



WICHITA STATE
UNIVERSITY

ECE 707, ML Essentials & Apps, Fall, 2024

(Machine Learning Essentials and Applications)

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- Preferred Method of Contact: In person during office hours or e-mail
- Classroom, Day/Time: 226 Jabara Hall, Monday & Wednesday 4:05-5:20 PM
- Student/Office Hours: Tuesday 11:00-12:30 & Wednesday 10:00-11:30 AM
- Prerequisites: IME 254 and CS 211
- Teaching Assistant (TA): Grading – Md “Raihan” Uddin
- TA Contacts: Grading – mxuddin11@shockers.wichita.edu

How to use this syllabus

This syllabus provides you with information specific to this course, and it also provides information about important university policies. This document should be viewed as a course overview; it is not a contract and is subject to change as the semester evolves. Any changes should be shared via lecture and/or Blackboard.

University Policies and Procedures

The Wichita State University Policies and Procedures Manual can be found at:
<https://www.wichita.edu/about/policy/>.

Academic Integrity

Students at Wichita State University are expected to uphold high academic standards. WSU will not tolerate a lack of academic integrity. Students are responsible for knowing and following the Student Code of Conduct http://webs.wichita.edu/inaudit/ch8_05.htm and the Student Academic Honesty policy http://webs.wichita.edu/inaudit/ch2_17.htm. When the faculty member determines sanctions are warranted for violations of academic integrity, regardless of severity, the faculty member must report the infraction to the Office of Student Conduct and Community Standards. If you need more information about the process or wish to appeal a decision, please visit https://www.wichita.edu/about/student_conduct/ai.php

If there are homework (HW) assignments in this course, each HW will be an individual assignment (unless otherwise stated). Students can discuss with others, but they should not write the solution together; one submission (wording/coding) should be reasonably different from other submissions. "Collaboration is good, cheating is not!" There will be severe consequences for academic dishonesty. Cheating (such as copying word-for-word from other sources) in any test will automatically result a 'Fail' grade in this course; this grading policy applies to all parties involved (including the ones who help/show).

Course Description

Presents essential principles, theories, and methodologies pivotal to machine learning and its implementations. Important topics include training, development, and testing machine learning classification models; analysis of model accuracy considering datasets, bias, and variance; prompt engineering; and utilization of TensorFlow library for artificial and deep neural networks. Team activities and projects give hands-on experience.

Measurable Student Learning Outcomes

After passing this course, students should be able to:

- (SO: EAC 1) identify, formulate, and solve machine learning based classification problems by applying principles of engineering, science, and mathematics (*Note: SO is Student Outcome and EAC is Engineering Accreditation Commission*)
- (SO: EAC 7) acquire and apply new machine learning knowledge as needed, using appropriate learning strategies

Required Texts/Readings Textbook

Please talk to the instructor before buying books for this course.

Book: Machine Learning Yearning by Andrew Ng (associate professor at Stanford's CS and EE Departments), a deeplearning.ai project, 2018. <https://techgrabyte.com/machine-learning-yearning-andrew-ng/>

Reference 1: Understanding Machine Learning: From Theory to Algorithms by Shai Shalev-Shwartz and Shai Ben-David, Cambridge University Press, 2014.

Reference 2: Master Machine Learning Algorithms by Jason Brownlee, 2016, Edition v1.1, <http://MachineLearningMastery.com>

Other Readings

Class notes and some reading materials (on Machine Learning and related topics) will be made available via WSU Blackboard. Some code examples will be made available via WSU Blackboard.

Other Equipment/Materials

If needed, students will be provided information about computing servers and service supports so that they can work on programming assignments and projects. More information will be provided during class lectures as may require.

Class Protocol

There are points on class performance. It is expected that students join the instructor and/or TA before classes start. Students are always encouraged to ask questions, especially if they find ambiguity in assignments and materials covered.

