School of Science, Computing and Engineering Technologies

SWINBURNE UNIVERSITY OF TECHNOLOGY

# Unit Outline

## COS30018

## Intelligent Systems

Semester Jan, 2024

**Please read this Unit Outline carefully. It includes:**

**PART A** Unit summary
**PART B** Your Unit in more detail
**PART C** Further information

"Swinburne University of Technology recognises the historical and cultural significance of Australia's Indigenous history and the role it plays in contemporary education

Each day in Australia, we all walk on traditional Indigenous land

We therefore acknowledge the traditional custodians of the land that our Australian campuses currently occupy, the Wurundjeri people, and pay respect to Elders past and present, including those from other areas who now reside on Wurundjeri land"

# PART A: Unit Summary

| | | |
|---|---|---|
| **Unit Code(s)** | | COS30018 |
| **Unit Title** | | Intelligent Systems |
| **Duration** | | One semester |
| **Total Contact Hours** | | 48 hours |
| **Requisites:** | | COS20011 Software Development in Java OR COS20007 Object-Oriented Programming OR COS30016 Programming in Java OR 65+% in SWE20004 Technical Software Development |
| | **Pre-requisites** | |
| | **Co-requisites** | Nil |
| | **Concurrent pre-requisites** | Nil |
| | **Anti-requisites** | Nil |
| | **Assumed knowledge** | Object-oriented programming at intermediate level |
| **Credit Points** | | 12.5 |
| **Campus/Location** | | Ho Chi Minh City |
| **Mode of Delivery** | | Blended |
| **Assessment Summary** | | 1. Assignment Group 50%<br>2. Continuous Oral Defence Individual 50%<br><br>As the minimum requirements of assessment to pass a unit and meet all ULOs to a minimum standard, a student must achieve an aggregate mark of 50% or more. |

## Aims

This Unit is designed to introduce students to a range of artificial intelligence (AI) techniques and how to apply them to solve real-world problems.

## Unit Learning Outcomes

Students who successfully complete this unit will be able to:

1. Explain a range of techniques of intelligent systems across artificial intelligence (AI) and intelligent agents (IA); both from a theoretical and a practical perspective.
2. Apply different AI/IA algorithms to solve practical problems.
3. Design and build simple intelligent systems based on AI/IA concepts.

### Graduate Attributes

This unit may contribute to the development of the following Swinburne Graduate Attributes:

- Communication 1 - Verbal communication
- Communication 2 - Communicating using different media
- Teamwork 1 - Collaboration and negotiation
- Teamwork 2 - Teamwork roles and processes
- Digital literacies 1 - Information literacy
- Digital Literacies 2 - Technical literacy

### Content

The unit includes the following topics:

- Introduction to Intelligent Systems
- Knowledge representation and reasoning
- Intelligent agents and multi-agent systems
- Learning and adaptation
- Evolutionary computing
- Neural networks
- Collective intelligence
- Methodologies and applications

## PART B: Your Unit in more detail

### Unit Improvements

Feedback provided by previous students through the Student Survey has resulted in improvements that have been made to this unit. Recent improvements include:

- Assessment criteria streamlined
- Change the final assessment to Continuous Oral Defense

### Unit Teaching Staff

| Name | Role | Email | Consultation Times |
|---|---|---|---|
| Dr Bao Nguyen | Unit Coordinator | aidennguyen@swin.edu.au | Appointment by email |

### Learning and Teaching Structure

| Activity | Total Hours | Hours per Week | Teaching Period Weeks |
|---|---|---|---|
| Lectures | 24 hours | 2 hours | Weeks 1 to 12 |
| Labs | 24 hours | 2 hours | Weeks 1 to 12 |

