

SI470: Machine Learning and Data Science

Course Policy, Fall AY24

Coordinator: Prof. Gavin Taylor, HP455, x3-6816, taylor@usna.edu

Course Description: Machine Learning is the study of mathematically making autonomous conclusions about new data given insight from previously-seen data. This course will cover a broad scope of machine learning and data science problems, including supervised learning, unsupervised learning, and reinforcement learning. Techniques will include parametric approaches, kernelized methods, and neural networks. Students will also be exposed to an introduction to learning theory and the mathematical underpinnings of modern machine learning.

Credits: 2-2-3

Pre-requisites: SI420

Student Outcomes:

Graduates of the program will have an ability to:

1. Analysis. Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.
2. Implementation. Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.
3. Communication. Communicate effectively in a variety of professional contexts.
4. Ethics. Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
5. Teamwork. Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.

CS-6. Theory. Apply computer science theory and software development fundamentals to produce computing-based solutions.

IT-6. Requirements. Identify and analyze user needs and to take them into account in the selection, creation, integration, evaluation, and administration of computing based systems.

Textbook(s): Abu-Mostafa, Magdon-Ismail, and Lin. Learning From Data.

Other online books will be used, and are linked to on the resources page on the course website.

Syllabus:

- Data manipulation
- Linear Algebra and Data Matrices
- Unsupervised Learning
- Recommendation Systems
- Learning Theory

- Linear Supervised Models
- Nonlinear Supervised Models
- Neural Networks/Convolutional Networks
- Reinforcement Learning
- Ethics

Extra Instruction: Extra instruction (EI) is strongly encouraged and should be scheduled by email with the instructor. EI is not a substitute lecture; students should come prepared with specific questions or problems.

Grading Policy and Collaboration: The guidance in the Honor Concept of the Brigade of Midshipmen and the Computer Science Department Honor Policy must be followed at all times. See www.usna.edu/CS/resources/honor.php. Specific instructions for this course:

- **Assignments:** There will be many assignments. These will be worked on in groups of 2 or 3, and will end with a group report. You may use any source for help, and discuss them with anybody, but **all submitted work must be yours**, and all help must be documented. Using **free** generative AI tools like ChatGPT is fully allowed, though you are responsible for your work being correct in content and nuance. Every assignment must begin with a Generative AI Citation, explaining what content was created by generative AI, and what specific tools were used to produce it.
- **Exams:** There will be one midterm and a comprehensive final. Should a make-up exam be needed, inform the instructor at least one week in advance.
- **Participation:** The class is designed as a project-heavy, collaborative experience. Participation is graded so that I can properly reward those who are on board with this. After each assignment, each partner will be polled about their partners' effort and contribution; the answers will inform that person's participation grade each marking period.

Classroom Conduct: The section leader will record attendance and bring the class to attention at the beginning and end of each class. If the instructor is late more than 5 minutes, the section leader will keep the class in place and report to the Computer Science department office. If the instructor is absent, the section leader will direct the class. Drinks are permitted, but they must be in reclosable containers. Food, alcohol, smoking, smokeless tobacco products, and electronic cigarettes are all prohibited. Cell phones must be silent during class. All discussions will be civil, and both faculty and midshipmen will be treated with dignity and respect at all times.

Late Policy: Nothing will be accepted late without a good reason.

Grading: Student performance will be translated to the following letter grades: A, A-, B+, B, B-, C+, C, C-, D+, D, F. The breakdown of the final course grade will be:

- **25% Final Exam** - the final exam will be cumulative.
- **20% Mid-term Exam** - The mid-term is written. There may be a component requiring a computer.
- **45% Programming Projects** - Detailed instructions for the electronic submission will accompany each project. Much of our classtime will be dedicated to these projects, but they are not intended to be completely finished in class. You should expect these to take some time.

- **10% Homework and Participation** - The percentage of this which is homework will be determined based on the amount of homework I feel I have to give. More homework, higher percentage.

Submitted: Professor Gavin Taylor