Course Outline

1. COURSE INFORMATION

Session Offered	Fall 2023
Course Name	Artificial Intelligence and Machine Learning
Course Code	SMRTTECH 4AI3
Date(s) and Time(s) of lectures	Lectures Tu 8:30AM – 10:20AM We 8:30AM - 9:20AM Labs: L01: Tu 2:30PM - 5:20PM L02: Tu 10:30AM - 1:20PM L03: Tu 6:30.PM - 9:30PM L04: Mo 6:30PM - 9:30PM
Program Name	Automation Engineering Technology
Calendar Description	This course deals with concepts of Artificial Intelligence and Machine Learning. It covers supervised classification based on artificial neural networks - deep Learning, as well as unsupervised learning - clustering, regression, optimization and reinforcement learning. In addition the course covers application in artificial intelligent systems..

C	Anwar Mirza (Instructor) Ali Kasmaee (Class TA)	E-Mail: mirzaa24@mcmaster.ca E-Mail: shiraeea@mcmaster.ca Office Hours: upon request
L	Anwar Mirza and Siqi Zhao (Lab)	E-Mail: mirzaa24@mcmaster.ca E-Mail: zhaos98@mcmaster.ca Office Hours: upon request

2. COURSE SPECIFICS

Course Description			

Instruction Type	Code	Type	Hours per term
	C	Classroom instruction	39
	L	Laboratory, workshop or fieldwork	39
	T	Tutorial	
	DE	Distance education	
		Total Hours	78

Resources	Textbook Title & Edition	Author & Publisher
	Mathematics for Machine Learning	M. Peter Deisenroth, A. Faisal, and C. Soon Ong
	Pattern Recognition and Machine Learning	Christopher Bishop
	Machine Learning: A Probabilistic Perspective	Kevin Murphy
	Neural Networks and Learning Machines, Pearson Education	Simon Haykin
	Deep Learning, MIT Press, 2016	I. Goodfellow, Y. Bengio, and A. Courville

	Other Supplies	Source
Prerequisite(s)	*ENGTECH 2MT3, 1CP3, 1PR3, 4EE0, SMRTTECH 4ID3 and registration in level IV of Automation Systems Engineering Technology, OR MECHENG 4R03 or IBEHS 4A03 and registration in any Mechanical Engineering Program*	
Corequisite(s)		
Antirequisite(s)	*SFWRTECH 4AI3, MANTECH 4AI3*	
Course Specific Policies	All work must be shown to get full credit. Missed test marks due to legitimate reasons (officially verified by the faculty of Engineering/B.Tech) will be added to the final examination. *Specific policy of Labs/Assignments submissions of Online Virtual Labs:* Labs will be conducted online by using related software which is same as regular on- site labs. Completed labs should be uploaded to the lab's drop box before midnight of the due date. Labs missed due to legitimate reasons must be completed later mutually agreed with the instructor.	
Departmental Policies	In order to achieve the required learning objectives, on average, B.Tech. students can expect to do at least 3 hours of "out-of-class" work for every scheduled hour in class. "Out-of-class" work includes reading, research, assignments and preparation for tests and examinations. Where group work is indicated in the course outline, such collaborative work is mandatory. The use of cell phones, iPods, laptops and other personal electronic devices are prohibited from the classroom during the class time, unless the instructor makes an explicit exception. Announcements made in class or placed on Avenue are considered to have been communicated to all students including those individuals that are not in class. Instructor has the right to submit work to software to identify plagiarism.	

