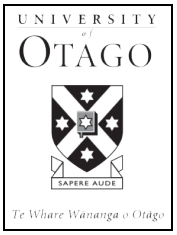

DEPARTMENT OF COMPUTER SCIENCE

COSC420

Deep learning

Semester 1

2023

Paper coordinator

Dr. Lech Szymanski

Office: Owheo 2.49
Email: lech.szymanski@otago.ac.nz

Lectures

Tuesday 9am-11am

Course Description

Artificial Intelligence has been revolutionised by a new generation of neural network based machine learning algorithms. This course will introduce these new algorithms, as they are applied in two important areas of AI: machine vision and natural language processing. The course will cover a range of new architectures and techniques, including convolutional networks for vision, and sequence-to-sequence networks and transformers for language processing.

Learning Outcomes

Students who successfully complete this paper will gain an understanding of a selection of core concepts in deep learning methods : training and testing, backpropagation, regularisation, transfer learning, self-attention; as well as strong fundamental in working with convolutional neural networks for image processing, and transformers for natural langauge processing.s

This paper will enable students to:

- Understand and implement a range of artificial neural networks using Tensorflow.
- Understand the strengths and weaknesses of neural networks compared to traditional symbolic methods.
- Perform practical research with a neural network simulation and systematically present the outcomes.

Lecture schedule

Week	Lecture	Title	
1	1	Introduction	Image processing and CNNs
2	2	Learning and backpropagation	
3	3	Architectures and CNNs	
4	4	Transfer learning	
5	5	Generative models	
6	6	Intepretability	
7	7	Vector representation of words	Natural language processing and Transformers
8	8	RNN and language modelling	
9	9	Sequence-to-sequence and attention	
10	10	Transformers I	
11	11	Transformers II	
12	12	Ethics	
13	13	Review	

Course Readings

There is no single textbook for this paper. Numerous readings will be prescribed in different lectures, including journal articles, as well as books including (but not limited to):

Chollet F., *Deep learning with Python* (2021), 2nd edition, Manning Publications Co.

Goodfellow I., Bengion Y., Courville A., *Deep learning* (2016), MIT Press.

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)
Studies/Reading	78 hours	(5h per week for 13 weeks)
Assignments	76 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 afterwards, 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.).

Although there are no official lab times scheduled for this paper, as part of their weekly studies students are expected to find practical exercises and devote some time to implementation of the models/techniques covered in class using Keras/Tensorflow/Hugging Face libraries.

Assessment

Internal assessment	**Due**	
Assignment 1	Week 7 of the course	**20%**
Assignment 2	Week 12 of the course	**20%**
Exam		**60%**
Total assessment		**100%**

Assignment 1 (20%)

Students will design, implement and train several convolutional neural network-based discriminative and/or generative models for image recognition tasks. This task will involve Python programming using Keras/Tensorflow libraries. Students will evaluate their models, assess the performance, and write a report.

Assignment 2 (20%)

Students will implement and train a language model (LM) using deep learning techniques. This task will involve Python programming using Keras/Tensorflow/Hugging Face libraries. Students will evaluate their models, assess the performance, and write a report.

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`.