

Course Outline (W2026)

ELE888: Intelligent Systems

Instructor(s)	Dr. Mohammed Saif [Coordinator] Office: EPH417 Phone: TBA Email: mohammed.saif@torontomu.ca Office Hours: Thursday 4:00 pm- 5:00 pm
Calendar Description	Machine learning and pattern classification are fundamental blocks in the design of an intelligent system. This course will introduce fundamentals of machine learning and pattern classification concepts, theories, and algorithms. Topics covered include: Bayesian decision theory, linear discriminant functions, multilayer neural networks, classifier evaluation, and an introduction to unsupervised clustering/grouping, and other state-of-the-art machine learning and AI algorithms.
Prerequisites	ELE 532 or MEC 733
Antirequisites	None
Corerequisites	None
Compulsory Text(s):	1. There are no required textbooks for this course. All of the material to be learned will be self-contained in the lecture notes that the instructor will provide as well as supplemental material to reinforce the concepts.
Reference Text(s):	1. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification, 2nd edition, John Wiley & Sons, 2002. ISBN: 0-471-05669-3.
Learning Objectives (Indicators)	At the end of this course, the successful student will be able to: <ul style="list-style-type: none"> 1. Generates solutions for complex engineering design problems (4b) 2. Demonstrate iterative design process in complex engineering projects (4c) 3. Construct effective arguments and draws conclusions using evidence. Write and revise documents using appropriate discipline specific conventions. Adapt format, content, organization, and tone for various audiences. Demonstrate accurate use of technical vocabulary. (7a) 4. Construct effective arguments and draw conclusions using evidence. Write and revise documents using appropriate discipline specific conventions. Adapt format, content, organization, and tone for various audiences. Use graphics to explain, interpret, and assess information. (7c) 5. Discuss the factors in decision making in the design of intelligent systems by principles and examples. Explain the impact of decisions and activities on the environment. (9a) 6. Assess ethical risks and evaluates situations and actions in terms of the professional code of ethics for engineers. Evaluate competing values in decision making, and analyzes components of a decision in terms of professional codes of ethics and other ethical guidelines and to make decisions correspondingly. (10a)

	<p>7. Investigate and communicate recent developments in a selected topics in intelligent system design. Critically evaluate the procured information for authority, currency and objectivity and make accurate and appropriate use of technical literature. (12b)</p> <p>NOTE: Numbers in parentheses refer to the graduate attributes required by the Canadian Engineering Accreditation Board (CEAB).</p>														
Course Organization	<p>3.0 hours of lecture per week for 13 weeks 1.0 hours of lab per week for 12 weeks 0.0 hours of tutorial per week for 12 weeks</p>														
Teaching Assistants	<p>1- Sarah Kamoun, email: skamoun@torontomu.ca 2- Osama Harmouche, email: oharmouche@torontomu.ca 3- Syed Ammad Ali Shah, email: s10shah@torontomu.ca 4- Erfan Shahab, email: erfan.shahab@torontomu.ca</p>														
Course Evaluation	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="2" style="text-align: left;">Theory</th> </tr> </thead> <tbody> <tr> <td>Midterm Exam</td> <td style="text-align: right;">30 %</td> </tr> <tr> <td>Quizzes (There is no quiz in course)</td> <td style="text-align: right;">0 %</td> </tr> <tr> <td>Final Exam</td> <td style="text-align: right;">40 %</td> </tr> <tr> <th colspan="2" style="text-align: left;">Laboratory</th> </tr> <tr> <td>Lab Reports</td> <td style="text-align: right;">30 %</td> </tr> <tr> <td>TOTAL:</td> <td style="text-align: right;">100 %</td> </tr> </tbody> </table> <p>Note: In order for a student to pass a course, a minimum overall course mark of 50% must be obtained. In addition, for courses that have both "Theory and Laboratory" components, the student must pass the Laboratory and Theory portions separately by achieving a minimum of 50% in the combined Laboratory components and 50% in the combined Theory components. Please refer to the "Course Evaluation" section above for details on the Theory and Laboratory components (if applicable).</p>	Theory		Midterm Exam	30 %	Quizzes (There is no quiz in course)	0 %	Final Exam	40 %	Laboratory		Lab Reports	30 %	TOTAL:	100 %
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Examinations	<p>Midterm exam, two hours, closed book (covers weeks 1-6). Final exam, during exam period, three hours, closed-book (covers all course materials).</p>														
Other Evaluation Information	<p>Laboratories</p> <p>There are 4 practical assignments in this course. These are to be done individually and handed in electronically online. These assignments are more like mini-projects and are NOT meant to be done/completed in the assigned lab hours. They are to be done primarily outside lab hours. The assigned lab hours are available for you to make use of as you see fit and will also be the best time to get direct help from the TA on these assignments. In addition, you will need to demonstrate your lab works to the TA. The assignments will consist of theoretical and practical parts and will require use of Python.</p>														
Teaching Methods	<p>The course is delivered in person. All communications are online. All course materials are provided on the course shell.</p>														
Other Information	<p>The Course Outline is tentative. Please refer to the course shell for the most up-to-date details.</p> <p>Students may use Generative AI (e.g. ChatGPT, Grammarly, Perplexity, DeepL Translator) for ideation and brainstorming but not for research or for writing anything (e.g., lab reports) that will be</p>														

submitted for credit. Failure to stay within these limits will be considered a breach of Policy 60.

