**STAT 4500 Section [001]**

**Statistical Machine Learning**

**Spring 2024 CRN: [21449]**

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Class Schedule: [MW] [8:00-9:15] (75 minutes, period 1)

Class Room: GH 115 Goodwyn Hall

Instructor: Yi Wang

## **Office**: Goodwyn 213D

**Phone:** 334 244 3318

**E-mail**: ywang2@aum.edu

**Office Hours**: M/T 4:00pm-5:00pm or by appointment

**Important Dates:**

[Jan 15-16] Labor Day (or MLK) holiday & student holiday!

[TBD], [8:00-9:15] Midterm Exam I

[March 25] Last day to drop/resign classes with a ‘W’

[TBD], [time span] Midterm Exam II

[March 11-15] Thanksgiving holiday (or Spring break)!

[April 10-24] Curtiss on-line Course evaluations

[TBD] Deadline for the project report and presentation

[Monday] [04] [29], [8:00-10:30] Final Exam

**Textbook and Codes:** The following textbook is required.

G. James, D. Witten, T. Hastie, R. Tibshirani, J Taylor. *An introduction to Statistical Learning with Applications in Python*. Springer, 2023.

The book is free to download at [An Introduction to Statistical Learning (statlearning.com)](https://www.statlearning.com/).

You should clone the code repository at [GitHub - intro-stat-learning/ISLP\_labs at stable](https://github.com/intro-stat-learning/ISLP_labs/tree/stable), and have Python computing environments set up on your computer.

Some lecture notes are posted at <https://ywanglab.github.io/stat4500/>.

**Prerequisites:**  STAT 3000 or STAT 1010. Students are expected to be familiar with basic levels of Python or R programming.

**Learning Objectives:**

1. learn the statistical foundation of various machine learning algorithms
2. learn the Python implementation of various machine-learning algorithms

**Learning Outcomes:** At the end of the semester, students will be trained to

* understand solidly statistical and mathematical concepts of machine learning
* build common machine learning algorithms including neural networks
* apply techniques such as regularization to overcome over-fitting
* Make reproducible data science reports using markdown documents

**To reach the learning outcomes, students are advised to**

1. **Pre-read each chapter before coming to each lecture**
2. **Review lecture notes after the lecture**
3. **Complete each ungraded lab solidly**
4. **Complete homework Assignments.**

**Catalog Description:** Introduces supervised and unsupervised machine learning, popular machine learning algorithms, principal component analysis, recommendation system and regularization. Topics also include overtraining and techniques to avoid it such as cross-validation.

**Outline of Topics**:

1. Machine Learning Basics
2. Linear Regression
3. Classification
4. Resampling Methods
5. Model Selection and Regularization
6. Moving beyond Linearity
7. Tree-based methods
8. Support Vector Machines
9. Deep Learning
10. Survival Analysis and Censored Data
11. Unsupervised Learning
12. Multiple Testing

**Methods of Instruction:** The format of class meetings will consist of lectures and in-class discussions. Student participation is highly encouraged.

**Programming language**: Python programming package (Free open source)

**Grading Policy**:

|  |  |
| --- | --- |
| Homework, in-class Quizzes, Projects  | 75 % |
| Final | 25% |
| Total | 100% |

 No grade or performance will be discussed over the telephone or via email. You must do so in person.

|  |  |
| --- | --- |
| [90%,100%] and 90% on Final | A |
| [86%,90%) and 86% on Final | B+ |
| [79%, 86%) and 79% on Final | B |
| [75%, 79%) | C+ |
| [65%, 75%) | C |
| [60%, 65%) | D+ |
| [55%, 60%) | D |
| [0%, 55%) | F |
| Missing an exam OR 4 or more absences | FA |

 **No other factors such as needing the course for graduation will be considered.**

**Make-up policy**: If you have a **written official excuse**, subject to my approval, you may make up a missing test or replace it with the final at my discretion.Assignments must be turned in at the designated period. There will be no late submissions. No make-up of any missing quizzes. Requests for makeup for an exam are ONLY allowed for the reasons outlined in the AUM Attendance Policy and must be justified with an official written excuse:

1. official university events **with excuses provided in advance** by the head of the University unit involved (e.g., for intercollegiate athletic matches, required academic events/academic travel)
2. student illness/medical emergency or medical emergency for a member of the student’s immediate family
3. death of a member of the student’s immediate family
4. military orders (**notification should occur prior to the absence**)
5. jury duty or court subpoena (**notification should occur prior to the absence**)
6. religious holiday (**notification should occur prior to the absence**)
7. weather emergencies or perilous driving conditions (with notification if feasible)

 The student should initiate the makeup exam by contacting their instructor, preferably in advance of the absence. Your instructor will then verify the written excuse and set up the makeup exam date/time.

