Information Sciences and Technology Department

AIT 736: Applied Machine Learning

Course Syllabus

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For each section, a customized syllabus with information specific to that section will be made available to registered students via the Blackboard Learning System.

Description and Learning Objectives

Machine learning as a field is now incredibly pervasive with several applications such as homeland security, face recognition, self-driving car, social media, bioinformatics, etc. This course provides a broad introduction to machine learning and statistical pattern recognition. It introduces interdisciplinary machine learning techniques such as statistics, linear algebra, optimization, and computer science to create automated systems able to make predictions or decisions without human intervention.

This course will familiarize students with a broad cross-section of models and algorithms for machine learning, and prepare students for research or industry application of machine learning techniques. The course also provides students with opportunities to gain **hands-on experience** with several machine learning tools. Topics include: (1) learning theory (e.g., bias/variance trade-off); (2) supervised learning (generative/discriminative learning, parametric/nonparametric learning, neural networks, and support vector machines); (3) unsupervised learning (clustering, dimensionality reduction, kernel methods); and (4) reinforcement learning.

The course will also discuss applications of machine learning in **various fields**, such as social media, security, self-driving cars, bioinformatics, medical imaging, finance, humanities, etc.

Prerequisites

Basic knowledge about probability theory, statistics, linear algebra and programming.

Course Learning Activities and Grade Distribution

This course includes homework, labs, programming assignments, a term project, and online discussion. Some assignments and term project need to be done in teams. There may be **no penalty** for **late submission** of **assignments** before the date as shown in the class schedule on Blackboard.

Your grade will be based on the following breakdown*:

Item	Quantity	Percent of Grade	Extra Credit
Discussion Boards	5	5%	No
Labs	6	30%	Yes
Homework Assignments	6	20%	No
** Programming Assignments	3	25%	Yes
** Term Project	1	20%	No
TOTAL	**100**% + extra credit		

** Subject to revision before and throughout the course.*
*** Teamwork (up to 4)*

Textbook and Required Materials

For this course, we will be using one required textbook.

- **Required Textbook**
  - Christopher Bishop, "Pattern Recognition and Machine Learning". *(Required).* *PDF download*
  - T. Mitchell, "Machine Learning", McGraw-Hill. (Recommended)
  - Max Kuhn and Kjell Johnson, "Applied Predictive Modeling", Springer. (Recommended)
  - Duda and Hart, "Pattern Classification", Wiley. (Recommended).
- **Other Resources**
  - Python tutorial: https://docs.python.org/3/tutorial/
  - Data: http://archive.ics.uci.edu/ml/index.php

Course Duration

Dates: GMU Academic Calendar: https://registrar.gmu.edu/calendars/
Total Duration: **16 weeks**

Tentative Course Outline

See the class schedule on Blackboard for a detailed list of topics that will be covered in this course. There will be readings assigned from the books and from external sources. Readings will be announced in advance and will need to be completed before the corresponding class meeting.

A detailed schedule for classes, topics, and assignment due dates will be published on Blackboard. As many factors may affect the development and progress of a class, the instructor reserves the right to alter the schedule as may be required to assure attainment of course objectives. The schedule is subject to revision before and throughout the course.

Registered students should see the Blackboard Learning System for the latest class schedule.

Class Participation

This course is designed for mixed "***synchronous***" and "***asynchronous***" delivery (https://masononline.gmu.edu/course-delivery-methods):

- ***Synchronous***: Classes are held on a set schedule, and students virtually attend an instructor-led session on a regular basis.
- ***Asynchronous***: Students can study at their own pace, accessing instructional materials online in Blackboard at any time, though a set schedule with due dates is still there.

For this course, there are *important* **regular online meetings** (***"Synchronous" mode***) as scheduled on **Blackboard Collaborate Ultra**. All students are required to virtually attend the instructor-led sessions on a regular basis but there is NO non-participation penalty.

All assignments, assessments, class announcements, schedules, files and presentations will use Blackboard.

Additionally, students need to contribute actively and participate in **online discussions** on Blackboard for grading.

Communication, Writing and Submissions

Communication: Course announcements will be made through Blackboard.

