



**Schulich School of Engineering
Department of Electrical and Software Engineering
GRADUATE COURSE OUTLINE**

COURSE TITLE:			
Course Name and Number	ENEL 645 – Data Mining & Machine Learning		
Pre/Co-Requisites	Basic linear algebra, calculus and programming knowledge.		
Desirable pre-requisites	Python programming, probability and information theory		
Faculty	Schulich School of Engineering, Electrical and Software Engineering Graduate Program		
Instructor Name(s)	Roberto Souza	Email	roberto.medeirosdeso@ucalgary.ca
Office Location	Zoom (link provided upon request)	Office Hours	TBD on D2L
Instructor Email Policy	Preference for using D2L discussion board. Email on special circumstances		
Telephone No.	n/a		
TA Names	Abbas Mahbod Kashyap Patel Omid Owjimehr	Email	abbas.mahbod1@ucalgary.ca kashyap.patel@ucalgary.ca omid.owjimehr@ucalgary.ca
Class Term, Days	Winter 2021 , Asynchronous classes		
Class Times	n/a		
Class Location	n/a – pre-recorded lectures		

Disclaimer:

This course will take place **online** via Zoom. To best succeed in the course, students are encouraged to participate in the asynchronous learning tasks (e.g., watching videos), to interact with others on D2L, and deliver the assignments within the proposed time frame.

If a student turns on their microphone or camera or uses the public chat feature, this constitutes consent for the student's video image or sound audio to be uploaded with the lecture or tutorial on university approved platforms such as D2L. If the student wishes to ensure that their questions/faces/voices are not recorded in the video, they should instead use private chat to ask questions.

COURSE INFORMATION/DESCRIPTION OF THE COURSE



This course is a hands-on course on Deep Learning (DL), which is a significant topic within machine learning. This course will give an overview of the historical context that allowed DL to flourish. It will cover different types of neural networks, how to train, and deploy them in different problems, such as image classification, image segmentation, and signal denoising. The neural network types that will be covered are fully connected networks, convolutional neural networks, fully convolutional neural networks, auto-encoders, recurrent neural networks, and others. Special emphasis will be given to popular network architectures like U-nets, ResNets, Inception, and VGG. The course will cover how to fine-tune pre-trained models to achieve state-of-the-art results in relevant applications. This course will also give a brief introduction to generative models, self-supervised learning and an overview of current new trends in DL.

LEARNING RESOURCES/REQUIRED READING

- **Materials provided by the instructor**

Recommended material for theoretical support:

- Goodfellow, Ian, Yoshua Bengio, Aaron Courville, and Yoshua Bengio. *Deep learning*. Vol. 1, no. 2. Cambridge: MIT press, 2016. Freely available at: <https://www.deeplearningbook.org/>
- Bishop, Christopher M. *Pattern recognition and machine learning*. springer, 2006. Freely available at: <https://www.microsoft.com/en-us/research/people/cmbishop/>

Recommended material for hands-on support:

- Geron, Aurélien. *Hands-on Machine Learning with Scikit-learn, Keras and TensorFlow*. O'Reilly, 2nd edition, 2019.

COURSE OBJECTIVES/LEARNING OUTCOMES

- To understand the basic concepts and definitions of machine learning;
- Design and develop machine learning solutions for relevant problems;
- Have a comprehensive overview of current trends in deep learning;
- To get familiarity with different Deep Learning algorithms and in which situations to deploy them;
- Acquire hands-on experience with deep learning programming frameworks (e.g., TensorFlow and PyTorch);

Communication with students:

Email and D2L will be the primary form of communications with students. Please ensure that you are regularly checking your @ucalgary.ca account and the course D2L page.

Learning Technology Requirements

In order to successfully engage in learning experiences at the University of Calgary, students taking online, remote and blended courses are required to have reliable access to the following technology:

- A computer with a current and updated web browser;
- Webcam (built-in or external);
- Microphone and speaker (built-in or external), or headset with microphone;
- VPN software to access the University of Calgary network;



- Broadband internet connection

Most current laptops will have a built-in webcam, speaker and microphone.

Please see the following for a detailed explanation of the minimal required technology for online learning

<https://elearn.ucalgary.ca/technology-requirements-for-students/>

For this course, it is also desirable that students have access to a camera phone.

The University of Calgary Schulich School of Engineering would like to acknowledge the traditional territories of the people of the Treaty 7 region in Southern Alberta, which includes the Blackfoot Confederacy (comprising the Siksika, Piikani, and Kainai First Nations), as well as the Tsuut'ina First Nation, and the Stoney Nakoda (including the Chiniki, Bearspaw, and Wesley First Nations). The City of Calgary is also home to Métis Nation of Alberta, Region III.