**Midterm Grade:** Your midterm grade will consist of the weighted average of quizzes, projects and exams graded to date using the previously designated weights. *This grade is only meant to be an estimate of current progress in the class and can be quite different than your final course grade.*

**Blackboard**: Students may seek technology assistance from the ITS Help Desk located in the computer lab on the first floor of the Taylor Center. You may also call 334-244-3500 or email helpdesk@aum.edu.

**Attendance**: Class attendance is mandatory. Attendance will be checked. Please bring copies of any documentation you may have regarding your absences like doctor’s notes, court summons, obituaries funeral programs, etc. A student is considered to be absent if he/she comes in late or leaves early. **Students are responsible for catching up with material they may miss due to absences of any sort**. A grade of FA will be issued for students with 6 or more absences OR students who fail to take the final exam.

**Classroom Behavior**: Patterns of disruptive behavior that obstruct or disrupt the teaching/learning process will not be tolerated. I would appreciate it if mobile phones or pagers were turned off or switched to vibration mode during class meetings. **During tests and the final exam, all cell phones must be ringed off/turned off.**

Please be courteous to your fellow students and the instructor at all times. For example, do not converse with other students, read the newspaper, or sleep during the lecture.

Children should not be brought to class, except in emergency circumstances and only with the permission of the instructor.

Food, drinks, or gum should not be brought into the classroom.

AUM prohibits smoking in campus buildings. If you smoke, you may only do so outside the buildings.

**Electronic Devices**: Cell phones, computers, tablets, and other electronic devices (except approved calculators) should be powered off, set to emit no audible sound, and put away during class. \*\*\*Use of cell phones for any purpose during class is in violation of class policy\*\*\* If you have to answer a cell phone call during class, please quietly leave the classroom and move to a location where your conversation does not disrupt any class in progress.

**Academic Integrity**: Anyone involved in plagiarism/cheating, of any kind, will be given a zero for that assignment, quiz, mid-term, or final exam. **All instances of academic dishonesty will be reported to administrator(s)**. You can discuss your assignments with your classmates but cannot copy (totally or partially) someone else's work or allow someone to copy your solution. Students are expected to maintain academic integrity in all work in this course. See the *AUM Graduate Catalog* for details. Procedures for violations are outlined in the *AUMANAC.* Cheating of any form is not tolerated and violators will be punished on a case-by-case basis.

**Disability Accommodations**: Students who need accommodations are asked to arrange a meeting during office hours to discuss their accommodations. If you have a conflict with my office hours, an alternate time can be arranged. To set up this meeting, please contact me by e-mail. If you have not registered for accommodation services through the Center for Disability Services (CDS), but need accommodations, make an appointment with CDS, 147 Taylor Center, or call 334-244-3631 or e-mail CDS at cds@aum.edu.

**Free Academic Support**: All students have the opportunity to receive free academic support at AUM. Visit the Learning Center (LC) in the WASC on the second floor Library or the Instructional Support Lab (ISL) in 203 Goodwyn Hall. The LC.ISL offers writing consulting as well as tutoring in almost every class through graduate school. The LC may be reached at 244-3470 (call or walk in for a session), and the ISL may be reached at 244-3265. ISL tutoring is first-come-first-served. Current operating hours can be found at [www.aum.edu/learningcenter](http://www.aum.edu/learningcenter).

**Course Evaluation Date**: [April 10-24]. Students can complete course evaluations online using their mobile devices, tablets, laptops, or another appropriate device during the scheduled Course Evaluation Period.

**Tentative Schedule (subject to change)**

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| --- | --- |
| Topics | Number of Weeks |
| Chapter 1 and Lab | 1 |
| Chapter 2 and Lab | 1 |
| Chapter 3 and Lab | 1 |
| Chapter 4 and Lab | 1 |
| Chapter 5 and Lab | 1 |
| Chapter 6 and Lab | 1 |
| Chapter 7 and Lab | 1 |
| Chapter 8 and Lab | 1 |
| Chapter 9 and Lab | 1 |
| Chapter 10 and Lab | 1 |
| Chapter 11 and Lab | 1 |
| Chapter 12 and Lab | 1 |
| Chapter 13 and Lab | 1 |