### Week by Week Schedule

| Teaching Week | Beginning Monday | Learning focus / delivery mode | Assessment |
|---|---|---|---|
| 1 | 01 Jan | **Topic:** Overview. Definition and scope of IS (AI and IA). Philosophical aspects of AI and IA.<br>**Tutorial:** Getting to know your tutor and team mates; Setting up your computing environment. Java and JADE | Reading unit references.<br>Forming the project team. |
| 2 | 08 Jan | **Topic:** Problem-Solving Agents: Search and Constraint Satisfaction Problem.<br>**Tutorial:** Choco (Constraint Solver) and JADE. | Reading unit references.<br>Forming the project team and selecting project. |
| 3 | 15 Jan | **Topic:** Multi-agent systems. Agent interactions (encounters, games). | Reading unit references.<br>Finalising project selection and |

| | | | |
|---|---|---|---|
| | | Agent communication. Reaching agreements (negotiations).<br>**Tutorial:** JADE | team.<br>Project assignment work. |
| 4 | 22 Jan | **Topic:** Introduction to machine learning (ML)<br>**Tutorial:** Introduction to Python & Machine Learning with Python practicals. | Project assignment work.<br>Reading unit references.<br>Continuous Oral Defence. |
| 5 | 29 Jan | **Topic:** Machine learning (ML) algorithms (DT, RF, KNN, PCA)<br>**Tutorial:** Machine Learning with Python practicals & Project assignment. | Project assignment work.<br>Reading unit references.<br>Continuous Oral Defence. |
| **Luna New Year's Holiday (05 – 18 February 2024 inclusively)** | | | |
| 6 | 19 Feb | **Topic:** Artificial neural networks and Deep Learning (DL)<br>**Tutorial:** ML/DL with Python practicals & Project assignment. | Project assignment work.<br>Reading unit references. |
| 7 | 26 Feb | **Topic:** Computational intelligence. Genetic algorithm and evolutionary computing.<br>**Tutorial:** ML/DL with Python practicals & Project assignment. | Project assignment progress review.<br>Reading unit references.<br>Continuous Oral Defence. |
| 8 | 04 Mar | **Topic:** Computational intelligence. Fuzzy systems. PSO/ACO.<br>**Tutorial:** EC/GA with PyGad & Project assignment | Project assignment work.<br>Reading unit references.<br>Continuous Oral Defence. |
| 9 | 11 Mar | **Topic:** Advanced topic 1: **Reinforcement learning**.<br>**Tutorial:** Project assignment. | Project assignment work.<br>Reading unit references. |
| 10 | 18 Mar | **Topic:** Advanced topic 2: Knowledge Representation and Reasoning (**KRR**) **&** Expert Systems (**ES**) **or** Distributed Constraint Optimization Problems (**DCOP**).<br>**Tutorial:** Project assignment. | Project assignment work.<br>Reading unit references. |
| 11 | 25 Mar | **Topic:** Advanced topic 3: Natural Language Processing (**NLP**).<br>**Tutorial:** Project assignment. | Project assignment work.<br>Reading unit references.<br>Continuous Oral Defence. |
| 12 | 01 Apr | **Topic:** Future directions of AI and IA - selected topics and examples. Review of the subject.<br>Sample examination.<br>**Tutorial:** Project assignment. | Project Assignment Report, Video, Working Prototype and Presentation<br>Continuous Oral Defence. |

## Assessment

### a) Assessment Overview

| Tasks and Details | Individual or Group | Weighting | Unit Learning Outcomes that this assessment task relates to | Assessment Due Date |
|---|---|---|---|---|
| 1. Project Assessment | Group | 50% | 1,2, 3 | Continuous until End of week 12 |
| 2. Continuous Oral Defence | Individual | 50% | 1,2, 3 | Continuous until End of week 12 |

**b) Minimum requirements to pass this Unit**

As the minimum requirements of assessment to pass a unit and meet all Unit Learning Outcomes to a minimum standard, a student must achieve an aggregate mark of 50% or more.

The students are assessed based on the project assignment and examination as follows:

- **Assignment/project:** Design and implementation of a simple intelligent system, working software demonstration and a short project report and a project presentation.
- **Continuous oral defence:** Each individual student will attend at least two (2) oral defence sessions during the semester to demonstrate their knowledge and understanding of the subject matter. The first oral defence session needs to be booked in Weeks 5-6 and covers the topics in the weeks BEFORE the oral defence. The second oral defence session needs to be booked in Weeks 9-10 and covers the topics in the weeks BEFORE the oral defence. For students who have not achieved a satisfactory mark after the first two oral defence sessions OR who would like to aim for higher marks, they can book an extra oral defence session in Weeks 12.