Contact Policy

Although you may attempt to reach me in-person or by phone, email communication is always preferred. Feel free to email me any questions and/or concerns following these guidelines:

- **Always** email me from your WSU email address and/or through Blackboard.
- Always use the course name in the subject line of the email.
- Remember to sign your name.
- If you have a problem with accessing or uploading assignments, you should let me know as soon as possible before the assignment is due. You will also have to accompany this notification with the file in question, so I can verify that it is completed by the due date/time.
- I offer a Discussion Forum on Blackboard which allows common questions to be seen and responded to publicly.
- You **should NOT** contact me for tech support.
 - Any technical problems involving your computer, or issues regarding file uploading or sharing, should go through the OneStop. You can contact them at 316-978-3909. You can also fill out a request for help form at their [website](https://wichita.edusupportcenter.com/sims/helpcenter/common/layout/SelectHelpHome.seam?inst_name=wichita):
https://wichita.edusupportcenter.com/sims/helpcenter/common/layout/SelectHelpHome.seam?inst_name=wichita

Response Time

To Email and Discussion Forum Questions:

I answer your questions as soon as possible within 24 hours. If you do not receive reply to your email within 24 hours, please re-send me the email, probably the email did not arrive to my Inbox.

Feedback on Assignments:

As soon as possible after the due date including the late submission date/time. Answer key will be discussed in lecture sessions and/or shared via Blackboard.

Undergraduate vs. Graduate Credit

Undergraduate students enrolled in 700 level courses will receive undergraduate credit (not graduate credit) unless they have a previously approved senior rule application or dual/accelerated enrollment form on file in the Graduate School. Undergraduate credit earned in 700 level courses cannot later be counted toward a graduate degree.

Grading Scale

WSU uses a +/- grading scale for final grades and to calculate grade point averages. In this class, grades are assigned according to the following chart. (Other classes might assign grades differently: Be sure to understand the different grading scales in all of your classes.)

| Points/Percentage | Letter Grade | Grade Points | Interpretation |
|-------------------|--------------|--------------|--------------------------------------------|
| 93 and up | A | 4.00 | A range denotes excellent performance |
| 90 – less than 93 | A- | 3.70 | |
| 87 – less than 90 | B+ | 3.30 | |
| 83 – less than 87 | B | 3.00 | B range denotes good performance |
| 80 – less than 83 | B- | 2.70 | |
| 77 – less than 80 | C+ | 2.30 | |
| 73 – less than 76 | C | 2.00 | C range denotes satisfactory performance |
| 70 – less than 73 | C- | 1.70 | |
| 67 – less than 70 | D+ | 1.30 | |
| 63 – less than 67 | D | 1.00 | D range denotes unsatisfactory performance |
| 60 – less than 63 | D- | 0.70 | |
| 0 – less than 60 | F | 0.00 | |

Assignments

List of grading assignments/components and values toward the final letter grade are shown below. While determining letter grades, the same grading scale will be used for graduate and undergraduate students. Homework assignment due dates will be announced in class and/or made available via Blackboard. Similarly, the dates for Quiz, Exam, and Project (Proposal, Article, Presentation, and Report) will be announced in class and/or made available via Blackboard.

| <u>Grading Assignments/Components</u> | <u>Values</u> |
|-----------------------------------------------------------------------------------------------|---------------|
| Homework (five of six, individual) | 15% |
| Quiz (two of three, 30-minute, individual) | 22% |
| Project Proposal defense & write-up (~ Week 5, teamwork) | 5% |
| Project related Articles presentation (~ Week 10, individual) | 3% |
| Project Presentation (~ Week 15, teamwork) | 10% |
| Project Report (~ Week-15, teamwork) | 12% |
| Exam (cumulative, 65-minute class-test, individual) | 33% |

Late Assignments

For homework assignments, late submissions will not be accepted after five days from the original due date/time. Homework scores will not be considered for letter grades. Exceptions include documented emergency situations and prior consents.

Missed Tests and Labs/Projects

Makeup for missed tests (Quiz and Exam) and Labs/Projects will be given only when there is a genuine reason, with clear proof. It is students' responsibility to provide the proof; if the reason for missing a test is illness, a doctor's note will be required. Students should contact the instructor before any makeup test.

