![THE UNIVERSITY OF BRITISH COLUMBIA](UBC logo)

Land Acknowledgement

We respectfully acknowledge the Syilx Okanagan Nation and their peoples, in whose traditional, ancestral, unceded territory UBC Okanagan is situated.

DATA 586: Advanced Machine Learning

Faculty: Irving K. Barber Faculty of Science

Department: Computer Science, Mathematics, Physics, and Statistics

Instructor(s): Dr. Shan Du

Instructor(s) Email: shan.du@ubc.ca

Duration: Term 2 Winter 2023

Delivery Modality: In-Person

Course Location: EME 1153

Course Days: Tue/Thu

Class Hours: 11:00AM - 12:30PM

Office hours: Friday 11:00AM-12:00PM on Canvas

Other Instructional Staff

TA: Amanat Ullah, amanat7@mail.ubc.ca

Course Description

Neural networks, backpropagation, deep learning. Restricted to students in the MDS program. Prerequisite: DATA 580.

Course Format

The course is structured by lectures and labs.

Course Overview, Content and Objectives

In this course, students will gain an introductory-level understanding of deep learning, understand how to build neural networks, and learn how to lead successful machine learning projects. Topics include: Foundations of neural networks and deep learning; Techniques to improve neural networks: regularization and optimizations, hyperparameter tuning and deep learning framework; Convolutional Neural Networks; Recurrent Neural Networks; Modern CNN and RNN networks.

Learning Outcomes
Upon successful completion of this course, students will be able to:

• Demonstrate understanding of the basic concepts of deep neural networks and their applications
• Develop practical skills for designing and training neural networks
• Be comfortable with tools and techniques required in deep learning
• Know how to use a neural network
• Explore the parameters for neural networks

Assessments of Learning

Grading: Total 100%
• Programming Assignments (4): 40%
• Project: 60%

Course schedule

Week	Contents
1	Introduction to Neural Network, Single Layer NN, Multiple Layer NN (MLP)
2	Convolutional Neural Network (CNN), Recurrent Neural Network (RNN)
3	Optimization, Regularization

4	Modern CNN, Modern RNN
5	Projects and Presentations

Late policy

Late assignments and report will be deducted 10% per day up to 3 days (after which they will receive 0 marks).

Passing/Grading Criteria

Students MUST achieve a passing grade in overall in order to pass the course.

Learning Materials

• Lecture Notes and Tutorials (available electronically)
• Recommended Textbooks :

   o An Introduction to Statistical Learning with Applications in Python (Chapter 10), Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Jonathan Taylor, 2023: https://www.statlearning.com/
   o Deep Learning (Chapter 5-10), Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press, 2016: https://www.deeplearningbook.org/
   o Dive into Deep Learning: Aston Zhang, Zachary C. Lipton, Mu Li, and Alexander J. Smola, Cambridge University Press, 2023: https://d2l.ai/

Programming Language: Python

Other Course Policies:

Academic Integrity

The academic enterprise is founded on honesty, civility, and integrity. As members of this enterprise, all students are expected to know, understand, and follow the codes of conduct

regarding academic integrity. At the most basic level, this means submitting only original work done by you and acknowledging all sources of information or ideas and attributing them to others as required. This also means you should not cheat, copy, or mislead others about what is your work. Violations of academic integrity (i.e., misconduct) lead to the breakdown of the academic enterprise, and therefore serious consequences arise and harsh sanctions are imposed. For example, incidences of plagiarism or cheating usually result in a failing grade or mark of zero on the assignment or in the course. Careful records are kept to monitor and prevent recidivism.

A more detailed description of academic integrity, including the University's policies and procedures, may be found in the Academic Calendar.

Final Examinations

You can find the [Senate-approved term and examination dates here](). Except in the case of examination clashes and hardships (three or more formal examinations scheduled within a 27-hour period) or unforeseen events, students will be permitted to apply for out-of-time final examinations only if they are representing the University, the province, or the country in a competition or performance; serving in the Canadian military; observing a religious rite; working to support themselves or their family; or caring for a family member. Unforeseen events include (but may not be limited to) the following: ill health or other personal challenges that arise during a term and changes in the requirements of an ongoing job.

Further information on Academic Concession can be found under Policies and Regulation in the [Okanagan Academic Calendar]().

Grading Practices

Faculties, departments, and schools reserve the right to scale grades in order to maintain equity among sections and conformity to University, faculty, department, or school norms. Students should therefore note that an unofficial grade given by an instructor might be changed by the faculty, department, or school. Grades are not official until they appear on a student's academic record.

