

TERM YEAR
Fall 2021

ECE 7650: APPLIED COMPUTATIONAL INTELLIGENCE

COURSE DESCRIPTION:

This course applies computationally intelligent algorithms to solve difficult computer engineering and computer science problems. This course consists of the following components: standard lecture delivery, hands-on, and project based. The theory of several computationally intelligent algorithms will be presented in class. Along with receiving the theory in class, students are required to demonstrate their understanding by implementing the algorithms in software to solve given difficult engineering problems, which have shown to be intractable with the application of conventional algorithms.

COURSE OBJECTIVE:

1. Ability to choose the appropriate machine learning algorithm to solve a computationally intelligent demanding problem.
2. Develop Matlab programs to implement computationally intelligent algorithms.
3. Identify, define, and describe the components of the computationally intelligent algorithms studied in this course.
4. Create and design novel methods to implement parts of given algorithms.

PRE-REQUISITES:

This course has the following pre-requisites:

- Software languages in C, Java, and Matlab.

CONTACT HOURS:

An equivalent of 3 lectures /week (3 credit hours).

COURSE CONTENT:

This course has the following content:

1. Introduction to machine learning.
2. Linear and logistic regression.
3. Support Vector Machine (SVM).
4. Simulated Annealing (SA).
5. Artificial Neural Network (ANN).
6. Genetic algorithm (GA).
7. Particle Swarm Optimization (PSO)
8. Ant Colony Optimization (ACO).
9. Data Sets.

Additional advanced research topics as determined by the instructor.
The following topics may be covered in the labs:

- Application of Linear Regression.
- Application of Logistic Regression.
- Analysis of the Backpropagation algorithm in ANNs.

- Investigation of the SVM algorithm in classification problems.
- Investigation and novel addition to the simulate annealing and genetic algorithms for classification problems.

HOMEWORK:

Homework will consist of assignments, preparation of a seminar on an assigned article from the research literature, and an individual design project.

TEXTBOOK:

This course provides online lecture notes and list of papers.

GRADE ANNOUNCEMENTS:

TBD

EVALUATION:

Your final course grade is determined by your performance in the components list below in the Evaluation Table (seminar, assignments, project, mid-term, and a final examination. **Students must receive a minimum of 50% on the final examination and must complete and pass all components in the course in order to be eligible to receive a passing grade.**

Your final course grade is determined by your performance in assignments, term test, and a final examination. The weighting of each of these components is as follows:

COMPONENT	NO	VALUE %	TOTAL VALUE	DETAILS / ADDITIONAL INFO
Term Test	1	30%	20	
Project	1	20%	20	
Final Exam	1	50%	50	
TOTAL			100	

GRADE SCALE:

LETTER	MARK	LETTER	MARK	LETTER	MARK	LETTER	MARK
A+	95-100	B+	80-84	C+	65-69	D	45-54
A	85-94	B	70-79	C	55-64	F	<45

INSTRUCTOR INFO:

Name: Ken Ferens
Office: E1-544 EITC
Tel:..... (204) 474-8517
Email: Ken.Ferens@umanitoba.ca

Office Hours:..... By appointment

VOLUNTARY WITHDRAW:

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REQUIREMENTS/REGULATIONS

Student Responsibilities: It is the responsibility of each student to contact the instructor if he/she is uncertain about his/her standing in the course and his/her potential for receiving a failing grade. Students should also familiarize themselves with Sections 4 and 6 of the Regulations dealing with, among others, incomplete term work, deferred examinations, attendance and withdrawal, etc..

Lectures: Attendance at lectures is essential for successful completion of this course. Students must satisfy each evaluation component in the course.

ACADEMIC INTEGRITY

Students are expected to conduct themselves in accordance with the highest ethical standards of the Profession of Engineering and evince academic integrity in all their pursuits and activities at the university. As such, in accordance with the General Academic Regulations and Requirements of the University of Manitoba, Section 7.1, students are reminded that plagiarism* or any other form of cheating is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university) regardless of media

- examinations
- assignments
- laboratory reports
- term exams

A student found guilty of contributing to cheating in examinations or term assignments is also subject to serious academic penalty

Please refer any questions regarding Academic Integrity to your course instructor.

***Plagiarism:** to steal and pass off (the ideas or words of another) as one's own; use (another's production) without crediting the source