Course Content

Week	Hours	Chapters / Section	Topic, description
1	3		Introduction and General Concepts of Machine Learning and AI systems
2	3		Linear Algebra Review. Optimization and Gradient Descent. Review of Probability Concepts
3	3		Bayesian Decision Theory. Bayes Theorem and Decision Rule. Minimum Risk Action. Discriminant Functions. Gaussian Distributions.
4	3		Bayesian Decision Theory (continued).
5	3		Linear Discriminant Functions
6	3		Linear Discriminant Functions/Algorithms
8	3		Midterm
9	3		Logistic Regression and Softmax Regression
10	3		Introduction of Multilayer Neural Networks and Deep Learning
11	3		Neural Networks Continued. Advice on using Neural Networks. Introduction to Support Vector Machines: Cost Function Kernels Optimizing Cost Function. Advice on Applying Machine Learning Algorithms. Bias and Variance.

			Learning Curves. Machine Learning System Design. Error Analysis. Classifier Evaluation.
12	3		Introduction to Unsupervised Learning and algorithms such as K-means, NN Clustering
13	3		Principal Component Analysis
14	3		Final Review/Final Exams

Laboratory(L)/Tutorials(T)/Activity(A) Schedule

Week	L/T/A	Description
1-2	Lab 0	Lab Assignment 0: Intro to Python for Machine Learning
3, 4, 5	Lab 1	Lab Assignment 1: Bayesian Decision Theory
6, 8	Lab 2	Lab Assignment 2: Linear Discriminant Function
9-10	Lab 3	Lab Assignment 3: Multilayer Neural Network
11-12	Lab 4	Lab Assignment 4: Unsupervised Learning

University Policies & Important Information

Students are reminded that they are required to adhere to all relevant university policies found in their online course shell in D2L and/or on [the Senate website](#)

Refer to the [Departmental FAQ page](#) for further information on common questions.

Important Resources Available at Toronto Metropolitan University

- [The University Libraries](#) provide research [workshops](#) and individual consultation appointments. There is a drop-in Research Help desk on the second floor of the library, and students can use the [Library's virtual research help service](#) to speak with a librarian, or [book an appointment](#) to meet in person or online.
- [Student Life and Learning Support](#) offers group-based and individual help with writing, math, study skills, and transition support, as well as [resources and checklists to support students as online learners](#).
- You can submit an [Academic Consideration Request](#) when an extenuating circumstance has occurred that has significantly impacted your ability to fulfill an academic requirement. You may always visit the [Senate website](#) and select the blue radio button on the top right hand side entitled: Academic Consideration Request (ACR) to submit this request.

For Extenuating Circumstances, [Policy 167: Academic Consideration](#) allows for a once per semester ACR request without supporting documentation if the absence is less than 3 days in duration and is not for a final exam/final assessment. Absences more than 3 days in duration and those that involve a final exam/final assessment, always require documentation. Students must notify their faculty/contract lecturer once a request for academic consideration is submitted. See Senate [Policy 167: Academic Consideration](#).

Longer absences are not addressed through Policy 167 and should be discussed with your Chair/Director/Program to be advised on next steps.

- [FAQs Academic Considerations and Appeals](#)
- Information on Copyright for [Faculty/Contract Lecturers](#) and [students](#).

Lab Safety (if applicable)

Students are to strictly adhere and follow:

- a. The Lab Safety information/guidelines posted in the respective labs,
- b. provided in their respective lab handouts, and
- c. instructions provided by the Teaching Assistants/Course instructors/Technical Staff.

During the lab sessions, to avoid tripping hazards, the area around the lab stations should not be surrounded by bags, backpacks etc, students should place their bags, backpacks etc against the walls of the labs and/or away from their lab stations in such a way that it avoids tripping hazards.

Accessibility

- Similar to an [accessibility statement](#), use this section to describe your commitment to making this course accessible to students with disabilities. Improving the accessibility of your course helps minimize the need for accommodation.
- Outline any technologies used in this course and any known accessibility features or barriers (if applicable).
- Describe how a student should contact you if they discover an accessibility barrier with any course materials or technologies.

Academic Accommodation Support

Academic Accommodation Support (AAS) is the university's disability services office. AAS works directly with incoming and returning students looking for help with their academic accommodations. AAS works with any student who requires academic accommodation regardless of program or course load.

- Learn more about [Academic Accommodation Support](#).
- Learn [how to register with AAS](#).
- Learn about [Policy 159: Academic Accommodation of Students with Disabilities](#)

Academic Accommodations (for students with disabilities) and Academic Consideration (for students faced with extenuating circumstances that can include short-term health issues) are governed by two different university policies. Learn more about [Academic Accommodations versus Academic Consideration and how to access each](#).

Wellbeing Support

At Toronto Metropolitan University, we recognize that things can come up throughout the term that may interfere with a student's ability to succeed in their coursework. These circumstances are outside of one's control and can have a serious impact on physical and mental well-being. Seeking help can be a challenge, especially in those times of crisis.

If you are experiencing a mental health crisis, please call 911 and go to the nearest hospital emergency room. You can also access these outside resources at anytime:

- **Distress Line:** 24/7 line for if you are in crisis, feeling suicidal or in need of emotional support (phone: 416-408-4357)
- **Good2Talk:** 24/7-hour line for postsecondary students (phone: 1-866-925-5454)
- **Keep.meSAFE:** 24/7 access to confidential support through counsellors via [My SSP app](#) or 1-844-451-9700

If non-crisis support is needed, you can access these campus resources:

- **Centre for Student Development and Counselling:** 416-979-5195 or email csdc@torontomu.ca
- **Consent Comes First - Office of Sexual Violence Support and Education:** 416-919-5000 ext 3596 or email osvse@torontomu.ca
- **Medical Centre:** call (416) 979-5070 to book an appointment

We encourage all Toronto Metropolitan University community members to access available resources to ensure support is reachable. You can find more resources available through the [Toronto Metropolitan University Mental Health and Wellbeing](#) website.