

Course Outline

EE8209/ELE888 - Intelligent Systems

Instructor	Ghassem Tofighi, Ph.D. email: gtofighi@ryerson.ca web: https://ghassem.com
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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: Linear regression, Logistic regression, Softmax regression, multilayer neural networks, classifier evaluation, and an introduction to unsupervised clustering/grouping, and Bayesian Decision Theory.
Prerequisites	MTH 514
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)	<p>At the end of this course, the successful student will be able to:</p> <ol style="list-style-type: none"> 1. Generates solutions for complex engineering design problems (4b) 2. Demonstrates iterative design process in complex engineering projects (4c) 3. Constructs effective arguments and draws conclusions using evidence. Writes and revises documents using appropriate discipline specific conventions. Adapts format, content, organization, and tone for various audiences. Demonstrates accurate use of technical vocabulary. (7a) 4. Constructs effective arguments and draws conclusions using evidence. Writes and revises documents using appropriate discipline specific conventions. Adapts format, content, organization, and tone for various audiences. Uses graphics to explain, interpret, and assess information. (7c) <p>NOTE: Numbers in parentheses refer to the graduate attributes required by the Canadian Engineering Accreditation Board (CEAB).</p>
Course Organization	3.0 hours of lecture per week for 13 weeks 1.0 hours of lab/tutorial per week for 12 weeks
Teaching Assistants	TBA

Course Evaluation	Midterm Exam	30 %
	Lab Reports	30 %
	Final Exam	40 %
	TOTAL:	100 %
Examinations	Midterm exam, two hours, closed book (covers Weeks 1-6). Final exam, during exam period, three hours, closed-book (covers all course materials).	
Other Evaluation Information	Will be informed if necessary	
Other Information	None	

CourseContent (Subject to change!)

Week	Labs	Topic, description
1		Introduction and General Concepts of Machine Learning
2		Introduction to Linear Regression
3		Multivariate Linear Regression and Gradient Descent Feature Scaling and Choice of Learning Rate - Gradient Descent.
4		Logistic Regression
5	Lab1	Softmax Regression
6		Introduction of Multilayer Neural Networks - Forward Propagation (Feed Forward)
7	Lab2	Multilayer Neural Networks continued - Backpropagation
8		Introduction to Deep Neural Networks
9		Midterm exam

10	Lab3		Convolutional Neural Networks Advices on Applying Machine Learning Algorithms. Bias and Variance. Machine Learning System Design. Classifier Evaluation using Cross Validation
11			Introduction to Unsupervised Learning. K-means Clustering PCA
12	Lab 4		Bayesian Decision Theory
13			Final Exam - Assigned DataCamp Modules (Just concepts)

Laboratory/Tutorials/Activity Schedule

Week	Lab	Description
1-2	Lab 0	Lab Assignment 0: Intro to matlab/python
3-4	Lab 1	Lab Assignment 1: Linear Regresseion
5-6	Lab 2	Lab Assignment 3: Logistic Regression
8-10	Lab 3	Lab Assignment 3: Multilayer Neural Network
11-12	Lab 4	Lab Assignment 4: Unsupervised Learning

Policies & Important Information:

1. Students are required to obtain and maintain a Ryerson e-mail account for timely communications between the instructor and the students;
2. Any changes in the course outline, test dates, marking or evaluation will be discussed in class prior to being implemented;
3. Assignments, projects, reports and other deadline-bound course assessment components handed in past the due date will receive a mark of ZERO, unless otherwise stated. Marking information will be made available at the time when such course assessment components are announced.
4. If you have taken the course previously and are currently looking to get a laboratory exemption, then you must fill out this form: <http://www.ee.ryerson.ca/guides/ECE-LabExemptionForm.pdf>
5. Refer to our **Departmental FAQ** page for information on common questions and issues at the following link: <https://www.ee.ryerson.ca/guides/Student.Academic.FAQ.html>.

Missed Classes and/or Evaluations

When possible, students are required to inform their instructors of any situation which arises during the semester which may have an adverse effect upon their academic performance, and must request any consideration and accommodation according to the relevant policies as far in advance as possible. Failure to do so may jeopardize any academic appeals.

