COURSE OUTLINE
FALL 2021

	Date	Initials
Prepared by Instructor	23-Aug	RMS
Approved by Head	03-Sep	amk

1. Calendar Information

ENSF 619.2
Advanced Topics in Image Analysis and Machine Learning

This course focuses on advanced machine learning and image analysis techniques. The course will cover the following topics: graph-based image representation, image segmentation, state-of-the-art methods on ImageNet, self-supervised learning, domain adaptation, adversarial models, and AutoML . A special emphasis will be given to recent cutting-edge techniques. The course will be hands-on.

Course Hours: 3 units; H(3-0)
Academic Credit: 3
Calendar Reference: http://www.ucalgary.ca/pubs/calendar/current/engineering.html#10159

2. Learning Outcomes

At the end of this course, you will be able to:

1. Acquire significant knowledge about cutting-edge image analysis and machine learning methods.
2. Design and develop image processing and machine learning solutions for relevant problems.
3. Acquire hands-on experience with image processing and machine learning programming frameworks (e.g., OpenCV, scikit-image, TensorFlow, etc.).

3. Timetable

Section	Day(s) of the Week	Time	Location
Fall 2021	TR	14:00-15:15	ENG 201

4. Course Instructors

Course Coordinator

Section	First Name	Family Name	Phone	Office	Email
	Roberto	Souza	403.210.6544	ICT 352C	roberto.medeirosdeso@ucalgary.ca

Other Instructors

Section	First Name	Family Name	Phone	Office	Email

Teaching Assistants

Section	First Name	Family Name	Phone	Office	Email

5. Assessments

Quizzes (10%): Three quizzes focused on the course theoretical aspects to evaluate the students' proficiency with the elements present in the proposed readings and discussed during the lectures and tutorials. The two highest marks will be kept.

Assignments (40%): Two programming assignments and one literature reading. The programming assignments will be assessed based on whether the proper techniques were employed to solve the assignment, the quality of the code, and the results obtained. The literature reading will be assessed orally through a five-minute presentation from each student, where the students need to demonstrate their understanding of the paper.

Project (50%): One final project developed individually or by students' pairs. Students can solve a significant image analysis problem of their choice as a final project. The students are encouraged to develop projects related to their research but are free to select other topics of interest. The students are required to apply the methods discussed in class to develop their projects. The evaluation will be based on an oral presentation and a written report, formatted using the template of a relevant conference in the field of the project. The presentations and reports should include:

- Motivation and significance of the problem being solved.
- Include relevant references (well cited, high impact factor journals, etc.).
- Describe and discuss the methodology employed to solve the problem.
- Present and discuss the results.
- Outline potential future work.

6. Use of Calculators in Examinations

You may use any calculator you wish for studying and completing lab reports. However, you must use one of the approved Schulich School of Engineering calculators for quizzes and exams. These calculators are the Casio 260 fx Solar, the Casio 300 MS, and the Texas Instruments TI30XIIS. Please note that no laptop computers, tablets, personal digital assistants, cellular phones, or other electronic devices will be permitted during quizzes and

7. Final Grade Determination

The final grade in this course will be based on the following components:

Component	Learning Outcome(s) Evaluated	Weight
Quizzes	1	10%
Assignments	1,2,3	40%
Project	1,2,3	50%
	Total:	100%

Notes:
Conversion from a score out of 100 to a letter grade will be done using the conversion chart shown below. This grading scale can only be changed during the term if the grades will not be lowered.

Letter Grade	Total Mark (T)
A+	T ≥ 95.0%
A	90.0% ≤ T < 95.0%
A-	85.0% ≤ T < 90.0%
B+	80.0% ≤ T < 85.0%
B	75.0% ≤ T < 80.0%
B-	70.0% ≤ T < 75.0%
C+	65.0% ≤ T < 70.0%
C	60.0% ≤ T < 65.0%
C-	55.0% ≤ T < 60.0%
D+	50.0% ≤ T < 55.0%
D	45.0% ≤ T < 50.0%
F	T < 45.0%

8. Textbook

The following textbook(s) is required for this course:

The following textbook(s) is recommended for this course:

Title	Deep Learning
Author(s)	Ian Goodfellow, Yoshua Bengio, Aaron Courville
Edition, Year	1st, 2016
Publisher	The MIT Press

9. University of Calgary Policies and Supports

*SSE ADVISING AND POLICIES

All Schulich School of Engineering students have access to a D2L site titled “Engineering Student Centre”. Students have a responsibility to familiarize themselves with the policies available on this site.

*ACADEMIC MISCONDUCT

Academic Misconduct refers to student behavior which compromises proper assessment of a student's academic activities and includes: cheating; fabrication; falsification; plagiarism; unauthorized assistance; failure to comply with an instructor's expectations regarding conduct required of students completing academic assessments in their courses; and failure to comply with exam regulations applied by the Registrar.