Teaching Assistants

Grading TA:

Md "Raihan" Uddin <mxuddin11@shockers.wichita.edu>

Office Hours/Room: TBD

The Grading TA (if any) is not allowed to solve student problems (any problem). The TA should grade test papers and provide feedback to students for any missing points. If students have any questions regarding the course materials or assignments, they should immediately contact the course instructor.

Syllabus Policies and Student Resources

All students should familiarize themselves with the course-related policies and student resources that can be found at: www.wichita.edu/syllabuspolicies

These include, but may not be limited to:

- [Academic Integrity](#)
- [CARE Team](#)
- [Concealed Carry Policy](#)
- [Counseling and Prevention Services](#)

- COVID-19 Conditions
- Definition of a credit hour
- Disability Services
- First Generation Students
- Heskett Center and Campus Recreation
- Important Academic Dates
- Inclusive Excellence and Respect for Diversity
- Intellectual Property
- Names and Pronouns
- Shocker Alert System
- Student Health Services
- Title IX
- Video and Audio recording

Students with Disabilities

A disability is something that affects a major life activity. These life activities include, but are not limited to, learning, walking, breathing, hearing, and seeing, in addition to many other physical, sensory functions, and psychological disabilities.

If you are a student with a disability, or believe you might have a disability, which requires accommodations, please contact the Office of Disability Services (ODS) www.wichita.edu/ods to discuss reasonable and appropriate accommodations and eligibility requirements. It is the University's goal that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability ODS will review your concerns and determine, with you, what academic accommodations are necessary and appropriate for you. For example, adaptations of teaching methods, class materials or testing may be made on a case-by-case basis if warranted, as required by the Americans with Disabilities Act (ADA). All information and documentation of your disability is confidential and will not be released by ODS without your written permission.

Respect for Diversity

Wichita State University is committed to being an inclusive campus that reflects the evolving diversity of society. To further that goal, Wichita State University does not discriminate in its employment practices, educational programs or activities on the basis of age (40 years or older), ancestry, color, disability, gender, gender expression, gender identity, genetic information, marital status, national origin, political affiliation, pregnancy, race, religion, sex, sexual orientation, or status as a veteran. Retaliation against an individual filing or cooperating in a complaint process is also prohibited.

Students from all diverse backgrounds and perspectives are welcome in this Course and the diversity that students bring to this course should be viewed as a resource, strength and benefit. All materials and activities are presented with the intent to be

respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups. In addition, if any of our class meetings conflict with your religious events, please let me know so that we can make arrangements for you.

Laboratory Information

Programming in Python is a must for coding in this course. Students in this course will need access to Beoshock, the HPC cluster at WSU, for their programming needs. There is no teaching/research lab associated to this course; however, we will provide supports so that you can perform the programming assignments. Information about Beoshock (such as how to log in and how to run TensorFlow code) will be provided via lectures. The main purpose of Beoshock is to provide students a machine learning platform so that they can write/debug/run programs for assignments and projects. The Computer Architecture and Parallel Programming Laboratory (CAPPLab) in 312 Wallace Hall may provide additional help.

Brief List of Topics to Cover

Introduction and Motivation

- Glossary: Artificial intelligence, machine learning, artificial neural networks, deep learning, deep neural networks, and programming in Python ...
- Why/How/What Machine Learning?

Course Project

- [Technical Reading, Writing, and Presentation](#)
- [Teamwork: Proposal \(with literature review\), Report, and Presentation](#)

Machine Learning Essentials

- Machine Learning strategies
- Training, development, and test data sets
- Single-number evaluation metrics; Optimizing and satisficing metrics
- Error analysis: Development set examples to evaluate ideas
- Bias and Variance: The two big sources of error; tradeoff
- Error analysis on the training set; Plotting training error
- Human-level performance
- Weighting data; Data mismatch; End-to-end learning;

Machine Learning Models and Applications

- Concept and coding of Artificial Neural Network (ANN), Deep Neural Network (DNN), and Convolutional Neural Network (CNN)