Writing: All discussions, and assignments for this course must be in standard English. Do not use slang or texting abbreviations (i.e., lol). Capitalize and use complete sentences in your discussion responses and in your paper. You can use bulleted lists if they make sense as a way to convey the information. Emoticons are acceptable as long as they are not overused and help with communication.

Before submitting work, be sure to proof read your writing and make sure that any references that you include are correct.

Submission of Work: All work for this class must be submitted as the assignment states.

ASA Style Guide: ASA Style Guides are easy to locate using an internet search. The following link is one that should work well for this class, you can access it by clicking here : http://personal.monm.edu/jkessler/ASA-Style.htm.

Academic Honesty

An important component in learning is taking on tasks, assignments and exams in an honest effort to do your best possible work. You are expected to turn in and do **original** work.

Grading Guidelines and Grade Scale

Grading Guidelines

Some grade components are evaluated subjectively

A: consistently above and beyond the course/assignment requirements

B: meets and occasionally exceeds the course/assignment requirements

C: minimally meets the course/assignment requirements
F: fails to meet the course/assignment requirements

Grades will be awarded in accordance with the Mason Grading System for graduate students. See the university catalog for policies: http://catalog.gmu.edu for more information.

Grading Scale

- The grading scale for this course, is:

97 – above	A+	Passing
93 – 96%	A	Passing
90 – 92%	A-	Passing
87 – 89%	B+	Passing
83 – 86%	B	Passing
77 – 82%	B-	Passing
70 – 76%	C	Passing
0 – 69%	F	Failing

NOTE: Study success takes constant effort!
Instructor will double check all students' coursework graded by GTA at the end of the course.
Raw scores may be adjusted by the Instructor to calculate final grades.

Students are responsible for checking the currency of their grade books. Grade discrepancies must be brought to instructor's attention within one week of assignment submission and 48 hours of exam submission.

No make-up for any activity, unless arranged in advance. Only in special cases, such as medical problems and family emergency, make-ups and late assignments may be allowed with verifiable proof.

Final grades will be posted to PatriotWeb, which is the only vehicle for students to obtain those grades. A student with a "hold" on his/her PatriotWeb account will be unable to access final grades until the hold has been removed by the Registrar.

Etiquette and Disabilities

Please observe proper "etiquette" and "netiquette" – courteous and appropriate forms of communication and interaction – within this course. This means no personal attacks, obscene language, or intolerant expression. All viewpoints should be respected.

Giving Feedback: This course is designed along the principles of synergy and collaborative learning. Therefore, it is important that all students understand how to provide quality feedback to their peers. Here are a few tips for providing, positive, constructive, and useful feedback to peers.

- Be empathetic and remember that this environment is a safe place for making mistakes
- Use nonjudgmental language and phrases that do not attack an individual. One way of doing this is to ask the individual to discuss his/her process for making the final decision.

- Use specific questions, examples, and references as a way of making your point.
- Make your feedback useful by providing suggestions that the individual can understand and use to improve her/his work.

Disabilities: Please message me if you have a disability so we can discuss ways to help you succeed in the course. If you need accommodations that would affect the terms of this syllabus, you will need to provide documentation of your disability.

Using Generative-AI Models*

ChatGPT or other Generative-AI models **may be used** in this course ONLY as an **assistant** in projects and homework assignments. Any use must follow the fundamental principles of the Honor Code and include the following statement with assignment submission: **The ideas in this submission are original and were generated by (*my name*). ChatGPT (*or name other Generative-AI model*) was used as an editorial/coding assistant, however, I take full responsibility for the originality and accuracy of the content.**

Risk accompanies use of any powerful tool. Students are cautioned that sharing their own original ideas with Generative-AI models can lead to loss of control and ownership of those ideas and coding. Furthermore, in terms of learning in this class, students who replace their own learning and project work with materials prepared by Generative-AI models:

- Surrender control over the material's truthfulness and accuracy, and violate the university's Honor Code.
- Sacrifice the opportunity to acquire the knowledge, skills, and critical thinking taught in the course.
- Risk being unable to perform to expectations when Generative-AI models are unavailable, such as in exams.
- Ultimately endanger their employability if they are unable to produce work other than that produced by Generative-AI models.

** D. J. Goodings, J. Nelson, and I. Rytikova. "Stating guidelines for using ChatGPT and other Generative-AI models in F2023 CEC course syllabi".*