![Michigan Technological University 1885]

Course Syllabus

CS5841-0A, EE5841-0A
College of Computing/Engineering
Spring 2024

Instructor Information

Instructor: Evan Lucas, PhD, Research Scientist
Office Location: 311 GLRC
E-mail: eglucas@mtu.edu
Office Hours: MWF 12-1 or by appointment

Course Identification

Course Number: CS5841-0A/EE5841-0A
Course Name: Machine Learning
Course Location: EERC 103
Class Times: MWF 2:00PM-2:50PM
Prerequisites: CS4821 or instructor approval

Course Description/Overview

This course will explore the foundational techniques of machine learning. Topics are pulled from the areas of unsupervised and supervised learning. Specific methods covered include naive Bayes, linear regression, logistic regression, dimensionality reduction, decision trees, support vector machine (SVMs), ensemble methods, neural networks, and clustering methods.

Course Resources

Course Website(s)

Canvas [www.courses.mtu.edu]

Required Books

• Pattern Recognition and Machine Learning, Chris Bishop, Springer, 2007, ISBN: 978-0387310732, https://www.microsoft.com/en-us/research/people/cmbishop/prml-book

Reference Books

• Probabilistic Machine Learning: An Introduction. Kevin P. Murphy. MIT press, 2022 (https://probml.github.io/pml-book/book1.html)

• Deep Learning. Ian Goodfellow, Yoshua Bengio, and Aaron Courville. MIT press, 2016, ISBN: 9780262035613 (https://www.deeplearningbook.org/)

• The Elements of Statistical Learning. Trevor Hastie, Robert Tibshirani, Jerome H. Friedman. Springer, ISBN 978-0-387-84858-7 (https://hastie.su.domains/ElemStatLearn)

Course Fees/Supplies
None

Course Learning Objectives
Upon successful completion of this course, students will be able to

- Understand the major machine learning problems as different types of tasks (regression, classification, clustering, etc.)
- Explain and evaluate both the strengths and limitations of various machine learning algorithms
- Build practical machine learning tools for real-world tasks

Grading Scheme

Grading System

Letter Grade	Percentage	Grade points/credit	Rating
A	90% & above	4.00	Excellent
AB	85% – 90%	3.50	Very good
B	80% – 85%	3.00	Good
BC	75% – 80%	2.50	Above average
C	70% – 75%	2.00	Average
CD	65% – 70%	1.50	Below average
D	60% - 65%	1.00	Inferior
F	Below 60%	0.00	Failure
I	Incomplete; given only when a student is unable to complete a segment of the course because of circumstances beyond the student's control.		
X	Conditional, with no grade points per credit; given only when the student is at fault in failing to complete a minor segment of a course, but in the judgment of the instructor does not need to repeat the course. It must be made up by the close of the next semester or the grade becomes a failure (F). A (X) grade is included in the grade point average calculation as a (F) grade.		

Grading Policy
Grades will be based on the following:

Course Component	Points
Homework	30%
Quizzes	20%
Exams (2X15%)	30%
Final Project	20%
Total Points	**100%**

Solutions and late assignments

Solutions to assignments will be posted, as appropriate, after the expiration of a grace period (or sooner, at the instructor's discretion). Quiz and Exam solutions will be only discussed in class (if needed). Quizzes will typically be online.

Late assignments will not be accepted unless approved by the Dean of Students, exceptions to this rule will only be made for cases brought to the instructor's attention prior to the due date. Exceptions are rarely granted.

Course Policies

Student expectations
We are all members of an academic community where it is our shared responsibility to cultivate a climate where all students/individuals are valued and where both they and their ideas are treated with respect. The classroom should be a place of mutual respect and active participation in class discussions is encouraged. Conflict of ideas on class discussion topics is encouraged and welcome, although such discussion must proceed in a civil and orderly fashion. If your conduct disrupts the environment of mutual respect, you will be asked to leave.

The instructor reserves the right to modify this syllabus at any time. Notice of such changes will be made by announcements in class, by email, or by changes on the course website on Canvas.

Michigan Tech is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of support, services are available. For help or to find additional resources, contact Counseling Services at 906-487-2538 or visit the Counseling Services website. (www.mtu.edu/counseling).

Academic Integrity Rules
Students are encouraged to discuss anything covered in this course outside of class with anyone they want using any tools they desire, however any work submitted is expected to

be an individual effort. The exception to this is the group project, which is expected to be performed only by the members of the group.

All authorized resources used, including but not limited to anything found on the internet, should be appropriately cited. Please bring a calculator to class for exams, as other devices, such as computers or phones, are not permitted during exams.

For more details on academic integrity, please review the [Academic Integrity Policy of Michigan Tech](http://www.admin.mtu.edu/usenate/policies/p109-1.htm) [http://www.admin.mtu.edu/usenate/policies/p109-1.htm].

University Policies

Student work products (exams, essays, projects, etc.) may be used for purposes of university, program, or course assessment. All work used for assessment purposes will not include any individual student identification.

Michigan Tech has standard policies on academic misconduct and complies with all federal and state laws and regulations regarding discrimination, including the Americans with Disabilities Act of 1990. For more information about reasonable accommodations or equal access to education or services at Michigan Tech, please call the Dean of Students Office at 906-487-2212. More information is also available from the [Syllabi Policies webpage](http://www.mtu.edu/ctl/instructionalresources/syllabus/syllabus_policies.html) [http://www.mtu.edu/ctl/instructionalresources/syllabus/syllabus_policies.html].

In accordance with University policy and the Americans with Disabilities Act (ADA), academic accommodations may be made for any student who notifies the instructor of the need for accommodation. It is imperative that you take the initiative to bring such needs to the instructor's attention, as he is not legally permitted to inquire about such particular needs of students. Students who may require special assistance in emergency evacuations (fire, tornado, etc.) should contact the instructor as to the most appropriate procedures to follow in such an emergency. Contact the Office of Affirmative Programs if you have questions about issues related to the ADA at 906-487-3310

Tentative Course Schedule

Week #	Topic	Assignment/Quizzes out	Assignments due
1	Course Introduction, Machine learning overview, Math Review	Math Review Assignment	
2	Linear Regression,	Regression Assignment	Math Review Assignment

	Cross Validation, Nonlinear Regression		
3	KNN, Logistic Regression		Regression Assignment
4	SVM, Naive Bayes	Classification Assignment 1	
5	Decision Trees, Ensemble Learning	Classification Assignment 2	Classification Assignment 1
6	Clustering, Dimensionality Reduction	Clustering and Dimensionality Reduction Assignment	
7	MLOps	Paper Presentation Project, Final Project Proposal, Exam 1 (Covers weeks 2-6)	Classification Assignment 2
8	Neural Networks		Clustering and Dimensionality Reduction Assignment
9	Convolutional Neural Networks	NN and CNN Assignment	
10	Transfer Learning		Final Project Proposal, NN and CNN Assignment
11	Recurrent Neural Networks	Transfer Learning and RNN Assignment	Paper Presentation Video
12	Deep Learning		Reviews for Paper Presentation, Transfer Learning and RNN Assignment
13	Special topics week (TBD)	Exam 2 (Covers weeks 8-12)	
14	Course project poster sessions		Final Projects due