For information on the Student Academic Misconduct Policy and Procedure please visit:
https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Student-Academic-Misconduct-Policy.pdf
https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Student-Academic-Misconduct-Procedure.pdf
Additional information is available on the Academic Integrity Website at https://ucalgary.ca/student-services/student-success/learning/academic-integrity.

*ACADEMIC ACCOMODATION

It is the student's responsibility to request academic accommodations according to the University policies and procedures listed below. The Student Accommodations policy is available at https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Student-Accommodation-Policy.pdf.
Students needing an accommodation based on disability or medical concerns should contact Student Accessibility Services (SAS) in accordance with the Procedure for Accommodations for Students with Disabilities (https://www.ucalgary.ca/policies/files/policies/https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Accommodation-for-Students-with-Disabilities-Procedure.pdf). SAS will process the request and issue letters of accommodation to instructors. For additional information on support services and accommodations for students

*INSTRUCTOR INTELLECTUAL PROPERTY

Course materials created by instructors (including presentations and posted notes, labs, case studies, assignments and exams) remain the intellectual property of the instructor. These materials may NOT be reproduced, redistributed or copied without the explicit consent of the instructor. 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.

*FREEDOM OF INFORMATION AND PROTECTION OF PRIVACY

Student information will be collected in accordance with typical (or usual) classroom practice. Students' assignments will be accessible only by the authorized course faculty. Private information related to the individual student is treated with the utmost regard by the faculty at the University of Calgary.

*COPYRIGHT LEGISLATION

All students are required to read the University of Calgary policy on Acceptable Use of Material Protected by Copyright (https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/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 https://www.ucalgary.ca/legal-

*MEDIA RECORDING (if applicable)
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

Media recording for lesson capture
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 self-assessment of teaching practices
The instructor may use media recordings as a tool for self-assessment of their teaching practices. Although the recording device will be fixed on the instructor, it is possible that student participation in the course may be inadvertently captured. These recordings will be used for instructor self-assessment only and will not be used for any other purpose.

Media recording for the 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.

SEXUAL VIOLENCE POLICY
The University recognizes that all members of the University Community should be able to learn, work, teach and live in an environment where they are free from harassment, discrimination, and violence. The University of Calgary's sexual violence policy guides us in how we respond to incidents of sexual violence, including supports available to those who have experienced or witnessed sexual violence, or those who are alleged to have committed sexual violence. It provides clear response procedures and timelines, defines complex concepts, and addresses incidents that occur off-campus in certain circumstances. Please see the policy available at https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Sexual-and-Gender-Based-Violence-Policy.pdf

*OTHER IMPORTANT INFORMATION
Please visit the Registrar's website at: https://www.ucalgary.ca/registrar/registration/course-outlines for additional important information on the following:
- Wellness and Mental Health Resources
- Student Success
- Student Ombuds Office
- Student Union (SU) Information
- Graduate Students' Association (GSA) Information
- Emergency Evacuation/Assembly Points
- Safewalk

10. Statements Specific to Fall 2021

Course Format and Scheduling

The course will be delivered through lectures that will have hads-on components. Students are expected to bring their laptops to class.

Course schedule

- Sep 07-11, 2021 Graph-based Image Representation
- Sept 12-18, 2021 HPC Computing – using the UCalgary computational resources
- Sep 20-26, 2021 The Watershed Transform
- Sept 27 – Oct 02, 2021 ImageNet state-of-the-art
- Oct 03 – Oct 09, 2021 Consolidation week (demos and exercises)
- Oct 10 – Oct 16, 2021 Self-supervised learning
- Oct 17- Oct 23, 2021 Domain Adaptation
- Oct 24 – Oct 30, 2021 Consolidation week (demos and exercises)
- Oct 31 – Nov 6, 2021 Adversarial Models (part 01)
- Nov 7 – Nov 13, 2021 Term Break
- Nov 14 – Nov 20, 2021 Adversarial Models (part 02)
- Nov 21 – Nov 27, 2021 AutoML
- Nov 28 – Dec 4, 2021 Consolidation week (demos and exercises)
- Dec 5 – Dec 9, 2021 Final Project Presentations

Course assessment

- Sep 23rd, 2021 Assignment #01 - programming
- Sep 23rd, 2021 Quizz #01
- Oct 14th, 2021 Assignment #02 - programming
- Oct 14th, 2021 Quizz #02
- Nov 18th, 2021 Assignment #03 – literature reading
- Nov 18th, 2021 Quizz #03
- Dec 7th, 2021 Final project – report delivery
- Dec 9th, 2021 Final project – presentation

Expectations for Attendance and Engagement in Sessions

The delivery is in-person and synchronous. Students are expected to come to class unless they can present an appropriate justification. Students are expected to engage on the D2L discussion board and potentially attend office hours, if they have questions.

Guidelines for Completing and Submitting Coursework

Quizzes and assignments are individual. Students will be requested to submit the quiz or upload the assigment on D2L on specificed dates. The projects will be developed individually or in doubles. Documents (e.g., reports) will be submitted through D2L on specified dates.

11. Additional Course Information