

UNIVERSITY OF OTAGO

INFO411 – MACHINE LEARNING AND DATA MINING

COURSE OUTLINE

SEMESTER 2, 2023

OVERVIEW

Machine Learning has become an increasingly important driving force to business, research, and even our daily lives. In this paper, various machine learning algorithms for a wide range of data mining tasks will be explored, including data visualisation, feature extraction and selection, clustering, classification, anomaly detection, prediction etc. Besides conventional machine learning approaches, new deep learning models and computational intelligence methods will also be discussed. The interrelationship between these methods will be addressed, and new online and distributed learning approaches will be explored. Research papers from selected journals and conferences will be used as extended readings and assignment references.

The paper is taught through formal lectures, tutorials, laboratories, student presentations, and guest lectures. In-class discussion is encouraged.

LEARNING OUTCOME

1. Establish a solid knowledge base of machine learning algorithms by developing mathematical understanding and relevant programming skills;
2. Gain insightful understanding of the state-of-the-art artificial intelligence techniques: their mechanism, strength and weakness;
3. Acquire practical skills in applying machine learning techniques critically and effectively for analytical problem solving in science, engineering or business.

COURSE MATERIAL

- **References:**

- E. Alpaydin, *Introduction to Machine Learning*, 4th Ed., MIT Press, 2020. [E-book available from UO Library]
- Duda, Hart & Stork, *Pattern Classification*, 2nd Edition, John & Wiley, 2001.
- Antonello Lobianco, *Julia Quick Syntax Reference: A Pocket Guide for Data Science Programming*, Apress, 2019. [E-book available from UO Library]
- Selected journal articles

- **Resources**

All course material, including lecture slides/notes, readings, Julia notebooks etc., will be distributed through the Piazza website: piazza.com/otago.ac.nz/semester22021/info411.

COURSE DELIVERY

- **Staff:**

- Assoc. Prof. Jeremiah Deng. Office: OBS 3.34, Ext.: 8090 | Office Hours: MON 4-5pm | email: jeremiah.deng@otago.ac.nz
- Tutors:
 - Ying Pang, email: ying.pang@postgrad.otago.ac.nz
 - Frank Dean, email: frank.dean@otago.ac.nz

- **Lectures** [Both sessions live streamed & recorded]:

- MON 12:00-12:50pm, OBS LG05
- TUE 4:00-4:50pm, OBS LG05

- **Laboratories:**

- FRI 9:00-10:50am, OBS 118
- Online THU 6:00-7:30pm, Zoom link available via Piazza: Resources / Course Information

- **Online Tutorials:** TUE 6-7pm. Zoom link same as above

ASSESSMENT PACKAGE

- This paper will be 100% internally assessed. The breakdown is:

• Lab assignments	30%
• Presentation	10%
• Assignment 1	20%
• Assignment 2	40%

There will be 10 labs, each worth 3 marks.

COURSE TERMS / REQUIREMENTS

To pass the paper, students *must* submit their work of at least **7 out of 10** labs.

ASSESSMENT POLICY

Student work is assessed individually in the assessed labs and participation in these labs is compulsory. Lab reports are due usually one day before the next lab is held.

Assignments and the Presentation are group work and members in a group are all expected to make significant contributions to the group work, in both coding and writing/presentation.

Unless approved by the staff at least *one day before* the specified submission deadline, late submissions will not be accepted.

ACADEMIC INTEGRITY

Students should ensure that *all submitted work is their own*. Plagiarism is a form of dishonest practice. It is defined as copying or paraphrasing another's work and presenting it as one's own. Any student found responsible for dishonest practice in any piece of work submitted for assessment shall be subject to the University's dishonest practice regulations, which may result in serious penalties, including forfeiture of marks for the piece of work submitted, a zero grade for the paper, or in extreme cases, exclusion from the University. The University of Otago reserves the right to use plagiarism detection tools.

The Golden Rule is to *read* wide, *verify* information, and *cite* your sources.

Use of AI tools such as ChatGPT is allowed as long as you acknowledge it.

Students are advised to inform themselves about University policies concerning dishonest practice and take up opportunities to improve their academic and information literacy. If necessary, seek advice from academic staff, or the Student Learning Centre. The guideline for students is available at this link: <http://www.otago.ac.nz/study/academicintegrity/>

Refer to the Library resource on ethical use of information: <http://oil.otago.ac.nz/oil/module8.html>

STUDENT FEEDBACK

We encourage and value your feedback. This can be in the form of contacting staff, communicating with class representatives, and participating in course evaluation surveys.

Your class representative's name and contact details will be notified early in the semester.

COURSE SCHEDULE¹

Wk	Week Starting	Lecture A	Lecture B	Practical
1	10/7	Introduction	Metrics	Lab 1. Getting started
2	17/7	Clustering I	Clustering II	Lab 2. Clustering
3	24/7	Clustering III	Clustering IV	Lab 3. Online clustering
4	31/7	Dimension reduction I	Dimension reduction II	Lab 4. Dimension reduction <i>Assignment 1 starts</i>
5	7/8	Classification I	Classification II	<i>No labs</i>
6	14/8	Classification III	Classification IV	Lab 5. Classification I
7	21/8	Performance evaluation	Feature selection	Lab 6. Classification II <i>Assignment 1 due</i>
Mid-semester Break 26/8 – 3/9				
8	4/9	Regression I	Regression II	Lab 7. Performance evaluation <i>Assignment 2 starts</i>
9	11/9	Model selection	Ensembles	Lab 8. Regression
10	18/9	Multilayer Perceptron	Variational Autoencoders	Presentation
11	25/9	Variational Autoencoders	Generative Adversarial Networks	Lab 9. Ensemble methods
12	2/10	Transfer learning I	Transfer learning II	Lab 10. Deep learning <i>Assignment 2 report due</i>
13	9/10	Federated Learning	Review	<i>Assignment 2 interview</i>

¹ Subject to potential changes.

STUDENT SUPPORT CONTACTS

- Campus Watch | (24/7) 0800 479 5000
- Career Development Centre | 0 479 8244
- Chaplains | chaplains@otago.ac.nz
- Counselling – need to talk? | Free text/ all 1737
- Disability Information and Support | 03 47 8235
- Department course advisors | (Dr. Nigel Stanger & A/Prof. Tony Savarimuthu)
- Emergency Psychiatric Service | 0800 467 846
- Graduate Research School | 03 479 5737
- HEDC – Student Learning Development | 03 479 880
- International Office | international.support@otago.ac.nz
- Librarians | ask.library@otago.ac.nz
- Locals Collegiate Community | locals@otago.ac.nz
- Manager Facilitation and Mediation | 03 47 5679
- OUSA Clubs and Societies | 03 479 5960
- OUSA Student Support | 03 479 5449, help@ousa.org.nz
- Silverline | silverline@otago.ac.nz
- Social Impact Studio | volunteer@otago.ac.nz
- Student Accommodation Centre | 479 4166
- Student Development | 0800 808 098 (AskOtago)
- Student Health | 0800 479 821
- Student Job Search | sjs.co.nz
- Te Whare Tāwharau: Sexual Violence Support and Prevention Centre | 03 479 3790
- Unipol | 479 5888, recreation@otago.ac.nz
- OBS Pacific Student Support Facilitators: Falaviena (Viena) Faiva, viena.faiva@otago.ac.nz, 021 279 0914; Jekope Ramala Maiono, jekope.maiono@otago.ac.nz, 021 279 0871
- OBS Kaiāwhina Māori | Māori student support: Ben Sommerville, ben.sommerville@otago.ac.nz, 027 513 6991.