**b) Examinations**

This unit will have no exam.

**c) Submission Requirements**

Assignments and other assessments must be submitted through Canvas or as specified in the Assignment.

Please ensure you keep a copy of all assessments that are submitted.

An Assessment Cover Sheet must be submitted with your assignment. The standard Assessment Cover Sheet is available from the Current Students web site (see Part C).

**d) Extensions and Late Submission**

Late Submissions - Unless an extension has been approved, late submissions will result in a penalty. You will be penalised 10% of the assessment's worth for each calendar day the task is late, up to a maximum of 5 working days. After 5 working days a zero result will be recorded.

Extensions will only be granted in exceptional circumstances on medical or compassionate grounds. Extensions must be applied for in advance of the assignment's due date and the convenor of the appropriate unit must sign the extension certificate on the assignment cover sheet.

Feedback or comments from the marker will generally not be available on assignments that are submitted after five working days past the published deadline.

**e) Referencing**

To avoid plagiarism, you are required to provide a reference whenever you include information from other sources in your work. Further details regarding plagiarism are available in Section C of this document.

Referencing conventions required for this unit are: APA

Helpful information on referencing can be found at
http://www.swinbume.edu.au/library/referencing/

**f) Groupwork Guidelines**

A group assignment is the collective responsibility of the entire group, and if one member is temporarily unable to contribute, the group should be able to reallocate responsibilities to keep to schedule. In the event of longer-term illness or other serious problems involving a member of group, it is the responsibility of the other members to immediately notify the Unit Convenor or relevant tutor.

Group submissions must be submitted with an Assignment Cover Sheet, signed by all members of the group.

All group members must be satisfied that the work has been correctly submitted. Any penalties for late submission will generally apply to all group members, not just the person who submitted.

## Required Textbook(s)

**Course Notes:**

Lecture Notes, 2023 (Available from the subject Canvas site during the teaching period)

**Text Book:**

**Negnevitsky, M.**, 2005. *Artificial intelligence: a guide to intelligent systems*. Pearson education, 3rd edition.

**Wooldridge, M.** *An Introduction to Multi-Agent Systems*. John Wiley & Sons, 2002

**Russell, S. & Norvig, P.** *Artificial Intelligence: A Modern Intelligence*. Prentice Hall, 3rd edition, 2009

## Recommended Reading Materials

The Library has a large collection of resource materials, both texts and current journals. Listed below are some references that will provide valuable supplementary information to this unit. It is also recommended that you explore other sources to broaden your understanding.

# PART C: FURTHER INFORMATION

For further information on any of these topics, refer to Swinburne's Current Students web page http://www.swinburne.edu.au/student/.

## Student behaviour and wellbeing

All students are expected to: act with integrity, honesty and fairness; be inclusive, ethical and respectful of others; and appropriately use University resources, information, equipment and facilities. All students are expected to contribute to creating a work and study environment that is safe and free from bullying, violence, discrimination, sexual harassment, vilification and other forms of unacceptable behaviour.

The Student Charter describes what students can reasonably expect from Swinburne in order to enjoy a quality learning experience. The Charter also sets out what is expected of students with regards to your studies and the way you conduct yourself towards other people and property.

You are expected to familiarise yourself with University regulations and policies and are obliged to abide by these, including the Student Academic Misconduct Regulations, Student General Misconduct Regulations and the People, Culture and Integrity Policy. Any student found to be in breach of these may be subject to disciplinary processes.

Examples of expected behaviours are:

- conducting yourself in teaching areas in a manner that is professional and not disruptive to others
- following specific safety procedures in Swinburne laboratories, such as wearing appropriate footwear and safety equipment, not acting in a manner which is dangerous or disruptive (e.g. playing computer games), and not bringing in food or drink
- following emergency and evacuation procedures and following instructions given by staff/wardens in an emergency response

## Canvas

You should regularly access the Swinburne learning management system, Canvas, which is available via the Current Students webpage or https://swinburne.instructure.com/ Canvas is updated regularly with important unit information and communications.