Further information on Grading Practices can be found in the [Okanagan Academic Calendar]().

Student Service Resources:

Disability Resource Centre

The Disability Resource Centre (DRC) facilitates disability-related accommodations and programming initiatives to that ameliorate barriers for students with disabilities and/or ongoing medical conditions. If you require academic accommodations to achieve the objectives of a course please contact the DRC at:

UNC 215   250.807.8053
Email: drc.questions@ubc.ca

Web: www.students.ok.ubc.ca/drc

Equity and Inclusion Office

Through leadership, vision, and collaborative action, the Equity & Inclusion Office (EIO) develops action strategies in support of efforts to embed equity and inclusion in the daily operations across the campus. The EIO provides education and training from cultivating respectful, inclusive spaces and communities to understanding unconscious/implicit bias and its operation within in campus environments. UBC Policy 3 prohibits discrimination and harassment on the basis of BC's Human Rights Code. If you require assistance related to an issue of equity, educational programs, discrimination or harassment please contact the EIO.

UNC 325H   250.807.9291
Email: equity.ubco@ubc.ca

Web: www.equity.ok.ubc.ca

Office of the Ombudperson

The Office of the Ombudsperson for Students is an independent, confidential and impartial resource to ensure students are treated fairly. The Ombuds Office helps students navigate campus-related fairness concerns. They work with UBC community members individually and at the systemic level to ensure students are treated fairly and can learn, work and live in a fair, equitable and respectful environment. Ombuds helps students gain clarity on UBC policies and procedures, explore options, identify next steps, recommend resources, plan strategies and receive objective feedback to promote constructive problem solving. If you require assistance, please feel free to reach out for more information or to arrange an appointment.

UNC 328   250.807.9818
Email: ombuds.office.ok@ubc.ca

Web: www.ombudsoffice.ubc.ca

Student Learning Hub

The Student Learning Hub is your go-to resource for free math, science, writing, and language learning support. The Hub welcomes undergraduate students from all disciplines and year levels to access a range of supports that include **tutoring in math, sciences, languages, and writing, as well as help with academic integrity, study skills and learning strategies**. Students are encouraged to visit often and early to build the skills, strategies and behaviors that are essential to being a confident and independent learner. For more information, please visit the Hub's website.

LIB 237   250.807.8491
Email: learning.hub@ubc.ca
Web: www.students.ok.ubc.ca/slh

Sexual Violence Prevention and Response Office (SVPRO)

The Sexual Violence Prevention and Response Office (SVPRO) is a confidential place for those who have been impacted by any form of sexual or gender-based violence, harassment, or harm, regardless of where or when it took place. SVPRO aims to be a safer space for all UBC students, faculty, and staff by respecting each person's unique and multiple identities and experiences. All genders and sexualities are welcome.

Nicola Townhome 120, 1270 International Mews   250.807.8053
Email: svpro@okangan@ubc.ca
Web: www.svpro.ok.ubc.ca

Wellbeing and Accessibility Services (WAS)

Wellbeing and Accessibility Services (WAS) supports holistic student wellbeing in body, mind, and spirit. Students can access nurses, physicians and counsellors for health care and counselling related to physical health, emotional/mental health and sexual/reproductive health concerns. WAS is also home to the Disability Resource Centre, Spiritual and Multi-Faith Services, and Campus Health and Education. If you require assistance with your health, please contact Wellbeing and Accessibility Services for more information or to book an appointment.

UNC 337   250.807.9270
Email: healthwellness.okanagan@ubc.ca
Web: www.students.ok.ubc.ca/was

Walk-In Well-Being Clinic

The Walk-In Well-Being clinic offers no-fee, brief, single-session psychological services. Sessions are led by a doctoral student in clinical psychology and supervised by a registered psychologist (UBCO Faculty member). Clinicians can provide support with stress management, sleep, self-care, depression, anxiety, interpersonal issues, substance misuse, coping with academic demands/stressors, and provide options for connecting to additional resources. Virtual or in-person sessions are available at the UBCO Psychology Clinic, located in ASC 167 with or without an appointment, on Tuesdays and Thursdays between 10 am and 3 pm from September to June, excluding campus closures.

UNC 337   250.807.8421 (ext. 1)
Email: ipc.ok@ubc.ca
Web: https://psych.ok.ubc.ca/psychology-clinic/walk-in-wellness/

Safewalk

Don't want to walk alone at night? Not too sure how to get somewhere on campus? Call Safewalk at **250-807-8076**.

Web: www.security.ok.ubc.ca

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