- TensorFlow (open-source software library for machine learning developed by the Google Brain team)

Prompt Engineering: Text Summarization, Information Extraction, Question Answering, Text Classification, Conversation, Code Generation, and Reasoning

Related Publications / Tools

- Applications of machine learning for making decisions by analyzing data
- Amazon Web Services; PyTorch; Scikit-Learn; OpenNN; Microsoft Azure;

Tentative Schedule

| Week Mon | Note | Important topics/readings, assignments, due dates, and reminders are listed here so that you can organize your time and academic work. |
|-------------|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 08/19 | | ECE 777AB: Machine Learning; Syllabus; K-probe; HW-1 Assign; Useful terms: neural networks; Project: Components, Grading ; |
| 2 08/26 | HW-1 | Why Machine Learning? Project: Teamwork, Groups, Topics ; HW-1 (Blackboard); Machine Learning Strategy; |
| 3 09/02 | HW-2 | 9/02 (Labor Day) No Class/Lab ; HW-2 (Bb); Useful terms: deep learning, ...; Quiz-1 discussion; |
| 4 09/09 | Quiz-1 | Development and test sets; Project: proposal/report next week ; Quiz-1 (class test, 30-min / 30-pts, closed book); |
| 5 09/16 | Project | Proposal defense presentation: Teamwork, in-class; Proposal write-up with literature review: One / group, Blackboard; |
| 6 09/23 | Update | Project: Technical reading, writing, and presentation ; Single-number evaluation metrics; |
| 7 09/30 | HW-3 | Optimizing and satisficing metrics; HW-3 (Bb); Error analysis: Development set examples; |
| 8 10/07 | Mid-Pt HW-4 | Bias and Variance: The two big sources of error; HW-4 (Bb); Bias vs. Variance tradeoff; Quiz-2 discussion; |
| 9 10/14 | Fal-Brk | 10/12 (Sat) to 10/15 (Tue) (Fall Break) No Class ; Project Related Article Presentation: Individual (3+ articles) ; |
| 10 10/21 | Update Quiz-2 | Error analysis on the training set; Plotting training error; Quiz-2 (class test, 30-min / 30-pts, closed book); |
| 11 10/28 | HW-5 | Human-level performance: what, how, why? Weighting data; HW-5 (Bb); Project: Report (format), Presentation (slides) ; |
| 12 11/04 | HW-6 | Addressing data mismatch; End-to-end learning: pros and cons; HW-6 (Bb); Related Tools; Quiz-3 discussion; |
| 13 11/11 | Quiz-3 | Research articles; Quiz-3 (class test, 30-min / 30-pts, closed book); Exam discussion; |

| Week Mon | Note | Important topics/readings, assignments, due dates, and reminders are listed here so that you can organize your time and academic work. |
|-----------------------------------------------------------------------------------------------|---------|----------------------------------------------------------------------------------------------------------------------------------------|
| 14 11/18 | Project | Project Presentation : Team-work, PowerPoint slides; Final Report : Team-work, via Blackboard on Friday; |
| 15 11/25 | Thx-Brk | Future of ML technology; Review for Exam; 11/27 (Wed) to 12/01 (Sun) (Thanksgiving Break) No Class; |
| 16 12/02 | Exam | Future of ML technology; Review for Exam; EXAM (class test, 65 minutes, 65 points, Closed book); |
| Finals | | None! |
| Note: A date in Column 1 indicates the Monday of that week. Here, 12/02 is Monday of Week 16. | | |

- 1) Apr. 19, 2024; prepared for fall 2024 term; DRZ
- 2) June 7, 2024; course change from ECE 777AB to ECE 707; DRZ

Definition of a Credit Hour

Example for 3 credit hour class: Success in this 3 credit-hour course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally 3 hours per unit per week with 1 of the hours used for lecture) for instruction and preparation/studying or course related activities for a total of 135 hours.

Go to 4.08 / Definition and Assignment of Credit Hours for the policy and examples for different types of courses and credit hour offerings.