CUT POINTS FOR GRADES			
This course adheres to the grading system outlined in the University of Calgary, Faculty of Graduate Studies Calendar. Grades of A+ and A are not distinguished in the calculation of GPAs. Percentage/letter grade conversion used for this course is as follows			
Grade	Grade Point Value	Percentage Conversion	Graduate Description
A+	4.00	95-100	Outstanding
A	4.00	85-94	Excellent – superior performance showing comprehensive understanding of the subject matter
A-	3.70	80-84	Very Good Performance
B+	3.30	75-79	Good Performance
B	3.00	70-74	Satisfactory Performance
B-	2.70	65-69	Minimum Pass for Students in the Faculty of Graduate Studies
C+	2.30	55-64	All grades below “B-” are indicative of failure at the graduate level and cannot be counted toward Faculty of Graduate Studies course requirements
C	2.00	50-54	

Assessment Components: The University policy on grading related matters is outlined in the 2020-2021 Calendar .			
Assessment Methods	Description	Weight (%)	Due Date and Time
Multiple Choice Quizzes*	There will be 5 quizzes during the term (top 4 considered for final grade)	20	See detailed schedule below



Team Programming Assignments ⁺	There will be 5 programming assignments during the term (top 4 considered for final grade)	20	See detailed schedule below
Team Project Proposal	2-page project proposal (not including references)	10	February 12
Team midterm project report and presentation	4-page max report (not including references) + 10 minute recorded presentation.	20	February 26
Team Final project report and presentation	6-page max report (not including references) + 10 minute recorded presentation.	30	April 12

* Quizzes will be made available three days before the due date

+ Programming assignments will be made available at least one week before their due date

ASSESSMENT AND EVALUATION INFORMATION

ATTENDANCE AND PARTICIPATION EXPECTATIONS:

The delivery is asynchronous, but students are expected to engage on the D2L discussion board and potentially attend office hours, if they have questions.

GUIDELINES FOR SUBMITTING ASSIGNMENTS:

Assignments are to be submitted as Jupyter Notebooks and their corresponding PDFs with a file name convention to be determined in class by the dates and times stipulated by the instructor.

EXPECTATIONS FOR WRITING:

Students are expected to write in clear and concise language using Microsoft Word or LaTeX. PDFs are desirable. Guidelines for report formatting will be shared with students during class.

LATE AND/OR MISSING QUIZZES AND ASSIGNMENTS:

Missing assignments will be assigned a mark of zero. Late assignments are acceptable if students have made arrangements with the instructor. Only the four quizzes and four assignments with highest marks are considered to compute the final student grades.

Course Schedule

Date	Topics
Jan 10-16, 2021	Python Bootcamp and basic machine learning concepts (quiz #1)
Jan 17-23, 2021	Fully Connected Neural Networks (assignment #1)
Jan 24 – Jan 30, 2021	Consolidating the knowledge #1 (tutorials and discussion)
Jan 31 – Feb 6, 2021	Convolutional Neural Networks (CNNs) and model fine-tuning (quiz #2)
Feb 7 – Feb 13, 2021	Fully Convolutional Neural Networks (Assignment #2)

Date	Topics
Feb 14 – Feb 20, 2021	Consolidating the knowledge #2 (tutorials and discussion)
Feb 21 – Feb 27, 2021	Recurrent Neural Networks (quiz #3 and assignment #3)
Feb 28 - Mar 6, 2021	Term break (<i>i.e.</i> , reading week)
Mar 7 - Mar 13, 2021	Generative Adversarial Networks (quiz #4 and assignment #4)
Mar 14 – Mar 20, 2021	Consolidating the knowledge #3 (tutorials and discussion)
Mar 21 – Mar 27, 2021	Self-supervised learning
Mar 28 - Apr 3 , 2021	Overview of recent trends in deep learning (quiz #5 and assignment #5)
Apr 4 – Apr 10, 2021	Consolidating the knowledge #4 (tutorials and discussion)
Apr 11 – Apr 15, 2021	Teams final project reports and presentations are due. Discussion on D2L and by email.

Guidelines for Zoom Sessions

Zoom is a video conferencing program that will allow us to meet at specific times for a ‘live’ video conference, so that we can have the opportunity to meet each other virtually and discuss relevant course topics as a learning community.

