

## Course Outline

### 1. COURSE INFORMATION

<b>Session Offered</b>	Fall 2021
<b>Course Name</b>	Artificial Intelligence and Machine Learning
<b>Course Code</b>	SMRTTECH 4AI3
<b>Date(s) and Time(s) of lectures</b>	Lectures (Online): Tu 9:30 am – 11:20 am Wed 9:30 am – 10:20 am  Labs (Online): Tu 2:30 pm – 5:20 pm
<b>Program Name</b>	Automation Engineering Technology
<b>Calendar Description</b>	Machine learning (ML) is a set of methods that allow computers to directly learn from data and experience, instead of humans specifying the desired behaviour manually. ML has become increasingly a key technology in both academia and industry. This course introduces the main concepts and ideas in Machine Learning, as well as an overview of commonly used machine learning algorithms. It also serves as a foundation for many advanced ML courses.
<b>C</b>	Hamidreza Mahyar E-Mail: <a href="mailto:mahyarh@mcmaster.ca">mahyarh@mcmaster.ca</a> Office Hours: upon request

### 2. COURSE SPECIFICS

<b>Course Description</b>			
<b>Instruction Type</b>	<b>Code</b>	<b>Type</b>	<b>Hours per term</b>
	C	Classroom instruction	39
	L	Laboratory, workshop or fieldwork	39
	T	Tutorial	
	DE	Distance education	
	<b>Total Hours</b>		78
<b>Resources</b>	<b>ISBN</b>	<b>Textbook Title &amp; Edition</b>	<b>Author &amp; Publisher</b>
		Mathematics for Machine Learning	<i>M. Peter Deisenroth, A Faisal, and C. Soon Ong</i>
		Pattern Recognition and Machine Learning	C. Bishop
		Machine Learning: A Probabilistic Perspective	K. Murphy
		Deep Learning, MIT Press, 2016	I. Goodfellow, Y. Bengio and A. Courville
	<b>Other Supplies</b>	<b>Source</b>	
<b>Prerequisite(s)</b>			
<b>Corequisite(s)</b>			
<b>Course Specific Policies</b>	All work must be shown to get full credit.		

	<p>Missed test marks due to legitimate reasons (officially verified by the faculty of Engineering/B.Tech) will be added to the final examination.</p> <p><i>Specific policy of Labs/Assignments submissions of Online Virtual Labs:</i> 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.</p>
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<b>Departmental Policies</b>	<p>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.</p> <p>Where group work is indicated in the course outline, such collaborative work is mandatory.</p> <p>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.</p> <p>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.</p> <p>Instructor has the right to submit work to software to identify plagiarism.</p>
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<b>3. SUB TOPIC(S)</b>		
Week 1	Introduction + Regression	
Week 2	Generalization and Validation + Model Selection	Lab 1
Week 3	Classification + Feature Selection	Lab 2
Week 4	Kernels	Lab 3
Week 5	Kernels + Class Imbalance	Lab 4
Week 6	Mid-term recess (reading week)	
Week 7	Neural Networks	Lab 5
Week 8	Neural Networks	
Week 9	Clustering + Dimensionality Reduction	Lab 6
Week 10	Probabilistic Modeling	Lab 7
Week 11	Generative Modeling	Lab 8
Week 12	GMMs	Lab 9
Week 13	GANs	Lab 10
Week 14	Final Review	

Classes end: December 8<sup>th</sup>

<b>4. ASSESSMENT OF LEARNING *including dates*</b>	<b>Weight</b>
Assignments	30%
Labs	30%
Project	40%
<b>TOTAL</b>	<b>100%</b>

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 familiar with classic AI and ML methods as well as newly emerged 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 area of automation.
6. Be familiar with well-known methods such as gradient decent, searching, SVM, linear regression, logistic regression, shallow neural networks, DNN and its variants.
7. Be able to code and debug independently of classic ML methods from scratching 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](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](http://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.

### **ACADEMIC ACCOMMODATION OF STUDENTS WITH DISABILITIES**

Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) at 905-525-9140 ext. 28652 or [sas@mcmaster.ca](mailto:sas@mcmaster.ca) to make arrangements with a Program Coordinator. For further information, consult McMaster University's Academic Accommodation of Students with Disabilities policy.

### **ACADEMIC ACCOMMODATION FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)**

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students should submit their request to their Faculty Office normally within 10 working days of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests. <http://www.mcmaster.ca/policy/Students-AcademicStudies/Studentcode.pdf>

### **COPYRIGHT AND RECORDING**

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, including lectures by University instructors

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

### **EXTREME CIRCUMSTANCES**

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.