



DEPARTMENT OF COMPUTER SCIENCE

COSC343

Artificial Intelligence

Semester 2

Paper coordinator

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Lectures

Monday

9am-10am

Wednesday

9am-10am

Labs

Wednesday

2pm-4pm (Stream A1)

Wednesday

4pm-6pm (Stream A2)

Course Description

In this paper we will look at different definitions of intelligence and at the concept of intelligent agents, concentrating on the issue of how to get information about the world and how to make use of it. We will consider techniques for machine learning and probabilistic reasoning. Almost every human ability results from learning from experience: we will look at how these learning processes can be modelled computationally.

Topics covered include:

- search and optimisation algorithms (including genetic algorithms);
- probabilistic reasoning methods (including Bayesian methods);
- machine learning algorithms (with a focus on neural networks).

Learning Outcomes

By completion of this paper students are expected to:

- Understand fundamental concepts relating to classical Artificial Intelligence methods.
- Develop appreciation for challenges of developing robust and reliable AI acting in the real world
- Have fundamental understanding of a range of AI methods and their applicability for different situations.
- Implement a basic algorithm from each of the different approaches listed above on a toy example, including but not limited to: simple games, basic spam filters, identifying objects in an image.
- Become adept with usage of basic software libraries for general machine learning (i.e. Python + sklearn)
- Develop awareness of ethical issues related to increasing pervasiveness of AI in everyday life along with the impact and repercussions of use of self-learning/adaptable systems.

Lecture/Lab Schedule

| Week | Lecture | Lab |
|------|---------------------------------|--------------------------------|
| 1 | Introduction | Robot navigation |
| | Agents and environments | |
| 2 | Uninformed search | Uninformed and informed search |
| | Informed search | |
| 3 | Adversarial search | Adversarial search |
| | Genetic algorithms | |
| 4 | Uncertainty | |
| | Bayesian reasoning I | |
| 5 | Bayesian reasoning II | Genetic algorithms |
| | Learning | |
| 6 | Classification I | Naive Bayes classifier |
| | Classification II | |
| 7 | Regression | Classification and perceptron |
| | Optimisation | |
| 8 | Multilayer perceptron I | Steepest gradient descent |
| | Classification III | |
| 9 | Multilayer perceptron II | |
| | Multilayer perceptron III | |
| 10 | Simple recurrent neural network | Multilayer perceptron |
| | Unsupervised learning I | |
| 11 | Unsupervised learning II | Simple recurrent network |
| | Reinforcement learning I | |
| 12 | Reinforcement learning II | Unsupervised learning |
| | Ethics | |
| 13 | Review | Reinforcement learning |

Labs

Laboratory exercises provide opportunities for developing practical understanding and implementation of methods that complement the theory covered in the lectures. All the programming will be done in Python. The development environment consist of PyCharm IDE running Anaconda virtual environment Python interpreter.

Check your eVision timetable to find the time and location of your lab stream.

Course Readings

Prescribed Course Textbook:

Stuart J. Russel, Peter Norvig, *Artificial intelligence : a modern approach* (2020), 4th edition, Pearson, Boston.

The book provides extended reading for almost every lecture, as well as comprehensive coverage of related AI topics. It is strongly recommended that you purchase or borrow this book for the semester.

Course Administration

The paper will be administered through [Blackboard](#).

Course Workload and Expectations

This is an 18-point paper. For your guidance, we offer the following breakdown of hours:

| | | |
|-----------------|-----------|------------------------------------|
| Lectures | 26 hours | (2h per week for 13 weeks) |
| Labs | 26 hours | (2h per week for 13 weeks) |
| Studies/Reading | 48 hours | (4h per week for 12 weeks) |
| Assignments | 80 hours | (for two assignments over 9 weeks) |
| Total | 180 hours | |

Students are expected to attend lectures. While handouts summarising the lecture slides will be provided, keeping good notes is recommended. The lectures will be recorded and available on Echo360 afterward, but these recordings will capture limited aspects of the lecture, such as the slides and the voice-over. The main purpose of these recordings is to serve as a supplement and a review of the lectures, and they should be viewed as a replacement only if necessary for those who cannot attend sporadically (due to sickness, etc.).

