School of
Engineering and Computer Science
Te Kura Mātai Pūkaha, Pūrorohiko

# Prescription

This course addresses several current topics in artificial intelligence. Possible topics include Reinforcement Learning, AI for robotics, AI in games, Intelligent image analysis, AI and optimisation, AI Planning.

# Course learning objectives

Students who pass this course should be able to:

1. Explain the concepts and techniques of a range of specialised areas within Artificial Intelligence.
2. Use a variety of specialised AI methods and techniques to solve problems.
3. Critically discuss and evaluate papers from the research literature in a range of specialised AI areas.

# Course content

2022: The course is primarily offered in-person, and there are components such as tests which require in-person attendance. There will be remote alternatives for all the components of the course, but these are only available to students studying from outside the Wellington region. The remote option for tests will use a Zoom-based system for online supervision of the tests.

Students taking this course remotely must have access to a computer with camera and microphone and a reliable high speed internet connection that will support real-time video plus audio connections and screen sharing. Students must be able to use Zoom; other communication applications may also be used. A mobile phone connection only is not considered sufficient. The computer must be adequate to support the programming required by the course: almost any modern windows, macintosh, or unix laptop or desktop computer will be sufficient, but an Android or IOS tablet will not.

In 2022, this course will cover the following four topics:

- Scheduling and Optimisation
- Reinforcement Learning
- AI for Medical Imaging
- AI for Image synthesis

A provisional outline for each topic is given below, but the details are only indicative and may change.

- Scheduling and Optimisation
  - Introduction to combinatorial optimisation: modelling and exact methods (such as mixed-integer programming, branch and bound)
  - Heuristic methods such as greedy heuristic, local search, simulated annealing, tabu search, genetic algorithm
  - Machine learning and hyper-heuristics for cmbinatorial optimisation

- Reinforcement Learning
  - Introduction to reinforcement learning and Markov decision process
  - Basic reinforcement learning techniques, dynamic programming, policy iteration, model-free vs model-based reinforcement learning
  - Monte-Carlo method and value function approximation
  - Temporal-difference learning and value function based reinforcement learning algorithms
  - Function approximation and policy gradient methods

- ML for Biomedical Imaging and Biophotonics
  - Introduction to biophotonics and biomedical imaging: devices, acquisition and data
  - Learning the features and insights from data utilizing machine learning
  - Practical applications of AI in the detection of a disease, Computer Graphics and Pathology

- AI for Image synthesis
  - Introduction to image synthesis and creation
  - Convolutional neural networks for image synthesis
  - GAN-based deep models for image generation

# Withdrawal from Course

Withdrawal dates and process:
https://www.wgtn.ac.nz/students/study/course-additions-withdrawals

# Lecturers


## Dr Yi Mei (Coordinator)

yi.mei@vuw.ac.nz 04 886 5331

CO 353 Cotton Building (All Blocks), Gate 7, Kelburn Parade, Kelburn

## Dr Aaron Chen

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AM 405 Alan Macdiarmid Building, Gate 7, Kelburn Parade, Kelburn

## Dr Alex Doronin

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CO 330 Cotton Building (All Blocks), Gate 7, Kelburn Parade, Kelburn

## Dr Fanglue Zhang

fanglue.zhang@vuw.ac.nz 04 886 5340

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# Teaching Format

This course will be offered primarily in-person for students in Wellington and can attend on campus, the primary teaching format will be in-person. For students who cannot attend on campus (such as enrolled from overseas), there will be web/internet based resources such as lecture notes, recorded lecture videos and assessments provided online.

# Student feedback

Student feedback on University courses may be found at:
www.cad.vuw.ac.nz/feedback/feedback_display.php

# Dates (trimester, teaching & break dates)

- Teaching: 11 July 2022 - 14 October 2022
- Break: 22 August 2022 - 04 September 2022
- Study period: 17 October 2022 - 20 October 2022
- Exam period: 21 October 2022 - 12 November 2022

# Class Times and Room Numbers

**11 July 2022 - 21 August 2022**

- **Tuesday** 14:10 - 15:00 – 118, Cotton, Kelburn
- **Thursday** 14:10 - 15:00 – 118, Cotton, Kelburn

**05 September 2022 - 16 October 2022**

- **Tuesday** 14:10 - 15:00 – 118, Cotton, Kelburn
- **Thursday** 14:10 - 15:00 – 118, Cotton, Kelburn

# Set Texts and Recommended Readings

## Required

There are no required texts for this offering.

# Mandatory Course Requirements

There are no mandatory course requirements for this course.

*If you believe that exceptional circumstances may prevent you from meeting the mandatory course requirements, contact the Course Coordinator for advice as soon as possible.*

# Assessment

This course will be assessed through four projects, each for one module.

| Assessment Item | Due Date or Test Date | CLO(s) | Percentage |
|---|---|---|---|
| Project 1 | End of week 5 | CLO: 1,2,3 | 25% |
| Project 2 | End of week 7 | CLO: 1,2,3 | 25% |
| Project 3 | End of week 11 | CLO: 1,2,3 | 25% |
| Project 4 | Assessment week | CLO: 1,2,3 | 25% |

## Extensions

There will be 3 late days (72 hours) that can be used freely across the projects. Individual extensions beyond this will only be granted in exceptional personal circumstances, and should be negotiated with the course coordinator, before the deadline whenever possible. Documentation (e.g., medical certificate) may be required.

## Submission & Return

All work should be submitted through the ECS submission system, accessible through the course web pages. Marks and comments will be returned through the ECS marking system, also available through the course web pages.

# Workload

The student workload for this course is 150 hours in total, which is 10 hours per week spread over 15 weeks.

# Teaching Plan

See https://ecs.wgtn.ac.nz/Courses/AIML431_2022T2/LectureSchedule

# Communication of Additional Information

All online material for this course can be accessed at https://ecs.wgtn.ac.nz/Courses/AIML431_2022T2/

# Links to General Course Information

- Academic Integrity and Plagiarism: https://www.wgtn.ac.nz/students/study/exams/integrity-plagiarism
- Academic Progress: https://www.wgtn.ac.nz/students/study/progress/academic-progess (including restrictions and non-engagement)
- Dates and deadlines: https://www.wgtn.ac.nz/students/study/dates
- Grades: https://www.wgtn.ac.nz/students/study/progress/grades
- Special passes: Refer to the Assessment Handbook, at https://www.wgtn.ac.nz/documents/policy/staff-policy/assessment-handbook.pdf
- Statutes and policies, e.g. Student Conduct Statute: https://www.wgtn.ac.nz/about/governance/strategy
- Student support: https://www.wgtn.ac.nz/students/support
- Students with disabilities: https://www.wgtn.ac.nz/st_services/disability/
- Student Charter: https://www.wgtn.ac.nz/learning-teaching/learning-partnerships/student-charter
- Terms and Conditions: https://www.wgtn.ac.nz/study/apply-enrol/terms-conditions/student-contract
- Turnitin: http://www.cad.vuw.ac.nz/wiki/index.php/Turnitin
- University structure: https://www.wgtn.ac.nz/about/governance/structure
- VUWSA: http://www.vuwsa.org.nz

**Offering CRN: 33073**

**Points:** 15
**Prerequisites:** AIML 420 or COMP 307
**Duration:** 11 July 2022 - 13 November 2022
**Starts:** Trimester 2
**Campus:** Kelburn