1. **Health certificates** - If a student misses the deadline for submitting an assignment, or the date of an exam or other evaluation component for health reasons, they should notify their instructor as soon as possible, and submit a Ryerson Student Health Certificate AND an Academic Consideration Request form within 3 working days of the missed date. Both documents are available at <https://www.ryerson.ca/senate/forms/medical.pdf>. **If you are a full-time or part-time degree student, then you submit your forms to your own program department or school;**
2. **Religious, Aboriginal and Spiritual observance** - If a student needs accommodation because of religious, Aboriginal or spiritual observance, they must submit a Request for Accommodation of Student Religious, Aboriginal and Spiritual Observance AND an Academic Consideration Request form within the first 2 weeks of the class or, for a final examination, within 2 weeks of the posting of the examination schedule. If the requested absence occurs within the first 2 weeks of classes, or the dates are not known well in advance as they are linked to other conditions, these forms should be submitted with as much lead time as possible in advance of the absence. Both documents are available at

www.ryerson.ca/senate/forms/reobservforminstr.pdf. If you are a full-time or part-time degree student, then you submit the forms to your own program department or school;

3. **Academic Accommodation Support** - Before the first graded work is due, students registered with the [Academic Accommodation Support office](http://www.ryerson.ca/studentlearningsupport/academic-accommodation-support) (AAS - www.ryerson.ca/studentlearningsupport/academic-accommodation-support) should provide their instructors with an Academic Accommodation letter that describes their academic accommodation plan.

Academic Integrity

Ryerson's [Policy 60 \(the Academic Integrity policy\)](#) applies to all students at the University. Forms of academic misconduct include plagiarism, cheating, supplying false information to the University, and other acts. The most common form of academic misconduct is plagiarism - a serious academic offence, with potentially severe penalties and other consequences. It is expected, therefore, that all examinations and work submitted for evaluation and course credit will be the product of each student's individual effort (or an authorized group of students). Submitting the same work for credit to more than one course, without instructor approval, can also be considered a form of plagiarism.

Suspensions of academic misconduct may be referred to the Academic Integrity Office (AIO). Students who are found to have committed academic misconduct will have a Disciplinary Notation (DN) placed on their academic record (not on their transcript) and will normally be assigned one or more of the following penalties:

1. A grade reduction for the work, ranging up to and including a zero on the work (minimum penalty for graduate work is a zero on the work);
2. A grade reduction in the course greater than a zero on the work. (Note that this penalty can only be applied to course components worth 10% or less, and any additional penalty cannot exceed 10% of the final course grade. Students must be given prior notice that such a penalty will be assigned (e.g. in the course outline or on the assignment handout);
3. An F in the course;
4. More serious penalties up to and including expulsion from the University.

The unauthorized use of intellectual property of others, including your professor, for distribution, sale, or profit is expressly prohibited, in accordance with Policy 60 (Sections 2.8 and 2.10). Intellectual property includes, but is not limited to:

1. Slides
2. Lecture notes
3. Presentation materials used in and outside of class
4. Lab manuals
5. Course packs
6. Exams

For more detailed information on these issues, please refer to the [Academic Integrity policy](https://www.ryerson.ca/senate/policies/pol60.pdf) (<https://www.ryerson.ca/senate/policies/pol60.pdf>) and to the Academic Integrity Office website (<https://www.ryerson.ca/academicintegrity/>).

Important Resources Available at Ryerson

1. [The Library](https://library.ryerson.ca/) (<https://library.ryerson.ca/>) provides research workshops and individual assistance. Inquire at the Reference Desk on the second floor of the library, or go to library.ryerson.ca/guides/workshops
2. [Student Learning Support](https://www.ryerson.ca/studentlearningsupport) (<https://www.ryerson.ca/studentlearningsupport>) offers group-based and individual help with writing, math, study skills and transition support, and other issues.

Approved by: _____ Date _____
Course Instructor

Approved by: _____ Date _____
Associate Chair or Program Director