



## 17-634: Applied Machine Learning

Mon & Wed, 3:30pm to 4:50pm, Location: 300 S. Craig St., Room 265

Semester: Spring (Mini 3) Year: 2024

Units: 6 Section(s): A3 / Lecture 43

### Instructor information

Name	Dr. Thomas P. Scanlon (Tom),	Dr. Clarence Worrell (Clarence)
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Office location	Software Engineering Institute (SEI) / Zoom	
Office hours	By Appointment	

### TA Information [If applicable]

TA name	Harshit Nanda
TA Contact Info	<a href="mailto:harshitn@andrew.cmu.edu">harshitn@andrew.cmu.edu</a>
Office location	Zoom
Office hours	By Appointment

### Course Description

Automated decisions systems increasingly rely on machine learning models for classification, regression, and prediction. The practical application of machine learning requires understanding the basic structure, assumptions, and limitations for a variety of model forms; how to formulate a meaningful problem; how to acquire and understand relevant data; how to select, train, evaluate, and use machine learning models; and how to securely integrate these models into deployable pipelines. This course introduces these concepts for the most widely used supervised and unsupervised machine learning methods, and the course includes a mix of classroom experience, a hands-on coding project using a real dataset of the student's choosing, and communication of the problem and results through a class presentation.

### Learning Objectives

- **Problem Formulation:** choosing the right question, business value, data sources
- **Mathematics of Data Science (conceptual):** statistical learning, optimization, algorithms
- **Machine Learning Models:** supervised, semi-supervised, unsupervised; classification and prediction; linear models, tree-based models, neighbor-based models, support vector machine, neural networks.
- **Exploratory Data Analysis:** computing statistics, data visualization, feature engineering, feature selection
- **Modeling Process:** training, validating, testing, evaluation metrics, tuning, feature importance, explainability

- **MLOPS:** deployment, versioning, operations, monitoring and maintenance, security
- **Tools:** Python, R, scikit-learn, Google Colab, Jupyter, Visual Studio Code

### Learning Resources

- There are no required textbooks for this course
- Course readings will consist of readings from publicly available sources and/or the CMU library system
- Students will need access to a personal computer, an internet browser, and basic productivity software
- No special equipment or software will need to be purchased for this course

### Assessments

The final course grade will be calculated using the following categories (see note on attendance below):

Assessment	Percentage of Final Grade
Assignment 1	10%
Assignment 2	15%
Assignment 3	15%
Assignment 4	15%
Assignment 5	15%
Project Report & Presentation	30%

Students will be assigned the following final letter grades, based on calculations coming from the course assessment section.

Grade	Percentage Interval
A+	98-100%
A	92-97%
A-	90-91%
B+	88-89%
B	82-87%
B-	80-81%
C+	78-79%
C	72-77%
C-	70-71%
D	65-69%
R (F)	0-64%

## Course Policies

- **Attendance & Participation:** Attendance is required for this course. No grade points are awarded for attending class, but missing class will result in a 2% penalty off the final grade *for each missed class* after the first one. Missing one class will result in no penalty, for each missed class after the first one, the 2% penalty will be applied per absence.
- **Late-work policy:** Late work will be accepted with the following conditions:
  - Work submitted 24 hours or less past the original due date & time will be accepted with no penalty
  - Work submitted more than 24 hours past the original due date & time will be accepted with a 10% penalty for up to 5 days (120 hours) past the original due date & time
  - Work will not be accepted more than 5 days (120 hours) past the original due date & time
- **Laptops & Mobile Devices:** Students are permitted to use laptops and mobile devices during class sessions, such as for note-taking purposes. Please ensure audio sounds are muted so as not to disturb the class. Some class activities may benefit from students having laptops & mobile devices, such as for referring to online sources, but laptops & mobile devices will never be required to have during class sessions.
- **Re-grade policy:** Students may request a re-grade within one week from the date the graded assignment is returned to students. If requesting a regrade, students should be prepared to make a compelling argument as to why the original grade needs to be reconsidered. *The student should discuss the grade with the TA first before requesting instructor re-grade.* The process for requesting an instructor re-grade is to email the instructor with the request within one week from the date the graded assignment is returned. The instructor and student(s) will then decide on a mutually agreeable time and place to discuss the assignment.
- **Hacking & Criminal Activity:** Assignments for this course will involve topics surrounding cybersecurity of AI & ML systems. No one should engage in criminal activity, cyber hacking, or other illegal/improper methods for the course requirements.

## Statement on Inclusivity

**We must treat every individual with respect.** We are diverse in many ways, and this diversity is fundamental to building and maintaining an equitable and inclusive campus community. Diversity can refer to multiple ways that we identify ourselves, including but not limited to race, color, national origin, language, sex, disability, age, sexual orientation, gender identity, religion, creed, ancestry, belief, veteran status, or genetic information. Each of these diverse identities, along with many others not mentioned here, shape the perspectives our students, faculty, and staff bring to our campus. We, at CMU, will work to promote diversity, equity and inclusion not only because diversity fuels excellence and innovation, but because we want to pursue justice. We acknowledge our imperfections while we also fully commit to the work, inside and outside of our classrooms, of building and sustaining a campus community that increasingly embraces these core values.

Each of us is responsible for creating a safer, more inclusive environment.

