overview

This programming assignment is marked based on its correctness and on programming style and critical analysis. Students can work on the assignment individually or along with a classmate from the same tutorial. In terms of assessment of correctness and style, there will be no differences in works made by 1 or 2 students. However, for the analysis and discussion, both students must participate. It is the student's responsibility to ensure that the submitted code runs on the school environment using the version of Python installed in the labs.

Weighting:

Results 12.5%
Discussion 12.5%

Feedback:

Students will receive feedback from tutors during the discussion session. In these sessions, students will demonstrate their code understanding while tutors will provide additional comments on individual students' solutions.

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### Assignment submission Turnitin type

Not Applicable

## Exam

### Assessment Overview

The final exam is a 2-hour examination covering all topics in the course.

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# General Assessment Information

<u>Grading Basis</u>

Standard

# Course Schedule

## Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

## General Schedule Information

Week 1 Introduction

1.1 History of AI

1.2 Agents

1.3 Knowledge representation

1.3.1 Feature-based vs iconic representations

1.3.2 Logic

1.3.3 Learning rules

Week 2 Neural Networks

2.1 Neurons - biological and artificial

2.2 Single-layer perceptron

2.3 Linear separability

2.4 Multi-layer networks

2.5 Backpropagation

2.6 Neural engineering methodology

Week 3 Search

3.1 Uninformed search

3.2 Informed search

3.3 Informed vs uninformed

Week 4 Rewards instead of goals

4.1 Elements of reinforcement learning

4.2 Exploration vs exploitation

4.3 The agent-environment interface

4.4 Values functions

4.5 Temporal-difference prediction

Week 5 Metaheuristics

5.1 Asymptotic complexity

5.2 Classes of problems

5.3 Linear programming

5.4 Search space

5.5 Metaheuristics with and without memory

5.6 Population-based methods

Week 6 Recap and consultation

Week 7 Computer vision

7.1 Image processing

7.2 Scene analysis

7.3 Cognitive vision

Week 8 Language processing

8.1 Formal languages

8.1.1 Chomsky's hierarchy

8.1.2 Grammars

8.2 Regular expressions

8.3. Minimum edit distance and words

8.4 Natural languages: N-gram models

Week 9 Reasoning with uncertain information

9.1 Confidence factors

9.1 Probability and probabilistic inference

9.2 Bayes nets

9.3 Fuzzy logic

Week 10 Human-aligned intelligent robotics

10.1 Human interaction and human-in-the-loop robot learning

10.2 Explainability and interpretability

10.3 Safe robot exploration

10.4 Ethics

# Course Resources

## Recommended Resources

- Poole, D.L. & Mackworth, A. Artificial Intelligence: Foundations of Computational Agents. Second Edition. Cambridge University Press, Cambridge, 2017.

- Russell, S.J. & Norvig, P. Artificial Intelligence: A Modern Approach. Fourth Edition, Pearson Education, Hoboken, NJ, 2021.

- Sutton, R. & Barto, A. Reinforcement Learning: An Introduction. MIT press. 2018.

- Jurafsky, D. & Martin, J. H. Speech and Language Processing. Stanford. 2023.

- Nilsson, N. J. Artificial intelligence: a new synthesis. Morgan Kaufmann. 1998.

- Aloimonos, Y., & Sandini, G. Principles of Cognitive Vision. In Cangelosi, A., & Asada, M. (Eds.). Cognitive robotics. MIT Press. 2022.

# Staff Details

| Position | Name | Email | Location | Phone | Availability | Equitable Learning Services Contact | Primary Contact |
|---|---|---|---|---|---|---|---|
| Convenor | Francisco Cruz | | | | | No | No |
| Administrator | Maryam Hashemi | | | | | Yes | Yes |

# Other Useful Information

## Academic Information

### I. Special consideration and supplementary assessment

If you have experienced an illness or misadventure beyond your control that will interfere with your assessment performance, you are eligible to apply for Special Consideration prior to, or within 3 working days of, submitting an assessment or sitting an exam.

Please note that UNSW has a Fit to Sit rule, which means that if you sit an exam, you are declaring yourself fit enough to do so and cannot later apply for Special Consideration.

