ME/MSE 4710 Syllabus

Foundations in Machine Learning for Mechanical Engineers 3 - 0 - 0 - 3

T/Th 2:00-3:15 PM, Fall 2026

Skiles Classroom Building 271

Instructor: Ruoyu Yang ruoyu.yang@me.gatech.edu

Textbook: All course reading materials provided by instructor.

General Information

Catalog Description

Engineers are taught foundational data analytics principles to learn when, why, and how to use or not use machine learning in engineering problems.

Pre-Requisites*

ME2016 Computing Techniques, Math 3670 Statistics & Applications (ME majors), or by instructor approval (non-ME majors).

Course Topics:

1. Documenting data analytics/machine learning workflows and programs.
2. Statistical measures used in data analytics and machine learning.
3. Design of Experiments, Data feature engineering, and Sequential Learning
4. Assessing datasets for amenability to machine learning methods
5. Algorithm selection
6. Data analysis
7. Data visualization

Course Objectives:

Students will be able to:

Objective 1: Evaluate when, why, and how to use or not use machine learning in solving engineering problems.

Objective 2: Perform the programming, statistics, linear algebra, and data processing methodologies needed to use machine learning libraries.

Objective 3: Understand and identify pitfalls of machine learning as applied to model engineering datasets.

Objective 4: Evaluate the performance of machine learning models using uncertainty quantification metrics.

Objective 5: Know common types of machine learning algorithms and their utility (or lack thereof) in engineering applications.

Course Outcomes:

- Instill proficiency in documenting and programming data analysis workflows.
- Calculate statistical measures used in modern data analytics and machine learning.
- Understand how and why to use machine learning in aiding design of experiments.
- Assess datasets to determine if statistics-based modeling is appropriate (i.e., test Similarity and Relational Hypotheses).
- Select the best data informatics algorithms to evaluate.
- Extract actionable information from that data through the evaluation and application of appropriate models.
- Effectively communicate to others the impact of these models and how these models guide and optimize an engineering process.

Course Requirements & Grading

Homework Assignments: 35%
In Class Problems: 25%
Exams: 40% (2 exams, 20% each)

- **Grading Scale**
- Your final grade will be assigned as a letter grade according to the following scale:
- A 90-100%
- B 80.00 - 89.99%
- C 70.00 - 79.99%
- D 60.00 - 69.99%
- F 0-59.99%

Homework submissions will be accepted out to 5 days late but marked down 10% for every 24 hrs late.

Course Website and Management Tools

Canvas will be used for distributing and submitting course materials and assignments.

Lecture Format & Course Notes

A "semi-flipped" classroom approach will be used for most lectures. Lectures will start with a short quiz & discussion of the pre-reading assignment, and then a combination of lecture notes, interactive examples, and in-class problems/discussions will be used to introduce and review the course concepts. A combination of white board, Powerpoint, and Jupyter notebook notes will be given.

Course Readings and In Class Problems

Pre-readings required for each class will be posted to Canvas the week before the readings need to be completed. The In-Class Problems will require familiarity with the pre-readings that have been assigned for that day/week. They may be individual or group problems. At the end of the semester, the lowest in-class grade will be dropped for each student. Additionally, in class assignments given on days when the student had an official excused absence will also be dropped. In-class problems will be graded as:

0: absent, or attempt at problem demonstrated that the student was completely unprepared

1: attempt at problem demonstrated that the student tried but struggled (not well prepared)

2: attempt at problem demonstrated that the student was well prepared and understood the concept

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech's Academic Honor Code, please visit http://www.catalog.gatech.edu/policies/honor-code/ or http://www.catalog.gatech.edu/rules/18/.

Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodations, contact the Office of Disability Services at (404)894-2563 or http://disabilityservices.gatech.edu/, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodation letter. Please also e-mail faculty as soon as possible to set up a time to discuss your learning needs.

Absence from Class

Class attendance is not required but **is strongly recommended**. 20% of your grade will be based upon completing in class assignments and quizzes. In the case of medical illness or family emergencies, please work with the Office of VP for Student Life (Dean of Students) with documentation that supports your situation. If the illness or family emergency is deemed serious enough, the Dean's office will then contact me and your other instructors with recommendations on how to proceed. Students who are absent because of participation of a known scheduled conflict such as conference travel or a religious observance will be permitted to schedule alternate arrangements for completing/submitting assignments, provided the student informs me of the absence in email **at least two weeks in advance of the absence**.

Collaboration, Group Work, and use of Generative AI

Assignments will be submitted individually for this course, but students are encouraged to have active study groups and to collaborate on finding solutions to the homework problems. Students are strongly encouraged to interact with each other, the instructor, and the grader to find solutions to problems, answers to questions, etc. Students may use generative AI tools to assist them with homework tasks such as making graphics, checking codes, etc. Still, it is expected that each student learns the material that is being covered in each homework. Exams will be open book and open note, but AI tools will not be permitted on exams.

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. See http://www.catalog.gatech.edu/rules/22/ for an articulation of some basic expectation that you can have of faculty and that faculty have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, we encourage you to remain committed to the ideals of Georgia Tech while in this class.

Campus Resources for Students

Undergraduate Student Academic Success Resources: A list of resources for undergraduate students' academic success and information about advising can be found at Success at Tech.

- Academic Support: Academic Success and Advising (a unit in the Office of Undergraduate Education & Student Success) provides free support for your courses. Students can attend scheduled supplemental review (PLUS) sessions, stop by Drop-In Tutoring, or schedule a one-on-one appointment through Knack. To explore what options work best for you, please visit us online at success.gatech.edu/tutoring, email us at tutoring@gatech.edu, or come see us at Clough Undergraduate Learning Commons, Suite 283.

Graduate Student Academic and Professional Success Resources: A list of resources for graduate students is given on the Office of Graduate and Postdoctoral Education website. Specific information for current graduate students includes

- Academic Resources such as the Communications Center, Language Institute, Library, Catalog, Registrar, resources for conducting research, Advocacy and Conflict Resolution resources, and how to manage unexpected situations that may impact your academic performance;
- Student Resources such as Campus Services, Child Care/Family programs, Health & Wellness, Career Services, and the Student Resource Guide; and
- Professional Development such as the programming from the Career Center and other professional development resources and events"]

Mental Health & Wellness: As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, depression, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. GT offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know is experiencing any of the issues noted above, consider utilizing the confidential mental health services available on campus. I encourage you to reach out to GT CARE (www.care.gatech.edu, 404-894-3498) or the Counseling Center (www.counseling.gatech.edu, 404-894-2575) for support. An on-campus counselor or after-hours services are available to assist you.