Students should prepare for labs by studying the class notes and reviewing the lab script. A demonstrator will be present in the lab to assist everyone in completing the exercise.

Assessment

| | | |
|----------------------------|----------------------|-------------|
| Internal assessment | Due | |
| Assignment 1 | Week 5 of the course | 20% |
| Assignment 2 | Week 9 of the course | 20% |
| Exam | | 60% |
| Total assessment | | 100% |

Assignment 1 (20%)

Students will write a program in Python to implement an agent for a simple task, such as playing a simple game. The framework for the environment will be provided. Students will evaluate their agent and assess its effectiveness. The objective of this assessment is not necessarily to implement any specific method taught in the course, but rather to encourage students to develop their own strategies for creating an intelligent software solution for a given problem.

Students will be assessed on:

- the effectiveness (but not optimality) of their agent in solving a given problem;
- the quality of the written code;
- the clarity of the technical report explaining methodology and the results.

Assignment 2 (20%)

Students will write a program in Python to implement a game that involves a population of agents. This time, the agents will need to learn successful strategies through a genetic algorithm. The environment will be provided, and students will design their agent, fitness function, and all aspects of the genetic algorithm that governs its learning.

Students will be assessed on:

- the effectiveness of their agent in solving a given problem;
- the effectiveness of the genetic algorithm in training a successful population;
- the quality of the written code;
- the clarity of the technical report explaining methodology and the results.

Submitting Assignments

All assignments must be submitted electronically via [Blackboard](#).

Assignment Returns

It is University policy that assignments must be marked, graded and returned to students within three weeks from the date the assignment was due.

Students will be informed in lectures when assignments will be ready and when they will be available for viewing on [Blackboard](#). Please note that late assignments and those with approved extensions will be returned three weeks from the date that they were submitted.

Extensions, Late Work and Deductions

In order to obtain an extension, you must see the course coordinator before the due date of the assignment. Except in cases of ill health supported by a medical certificate, students must submit evidence that they have already done some work on the assignment. Any work handed in after the closing date or after the last date of an extension is considered late.

Late work will have 5% (out of 100%) deducted each day (including weekends) after the due date. No assignments without an extension will be accepted more than 5 days (including weekends) after the due date, except in cases of illness or other exceptional circumstances beyond the student's control. In these cases, you must contact your course coordinator as soon as possible with appropriate supporting evidence.

Academic Integrity and Academic Misconduct

Academic integrity means being honest in your studying and assessments. It is the basis for ethical decision-making and behaviour in an academic context. Academic integrity is informed by the values of honesty, trust, responsibility, fairness, respect and courage. Students are expected to be aware of, and act in accordance with, the University's Academic Integrity Policy.

Academic Misconduct, such as plagiarism or cheating, is a breach of Academic Integrity and is taken very seriously by the University. Types of misconduct include plagiarism, copying, unauthorised collaboration, taking unauthorised material into a test or exam, impersonation, and assisting someone else's misconduct. A more extensive list of the types of academic misconduct and associated processes and penalties is available in the University's Student Academic Misconduct Procedures.

Use of generative software such as ChatGPT is also considered academic misconduct unless specifically specified otherwise in an assignment handout. If generative software is used, students must specify how it was used and on what aspects of any assignment.

It is your responsibility to be aware of and use acceptable academic practices when completing your assessments. To access the information in the Academic Integrity Policy and learn more, please visit the [University's Academic Integrity website](#) or ask at the Student Learning Centre or Library. If you have any questions, ask your lecturer.

- [Academic Integrity Policy](#)
- [Student Academic Misconduct Procedures](#)

Support Services

Class representatives. Volunteers for class representative will be registered at the beginning of this course. The class representative is intended to help facilitate staff-student communication, enabling liaison, consultation and passage of information between teaching staff and the student body. Representatives usually meet with representatives of the academic staff twice a semester for about one hour. A full job description for the class representative is available from the Otago University Student's Association.

University Library. The Library website, <https://www.otago.ac.nz/library>, gives online access to Library services and resources including databases, past exam papers, referencing guides and the booking system for group study rooms.

Support for international students: <https://www.otago.ac.nz/international/support-services>.

Disabilities information and support: <https://www.otago.ac.nz/disabilities>.