For details of applying for Special Consideration and conditions for the award of supplementary assessment, please see the information on UNSW's Special Consideration page.

## II. Administrative matters and links

All students are expected to read and be familiar with UNSW guidelines and polices. In particular, students should be familiar with the following:

- Attendance
- UNSW Email Address
- Special Consideration
- Exams
- Approved Calculators
- Academic Honesty and Plagiarism
- Equitable Learning Services

## III. Equity and diversity

Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course convener prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equitable Learning Services. Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.

## IV. Professional Outcomes and Program Design

Students are able to review the relevant professional outcomes and program designs for their streams by going to the following link: https://www.unsw.edu.au/engineering/student-life/student-resources/program-design.

*Note: This course outline sets out the description of classes at the date the Course Outline is published. The nature of classes may change during the Term after the Course Outline is published. Moodle or your primary learning management system (LMS) should be consulted for the up-to-date class descriptions.  If there is any inconsistency in the description of activities between the University timetable and the Course Outline/Moodle/LMS, the description in the Course Outline/Moodle/LMS applies.*

## Academic Honesty and Plagarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.*

Plagiarism is a type of intellectual theft. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement. UNSW has produced a website with a wealth of resources to support students to understand and avoid plagiarism, visit: student.unsw.edu.au/plagiarism. The Learning Centre assists students with understanding academic integrity and how not to plagiarise. They also hold workshops and can help students one-on-one.

You are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting and the proper referencing of sources in preparing all assessment tasks.

Repeated plagiarism (even in first year), plagiarism after first year, or serious instances, may also be investigated under the Student Misconduct Procedures. The penalties under the procedures can include a reduction in marks, failing a course or for the most serious matters (like plagiarism in an honours thesis or contract cheating) even suspension from the university. The Student Misconduct Procedures are available here:

www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf

## Submission of Assessment Tasks

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of five percent (5%) of the maximum mark possible for that assessment item, per calendar day.

The late penalty is applied per calendar day (including weekends and public holidays) that the assessment is overdue. There is no pro-rata of the late penalty for submissions made part way through a day. This is for all assessments where a penalty applies.

Work submitted after five days (120 hours) will not be accepted and a mark of zero will be

awarded for that assessment item.

For some assessment items, a late penalty may not be appropriate. These will be clearly indicated in the course outline, and such assessments will receive a mark of zero if not completed by the specified date. Examples include:

- Weekly online tests or laboratory work worth a small proportion of the subject mark;
- Exams, peer feedback and team evaluation surveys;
- Online quizzes where answers are released to students on completion;
- Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date; and,
- Pass/Fail assessment tasks.

# Faculty-specific Information

Engineering Student Support Services – The Nucleus - enrolment, progression checks, clash requests, course issues or program-related queries

Engineering Industrial Training – Industrial training questions

UNSW Study Abroad – study abroad student enquiries (for inbound students)

UNSW Exchange – student exchange enquiries (for inbound students)

UNSW Future Students – potential student enquiries e.g. admissions, fees, programs, credit transfer

**Phone**

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

# School Contact Information

**CSE Help! - on the Ground Floor of K17**

- For assistance with coursework assessments.

**The Nucleus Student Hub** - https://nucleus.unsw.edu.au/en/contact-us

- Course enrolment queries.

**Grievance Officer** - [grievance-officer@cse.unsw.edu.au](mailto:grievance-officer@cse.unsw.edu.au)

- If the course convenor gives an inadequate response to a query or when the courses convenor does not respond to a query about assessment.

**Student Reps** -  [stureps@cse.unsw.edu.au](mailto:stureps@cse.unsw.edu.au)

- If some aspect of a course needs urgent improvement. (e.g. Nobody responding to forum queries, cannot understand the lecturer)

You should **never** contact any of the following people directly:

- Vice Chancellor

- Pro-vice Chancellor Education (PVCE)

- Head of School

- CSE administrative staff

- CSE teaching support staff

They will simply bounce the email to one of the above, thereby creating an unnecessary level of indirection and a delay in the response.