Unfortunately, incidents of bias or discrimination do occur, whether intentional or unintentional. They contribute to creating an unwelcoming environment for individuals and groups at the university. Therefore, the university encourages anyone who experiences or observes unfair or hostile treatment on the basis of identity to speak out for justice and support, within the moment of the incident or after the incident has passed. Anyone can share these experiences using the following resources:

- **Center for Student Diversity and Inclusion:** [csdi@andrew.cmu.edu](mailto:csdi@andrew.cmu.edu), (412) 268-2150
- **Report-It online anonymous reporting platform:** [reportit.net](https://reportit.net) username: *tartans* password: *plaid*

All reports will be documented and deliberated to determine if there should be any following actions. Regardless of incident type, the university will use all shared experiences to transform our campus climate to be more equitable and just.

## Student Wellness

As a student, you may experience a range of challenges that can interfere with learning, such as strained relationships, increased anxiety, substance use, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may diminish your academic performance and/or reduce your

ability to participate in daily activities. CMU services are available, and treatment does work. You can learn more about confidential mental health services available on campus at: <http://www.cmu.edu/counseling/>. Support is always available (24/7) from Counseling and Psychological Services: 412-268-2922.

### **Food Insecurity**

If you are worried about affording food or feeling insecure about food, there are resources on campus that can help. Email the CMU Food Pantry Coordinator to schedule an appointment:

Pantry Coordinator

[cmu-pantry@andrew.cmu.edu](mailto:cmu-pantry@andrew.cmu.edu)

412-268-8704 (SLICE office)

### **Accommodations for Students with Disabilities**

If you have a disability and have an accommodations letter from the Disability Resources office, I encourage you to discuss your accommodations and needs with me as early in the semester as possible. I will work with you to ensure that accommodations are provided as appropriate. If you suspect that you may have a disability and would benefit from accommodations but are not yet registered with the Office of Disability Resources, I encourage you to contact them at [access@andrew.cmu.edu](mailto:access@andrew.cmu.edu).

### **Academic Integrity**

Honesty and transparency are important features of good scholarship. On the flip side, plagiarism and cheating are serious academic offenses with serious consequences. If you are discovered engaging in either behavior in this course, you will earn a failing grade on the assignment in question, and further disciplinary action may be taken. For a clear description of what counts as plagiarism, cheating, and/or the use of unauthorized sources, please see the University's Policy on Academic Integrity (revised in April 2013): [http://www.cmu.edu/policies/documents/Academic\\_Integrity.htm](http://www.cmu.edu/policies/documents/Academic_Integrity.htm)

### **Recording of Class Sessions**

For this course, I do not intend to record class sessions. However, circumstances may arise where this policy is changed and all or some class sessions are recorded. If a class session is being recorded, students will be notified as soon as practical, and the recording will be made available to all students. In the event one or more class sessions is recorded, the following policy applies:

Class recordings are for your personal, educational use. Recordings of class sessions are covered under the **Family Educational Rights and Privacy Act (FERPA)** and must *not* be shared with anyone outside your course-section. The purpose of these recordings is so students in this course (and only students in this course) can watch or re-watch past class sessions. Feel free to use the recordings if you would like to review something we discussed in class or if you are temporarily unable to attend class.

### **SASC Resources**

SASC programs to support student learning include the following (program titles link to webpages):

- [Academic Coaching](#) – This program provides holistic, one-on-one peer support and group workshops to help undergraduate and graduate students implement habits for success. Academic Coaching assists students with time management, productive learning and study habits, organization, stress management, and other skills. Request an initial consultation [here](#).
- [Peer Tutoring](#) – Peer Tutoring is offered in two formats for students seeking support related to their coursework. Drop-In tutoring targets our highest demand courses through regularly scheduled open tutoring sessions during the fall and spring semesters. Tutoring by appointment consists of ongoing individualized and small group sessions. You can utilize tutoring to discuss course related content, clarify and ask questions, and work through practice problems. Visit the [webpage](#) to see courses currently being supported by Peer Tutoring.
- [Communication Support](#) – Communication Support offers free one-on-one communication consulting as

well as group workshops to support strong written, oral, and visual communication in texts including IMRaD and thesis-driven essays, data-driven reports, oral presentations, posters and visual design, advanced research, application materials, grant proposals, business and public policy documents, data visualisation, and team projects. Appointments are available to undergraduate and graduate students from any discipline at CMU. Schedule an [appointment](#) (in-person or video), attend a [workshop](#), or consult [handouts or videos](#) to strengthen communication skills.

- [Language and Cross-Cultural Support](#) – This program supports students seeking help with language and cross-cultural skills for academic and professional success through individual and group sessions. Students can get assistance with writing academic emails, learning expectations and strategies for clear academic writing, pronunciation, grammar, fluency, and more. [Make an appointment](#) with a Language Development Specialist to get individualized coaching.

### **Use of Generative AI**

Certain assignments in this course will permit or even encourage the use of generative artificial intelligence (AI) tools, such as ChatGPT. When AI use is permissible, it will be clearly stated in the assignment prompt posted in Canvas. Otherwise, the default is that use of generative AI is disallowed. In assignments where generative AI tools are allowed, their use must be appropriately acknowledged and cited. For instance, if you generated the whole document through ChatGPT and edited it for accuracy, your submitted work would need to include a note such as “I generated this work through Chat GPT and edited the content for accuracy.” Paraphrasing or quoting smaller samples of AI generated content must be appropriately acknowledged and cited, following the guidelines established by [the APA Style Guide](#). It is each student’s responsibility to assess the validity and applicability of any AI output that is submitted. You may not earn full credit if inaccurate or invalid information is found in your work. Deviations from the guidelines above will be considered violations of [CMU’s academic integrity policy](#). Note that expectations for “plagiarism, cheating, and acceptable assistance” on student work may vary across your courses and instructors. Please email me if you have questions regarding what is permissible and not for a particular course or assignment.