To help ensure Zoom sessions are private, do not share the Zoom link or password with others, or on any social media platforms. Zoom links and passwords are only intended for students registered in the course. Zoom recordings and materials presented in Zoom, including any teaching materials, must not be shared, distributed or published without the instructor’s permission.

The use of video conferencing programs relies on participants to act ethically, honestly and with integrity; and in accordance with the principles of fairness, good faith, and respect (as the Code of Conduct). When entering Zoom or other video conferencing sessions, you play a role in helping create an effective, safe and respectful learning environment. Please be mindful of how your behaviour in these sessions may affect others. Participants are required to use names officially associated with their UCID (legal or preferred names listed in the Student Centre) when engaging in these activities. Instructors/moderators can remove those whose names do not appear on class rosters. Non-compliance may be investigated under relevant University of Calgary conduct policies. If participants have difficulties complying with this requirement, they should email the instructor of the class explaining why, so the instructor may consider whether to grant an exception, and on what terms. For more information on how to get the most out of your zoom sessions visit: <https://elearn.ucalgary.ca/guidelines-for-zoom/>.

If you are unable to attend a Zoom session, please contact your instructor to arrange an alternative activity (where available). Please be prepared, as best as you are able, to join class in a quiet space that will allow you to



be fully present and engaged in Zoom sessions. Students will be advised by their instructor when they are expected to turn on their webcam (such as for group work, presentations, etc).

The instructor may record online Zoom class sessions for the purposes of supporting student learning in this class – such as making the recording available for review of the session or for students who miss a session. Students will be advised before the instructor initiates a recording of a Zoom session. These recordings will be used to support student learning only.

Conduct During Instructor-Student Interactions

The classroom should be respected as a safe place to share ideas without judgement - a community in which we can all learn from one another. Students are expected to frame their comments and questions to lecturers in respectful and appropriate language, always maintaining sensitivity towards the topic. Students, employees, and academic staff are also expected to demonstrate behaviour in class that promotes and maintains a positive and productive learning environment.

As members of the University community, students, employees and academic staff are expected to demonstrate conduct that is consistent with the University of Calgary Calendar, the Code of Conduct and Non-Academic Misconduct policy and procedures, which can be found at <https://www.ucalgary.ca/policies/forms/title>.

Equity, Diversity and Inclusion

The Schulich School of Engineering recognizes that equity, diversity, and inclusion benefits and strengthens all communities, including the medical community and those served by it. We aim to actively engage all learners, particularly those from equity seeking groups including women, Indigenous peoples, visible/racialized minorities, persons with disabilities, and LGBTQ+. While our faculty continues to learn about more equitable, diverse, and inclusive approaches to education, we welcome and appreciate suggestions to help us ensure that all learners are well served by our courses.

To help cultivate learning environments that support diverse and inclusive perspectives and lived experiences, learners are invited to let instructors know if:

- they have names and/or pronouns they would prefer to use that differ from those that appear on official records
- scheduled class meetings conflict with religious events so that alternative arrangements can be made

If they are not already, learners are also encouraged to become familiar with the various opportunities for diverse engagement, learning, and support on campus, including, but not limited to the following resources:

The Office of Equity, Diversity and Inclusion

<https://www.ucalgary.ca/equity-diversity-inclusion>

The Q Centre

<https://www.su.ucalgary.ca/programs-services/student-services/the-q-centre/>



The Writing Symbols Lodge

<https://www.ucalgary.ca/student-services/writing-symbols/home>

MEDIA AND RECORDING IN LEARNING ENVIRONMENTS

Media recording for lesson capture

Please refer to the following statement on media recording of students: https://elearn.ucalgary.ca/wp-content/uploads/2020/05/Media-Recording-in-Learning-Environments-OSP_FINAL.pdf

The instructor may use media recordings to capture the delivery of a lecture. These recordings are intended to be used for lecture capture only and will not be used for any other purpose. Although the recording device will be fixed on the Instructor, in the event that incidental student participation is recorded, the instructor will ensure that any identifiable content (video or audio) is masked, or will seek consent to include the identifiable student content to making the content available on University approved platforms.

Media recording for assessment of student learning

The instructor may use media recordings as part of the assessment of students. This may include but is not limited to classroom discussions, presentations, clinical practice, or skills testing that occur during the course. These recordings will be used for student assessment purposes only and will not be shared or used for any other purpose.

Student Recording of Lectures

Audio or video/visual recording of lectures is prohibited except where explicit permission has been received from the instructor.