3. SUB TOPIC(S)		
Week 1 (Sep 4th)	Introduction and Review	
Week 2 (Sep 11th)	Regression, Generalization and Validation	Lab 1: Python Basics
Week 3 (Sep 18th)	Classification + Feature Selection	Lab 2: Data Pre-Processing
Week 4 (Sep 25th)	Kernels	Lab 3: Linear Regression
Week 5 (Oct 2nd)	Neural Networks	Lab 4: SVM + Classification
Week 6 (Oct 9th)	Midterm recess (reading week)	
Week 7 (Oct 16th)	Neural Networks	Lab 5: Multi-class Problems
Week 8 (Oct 23rd)	Clustering + Dimensionality Reduction	Lab 6: FNN + Tensorflow
Week 9 (Oct 30th)	Unsupervised Learning	Lab 7: CNN + Tensorflow
Week 10 (Nov 6th)	Probabilistic Modeling	Lab 8: KNN
Week 11 (Nov 13th)	Generative Modeling	Lab 9: PCA + LDA
Week 12 (Nov 20th)	GANs	Lab 10: GANs
Week 13 (Nov 27th)	Project Presentations	
Week 14 (Dec 4th)	Project Presentations	
Classes end: December 6th, 2023		

Note that this structure represents a plan and is subject to adjustment term by term.

The instructor and the University reserve the right to modify elements of the course during the term. The University may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes.

4. ASSESSMENT OF LEARNING *including dates*	Weight
Hands-on Assignment 1 (Deliverables: Report and Source Code) (Due date: Week 3)	6%
Hands-on Assignment 2 (Deliverables: Report and Source Code) (Due date: Week 5)	8%
Hands-on Assignment 3 (Deliverables: Report and Source Code) (Due date: Week 7)	8%
Hands-on Assignment 4 (Deliverables: Report and Source Code) (Due date: Week 9)	8%
Labs	40%
Project (Deliverables: Report, Presentation and Source Code) (Due Date: Week 13)	30%
TOTAL	**100%**

Note that the percentage distribution of each module may be adjusted.
Percentage grades will be converted to letter grades and grade points per the University calendar.

5. LEARNING OUTCOMES

1. Be familar with classic AI and ML methods as well as newl emerging techniques such as Deep Learning.
2. Be capable of connecting theory with practice through transferable skills.
3. Understand the current limitations of ML when applying in real world.
4. Know how to handle AI/ML data properly and efficiently.
5. Gain experience to design, evaluate, and improve ML models for real-world problem solving in areas of automation.
6. Be familiar with well-known methods such as gradient decent, seaching, SVM, linear regression, logistic regression, shallow neural networks, DNN and its variants.
7. Be able to code and debug independently of classic ML mehods from scratch without using libraries or tools.
8. Be able to apply advanced libraries or tools, such as tensorflow, Keras, PyTorch, and Scikit-Learn for complicated ML problems.

6. COURSE OUTLINE – APPROVED ADVISORY STATEMENTS

ANTI-DISCRIMINATION

The Faculty of Engineering is concerned with ensuring an environment that is free of all discrimination. If there is a problem, individuals are reminded that they should contact the Associate Director, Graduate Studies, the Sexual Harassment Officer or the Human Rights Consultant, as soon as possible.
http://www.mcmaster.ca/policy/General/HR/Discrimination_Harassment_Sexual_Harassment-Prevention&Response.pdf

ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. It is your responsibility to understand what constitutes academic dishonesty.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/

The following illustrates only three forms of academic dishonesty:
• plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
• improper collaboration in group work.
• copying or using unauthorized aids in tests and examinations.

AUTHENTICITY / PLAGIARISM DETECTION

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. A2L, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, other software, etc.). For more details about McMaster's use of Turnitin.com please go to www.mcmaster.ca/academicintegrity.

COURSES WITH AN ON-LINE ELEMENT

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn (A2L), LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.

ONLINE PROCTORING

Some courses may use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

COMMUNICATIONS

It is the student's responsibility to:
- Maintain current contact information with the University, including address, phone numbers, and emergency contact information.
- Use the University provided e-mail address or maintain a valid forwarding e-mail address.
- Regularly check the official University communications channels. Official University communications are considered received if sent by postal mail, by fax, or by e-mail to the student's designated primary e-mail account via their @mcmaster.ca alias.
- Accept that forwarded e-mails may be lost and that e-mail is considered received if sent via the student's @mcmaster.ca alias.
- Check the McMaster/Avenue email and course websites on a regular basis during the term.

CONDUCT EXPECTATIONS

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the Code of Student Rights & Responsibilities (the "Code"). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, whether in person or online.

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students' access to these platforms.