AE4803 - AIM Syllabus

AI & Machine Learning for Aerospace Engineers, AIM, 3 credits

CRN: 94633

Fall 2026

Instructor Information

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General Course Information

Description

This course will cover a range of topics to prepare students for data-driven engineering problems in the age of Artificial Intelligence. Students will receive a survey of classical scientific machine learning techniques with an initial emphasis on regression, and later Bayesian inference, deep learning, classification, and clustering. The coursework combines hands-on applied programming problems with rigorous theoretical foundation.

Course Learning Outcomes

Upon successful completion of the course, you will be able to...

- Understand the fundamental paradigm of supervised machine learning as a combination of (a) choosing a parameterized model class, and (b) defining an optimization problem to choose the best parameters.
- Explain how the methods covered in class may be understood in terms of this fundamental paradigm.
- Demonstrate basic mathematical relationships to understand optimality, limitations, and implementations of the methods discussed in class.
- Implement, debug, and validate basic versions of the machine learning methods discussed in class by
    - Writing well-structured and correct Python code
    - Assessing the performance of specific machine learning methods using metrics discussed in class

    - Applying relevant model validation strategies
    - Demonstrate an understanding of the limitations of the various methods discussed in class
- Read, write, and orally communicate precise descriptions of machine learning algorithms, self-run experiments, and results. This includes research papers, prose, and mathematical derivations.

Required Course Materials

No textbooks/additional materials are required for this course. Students will be required to install Python version 3.11 or higher on their laptops. Useful/supplementary information will be announced on Canvas as needed.

Grading Policy:

Final grades will be a weighted average of three different components of the course: Homework, Exams, and a Project. There will be 4-5 homework assignments, a midterm exam, a final exam, and one group project. The lowest homework assignment grade will be dropped at the end of the semester to account for any unforeseen challenges a student may encounter. Each assignment will have a maximum point total and will be graded as the proportion of earned points to maximum achievable points unless specified otherwise.

Assignments

- **Homework (35%):** There will be 4-5 homework assignments, the lowest score of which will be dropped.
- **Project (15%):** Students will complete one open-ended project individually. This project will involve choosing a machine learning problem (with data) on their own, and applying the methods learned in class on this problem.
- **Midterm (25%):** exam covering roughly the first half of the semester's content
- **Final (25%):** cumulative final exam covering topics drawn from all five homework assignments.

Description of Graded Components

Homeworks: these will be a mix of theoretical and programmatic problem-solving exercises. Students will have a minimum of two weeks to complete each of the five total homework assignments and all materials required will be announced in advance. These will generally involve a mix of mathematical reasoning and programming problems in a python Jupyter Notebook. NOTE: I will **not** run your code; the submitted notebook must have all necessary outputs/plots displayed. We will also frequently ask more open-ended

questions to encourage critical thinking. Full credit is given for correct solutions and demonstrated written understanding of the concepts discussed. Homework will be submitted on Canvas. Students may be asked to submit parts of their assignments in LaTeX.

Project: the project will be an individual open-ended assignment, in which the students identify an engineering/scientific problem of interest, obtain a data set, and apply at least one of the methods used in class to learn a quantity of interest. This project needs to consist of four general components: data preprocessing, model training, model validation, and visualization of results. These four components will be summarized in a short writeup. Credit will be given for completeness of the four components, as well as the quality of the writeup, according to a rubric which will be posted on Canvas when the project is assigned. The project will be submitted on Canvas.

Exams: the midterm and final will be a set of problem-solving review questions based on past assignments. These will be written and generally closed book. Any relevant formulas/equations will be provided. The exams will be a natural extension of the concepts discussed on the homework.

Grading Scale

- A 90.00-100%
- B 80.00-89.99%
- C 70.00-79.99%
- D 60.00-69.99%
- F 00.00-59.99%

At Georgia Tech, final course grades are awarded on a scale of A-F with no +/- grades permitted.

Course Policies

Attendance and/or Participation

Attendance will not be checked, nor enforced. To encourage in-person participation, lectures will not be recorded, however the in-class notes will be uploaded to Canvas after class. I should remark that it will be **very difficult** to get an A without attending class, as this is when the main learning for the course is intended to happen. When attending class, **please be on time**; late students entering class during instruction is a disruption to both the instructor and on-time students. If a student must miss class time, it is up to them to

read the online notes and/or attend the instructor's office hours to learn the missed material.

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. Review Georgia Tech's Honor Code and the student Code of Conduct.

Any student suspected of cheating or plagiarism 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 accommodation, contact the Office of Disability Services (404-894-2563) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

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. The Student-Faculty Expectations articulate some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

Pre- &/or Co-Requisites

Students taking this course should have taken college-level Linear Algebra, Multivariable Calculus, and at least one course in Statistics. This course is typically taken by third- or fourth-year students.

Extra Credit Opportunities

Opportunities will be limited and announced in class.

Collaboration, Group Work, and Use of Generative AI

Introductory Python programming and machine learning assignments are completed readily by Generative AI tools. As a general suggestion, it is in the student's best interest not to use these tools on homework and project assignments. However, the use of generative AI on homework and project assignments will not be enforced in this class.

These exams will be a natural extension of the homework assignments, and if students demonstrate an understanding of the homework, they should earn high scores on the exams.

Extensions, Late Assignments, & Re-Scheduled/Missed Exams

For homeworks and the project, these will be due at 11:59pm on Thursday nights. However, students may turn in these assignments without late penalty until Sunday nights at 11:59pm. After this grace period, late work may not be accepted. If a student is unable to attend an exam due to illness or approved institute activity, students will have an opportunity to reschedule the exam according to the instructor's availability. If the student does not have a valid excuse for missing an exam, the exam will result in a failing grade.

Inclement Weather and Digital Learning Days

In the event of inclement weather or other university disruption, the course temporarily may pivot to remote instruction via Zoom to stay on schedule.

Student Use of Mobile Devices in the Classroom

Mobile devices are a distraction to the learning environment of others. They should be kept silent and away during class time.

Additional Course Policies

If there are any grading errors in any assignments, I will be happy to meet to discuss and correct them.

Campus Resources for Students

Undergraduate Student Academic Success Resources:

- 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.

Student Well-Being:

At Georgia Tech, we are concerned about your overall physical, social, and mental well-being. A comprehensive list of wellness related resources has been compiled and

maintained by the Office of the Vice President for Student Engagement and Well-being (student-resource-guide (gatech.edu))