UNIVERSITY OF CALGARY POLICIES AND SUPPORTS

ACADEMIC ACCOMMODATIONS

Students seeking an accommodation based on disability or medical concerns should contact Student Accessibility Services; SAS will process the request and issue letters of accommodation to instructors. For additional information on support services and accommodations for students with disabilities, visit www.ucalgary.ca/access/. Students who require an accommodation in relation to their coursework based on a protected ground other than disability should communicate this need in writing to their Instructor. The full policy on Student Accommodations is available at www.ucalgary.ca/policies/files/policies/student-accommodation-policy.pdf

IMPORTANT INFORMATION

Any research in which students are invited to participate will be explained in class and approved by the appropriate University Research Ethics Board

INSTRUCTOR INTELLECTUAL PROPERTY



Course materials created by professor(s) (including course outlines, presentations and posted notes, labs, case studies, assignments and exams) remain the intellectual property of the professor(s). These materials may NOT be reproduced, redistributed or copied without the explicit consent of the professor. The posting of course materials to third party websites such as note-sharing sites without permission is prohibited. Sharing of extracts of these course materials with other students enrolled in the course at the same time may be allowed under fair dealing

COPYRIGHT LEGISLATION

All students are required to read the University of Calgary policy on Acceptable Use of Material Protected by Copyright www.ucalgary.ca/policies/files/policies/acceptable-use-of-material-protected-by-copyright-policy.pdf and requirements of the copyright act (<https://laws-lois.justice.gc.ca/eng/acts/C-42/index.html>) to ensure they are aware of the consequences of unauthorised sharing of course materials (including instructor notes, electronic versions of textbooks etc.). Students who use material protected by copyright in violation of this policy may be disciplined under the Non-Academic Misconduct Policy

ACADEMIC INTEGRITY

The Schulich School of Engineering expects intellectual honesty from its students. Course participants should be aware of University policies relating to Principles of Conduct, Plagiarism and Academic Integrity. These are found in the printed Faculty of Graduate Studies Calendar, or online under Academic Regulations in the Faculty of Graduate Studies Calendar, available at [Faculty of Graduate Studies Academic Regulations](#)

ACADEMIC MISCONDUCT

For information on academic misconduct and its consequences, please see the University of Calgary Calendar at www.ucalgary.ca/pubs/calendar/current/k.html

APPEALS

If there is a concern with the course, academic matter or a grade, first communicate with the instructor. If these concerns cannot be resolved, students can proceed with an academic appeal, as per Section N of the Faculty of Graduate Studies Calendar. Students must follow the official process and should contact the Student Ombuds Office (www.ucalgary.ca/student-services/ombuds) for assistance with this and with any other academic concerns, including academic and non-academic misconduct

THE FREEDOM OF INFORMATION AND PROTECTION OF PRIVACY (FOIP) ACT

This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIP) and students should identify themselves on written assignments (exams and term work.) by their name and ID number on the front page and ID on each subsequent page. Assignments given by you to your course instructor will remain confidential unless otherwise stated before submission. The assignment cannot be returned to anyone else without your expressed permission to the instructor. Grades will be made available on an individual basis and students will not have access to other students' grades without expressed consent. Similarly, any information about yourself that you share with your course instructor will not be given to anyone else without your permission

WELLNESS AND MENTAL HEALTH RESOURCES

The University of Calgary recognizes the pivotal role that student mental health plays in physical health, social connectedness and academic success, and aspires to create a caring and supportive campus community where



individuals can freely talk about mental health and receive supports when needed. We encourage you to explore the excellent mental health resources available throughout the university community, such as counselling, self-help resources, peer support or skills-building available through the SU Wellness Centre, at www.ucalgary.ca/wellnesscentre/services/mental-health-services and the Campus Mental Health Strategy website [at www.ucalgary.ca/mentalhealth/](http://www.ucalgary.ca/mentalhealth/)

SUPPORTS FOR STUDENT LEARNING, SUCCESS, AND SAFETY

Student Ombudsman: The Student Ombuds' Office supports and provides a safe, neutral space for students. For more information, please visit www.ucalgary.ca/ombuds/ or email ombuds@ucalgary.ca

Student Union: The SU Vice-President Academic can be reached at (403) 220-3911 or suvpaca@ucalgary.ca; Information about the SU, including elected Faculty Representatives can be found here: www.su.ucalgary.ca/

Graduate Student's Association: The GSA Vice-President Academic can be reached at (403) 220- 5997 or gsa.vpa@ucalgary.ca; Information about the GSA can be found here: gsa.ucalgary.ca