Toronto Metropolitan University

Department of Electrical, Computer, & Biomedical Engineering
Faculty of Engineering & Architectural Science

Course Outline (W2024)

ELE888: Intelligent Systems

Instructor(s)	Ghassem Tofighi [Coordinator] Office: online - by appointment Phone: TBA Email: gtofighi@torontomu.ca Office Hours: online - by appointment
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
Corequisites	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: 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**)

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**)

NOTE: *Numbers in parentheses refer to the graduate attributes required by the Canadian Engineering Accreditation Board (CEAB).*

Course Organization	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
Teaching Assistants	TBA

Course Evaluation

Theory	
Midterm Exam	30 %
Quizzes	0 %
Final Exam	40 %
Laboratory	
Lab Reports	30 %
TOTAL:	100 %

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).

Examinations	Midterm exam, two hours, closed book. Final exam, during exam period, three hours, closed-book.
Other Evaluation Information	Laboratories There are 4 practical assignments in this course. These are to be done in partners 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 and lecture 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. The assignments will consist of theoretical and practical parts and will require use of Python programming language.
Teaching Methods	The course is delivered in-person/online or hybrid. All communication is online. All course materials are provided on the course web.
Other Information	Some practical problems and solutions will be on the course web page as a study guide. You are strongly recommended to attempt to solve the problems on your own without looking at the solutions first. It is your responsibility to check the course web and download the materials. If you have any question about a problem or its respective solution, please consult the course instructor or the teaching assistant during their consulting hours.

Course Content

Week	Hours	Chapters / Section	Topic, description
1	6		1- Introduction to the concept, History and application of Intelligent Systems 2- Data Processing, Linear Regression and Polynomial Regression
2	6		1- Artificial Neural Networks (ANN) and Nonlinear Regression 2- Practical Aspects on Training Artificial Neural Networks
3	6		1- Evolutionary Computation 2- Classification, Logistic Regression and Linear Discriminant Function
4	6		1- Midterm Exam 2- Classification Using Artificial Neural Networks
5	6		1- Unsupervised Learning and Clustering 2- Fuzzy Clustering
6	6		1- Deep learning and Convolutional Neural Networks (CNN) 2- Bayesian Decision Theory
7	6		1- Challenges on the Implementation of Intelligent Systems 2- Final Exam

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

Week	L/T/A	Description
1	Lab 0	Lab Assignment 0: Intro to Python for Machine Learning

2	Lab 1	Lab Assignment 1: Regression
3	Lab 2	Lab Assignment 2: Multilayer Neural Network
5	Lab 3	Lab Assignment 3: Classification
6	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 furhter information on common questions.

Important Resources Available at Toronto Metropolitan University

- The Library provides research workshops and individual assistance. If the University is open, there is a Research Help desk on the second floor of the library, or students can use the Library's virtual research help service to speak with a librarian.
- 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, require documentation. Students must notify their instructor once a request for academic consideration is submitted. See Senate Policy 167: Academic Consideration.

- If a student is requesting accommodation due to a religious, Aboriginal and/or spiritual observance, they must submit their request via the online Academic Consideration Request (ACR) system **within the first two weeks of the class or, for a final examination, within two weeks of the posting of the examination schedule**. If the required absence occurs within the first two weeks of classes, or the dates are not known well in advance as they are linked to other conditions, these requests should be submitted with as much lead time as possible in advance of the required absence.

- If taking a remote course, familiarize yourself with the tools you will need to use for remote learning. The Remote Learning Guide for students includes guides to completing quizzes or exams in D2L Brightspace, with or without Respondus LockDown Browser and Monitor, using D2L Brightspace, joining online meetings or lectures, and collaborating with the Google Suite.
- Information on Copyright for Faculty and students.

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](#).

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.