## Communication

All communication will be via your Swinburne email address. If you access your email through a provider other than Swinburne, then it is your responsibility to ensure that your Swinburne email is redirected to your private email address.

## Academic Integrity

Academic integrity is about taking responsibility for your learning and submitting work that is honestly your own. It means acknowledging the ideas, contributions and work of others; referencing your sources; contributing fairly to group work; and completing tasks, tests and exams without cheating.

Swinburne University uses the Turnitin system, which helps to identify inadequate citations, poor paraphrasing and unoriginal work in assignments that are submitted via Canvas. Your Unit Convenor will provide further details. Plagiarising, cheating and seeking an unfair advantage with regards to an exam or assessment are all breaches of academic integrity and treated as academic misconduct.

Plagiarism is submitting or presenting someone else's work as though it is your own without full and appropriate acknowledgement of their ideas and work. Examples include:

- using the whole or part of computer program written by another person as your own
- using the whole or part of somebody else's written work in an essay or other assessable work, including material from a book, journal, newspaper article, a website or database, a set of lecture notes, current or past student's work, or any other person's work

- poorly paraphrasing somebody else's work
- using a musical composition or audio, visual, graphic and photographic work created by another
- using realia created by another person, such as objects, artefacts, costumes, models
- submitting assessments that have been developed by another person or service (paid or unpaid), often referred to as contract cheating
- presenting or submitting assignments or other work in conjunction with another person or group of people when that work should be your own independent work. This is regardless of whether or not it is with the knowledge or consent of the other person(s). Swinburne encourages students to talk to staff, fellow students and other people who may be able to contribute to a student's academic work but where an independent assignment is required, the work must be the student's own
- enabling others to plagiarise or cheat, including letting another student copy your work or by giving access to a draft or completed assignment

The penalties for academic misconduct can be severe, ranging from a zero grade for an assessment task through to expulsion from the unit and, in the extreme, exclusion from Swinburne.

## Student support

Swinburne offers a range of services and resources to help you complete your studies successfully. Your Unit Convenor or studentHQ can provide information about the study support and other services available for Swinburne students.

## Special consideration

If your studies have been adversely affected due to serious and unavoidable circumstances outside of your control (e.g. severe illness or unavoidable obligation), you may be able to apply for special consideration (SPC).

Applications for Special Consideration will be submitted via the SPC online tool normally no later than 5.00pm on the third working day after the submission/sitting date for the relevant assessment component.

## Accessibility needs

Sometimes students with a disability, a mental health or medical condition or significant carer responsibilities require reasonable adjustments to enable full access to and participation in education. Your needs can be addressed by Swinburne's AccessAbility Services by negotiating and distributing an 'Education Access Plan'. The plan makes recommendations to University teaching and examination staff. You must notify AccessAbility Services of your disability or condition within one week after the commencement of your unit to allow the University to make reasonable adjustments.

## Review of marks

An independent marker reviews all fail grades for major assessment tasks. In addition, a review of assessment is undertaken if your final result is between 45 and 49 or within 2 marks of any grade threshold.

If you are not satisfied with the result of an assessment, you can ask the Unit Convenor to review the result. Your request must be made in writing within 10 working days of receiving the result. The Unit Convenor will review your result to determine if your result is appropriate.

If you are dissatisfied with the outcomes of the review, you can lodge a formal complaint.

## Feedback, complaints and suggestions

In the first instance, discuss any issues with your Unit Convenor. If you are dissatisfied with the outcome of the discussion or would prefer not to deal with your Unit Convenor, then you can complete a feedback form. See https://www.swinburne.edu.au/corporate/feedback/

## Advocacy

Should you require assistance with any academic issues, University statutes, regulations, policies and procedures, you are advised to seek advice from an Independent Advocacy Officer at Swinburne Student Life.

For an appointment, please call +61-(0)3-9214 5445 or email advocacy@swin.edu.au For more information, please see https://www.swinburne.edu.au/current-students/student-services- support/advocacy/