

Honors Seminar in Machine Learning

Math 3094, Spring Semester 2022 University of Connecticut

Instructors

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Introduction

The interdisciplinary field known as Machine Learning or Data Science draws together techniques from computer science, mathematics, and statistics to extract meaning from data. In this course, we will discuss some of the essential mathematical ideas in this field.

While our focus will be on the role of Calculus, Probability, and Linear Algebra, we will introduce computational techniques using Python and the Jupyter notebook environment, and some ideas from statistics, in order to closely link theory and practice.

Schedule

The course will meet synchronously online on Tuesdays and Thursdays from 11:00 to 12:15 EST.

Topics

Topics will include Linear Regression, Gradient Descent, Logistic Regression, Principal Component Analysis, and others as time permits. The course will include both (online) lectures and lab sessions.

Assessment

Students will be expected to complete two projects, one due at midterm time and one by the final. The final project may be a continuation/extension of the midterm project. A typical project will be an example data analysis written up using the Jupyter notebook. Projects may be done individually or in groups of up to three people.

Resources

We will use the Campus Wire platform for online help and discussions. Students enrolled in the course should receive an electronic invite to the forum. Contact one of the professors if you need access.

We will rely on the Python programming language, the Anaconda open source data science platform, and the Jupyter notebook environment for our computer

work. All of this software can be obtained for Linux, Mac, or Windows from the Anaconda website: www.anaconda.com.

A very brief guide to installing the software is available [here](#).

There is no official textbook for the course. We will be providing notes as we progress. The following texts may be useful as references.

- James, Witten, Hastie, Tibshirani. An Introduction to Statistical Learning (with Applications in R). This is an introductory text on machine learning with a more statistical emphasis than our course, and with computer examples in R instead of Python. It is an excellent and informative work, and it is available for free from the book home page.
- Bass, Alonso-Ruiz, Baudoin, et. al. UConn's Open Undergraduate Probability Text. This is the (open source) textbook for UConn's undergraduate probability course, Math 3160.
- Boyd, S. and Vandenberghe, L. Introduction to Applied Linear Algebra. This is a (free) introductory text on Linear Algebra with a focus on applications, especially to Least Squares.
- Treil, S. Linear Algebra Done Wrong. This is a more theoretical linear algebra text that treats important topics such as inner product spaces.
- Bishop, C. Pattern Recognition and Machine Learning This is a (free) comprehensive look at machine learning; it claims to be aimed at "advanced undergraduates or first year PhD students" but is technically demanding.

Policy Statements

Academic Integrity

Students are bound by the university's policies on academic integrity.

Students with disabilities

Students with disabilities should contact one of the instructors as soon as possible to discuss any accommodations needed during the semester due to a documented disability. If you have a documented disability for which you wish to request academic accommodations and have not contacted the Center for Students with Disabilities, please do so as soon as possible. The CSD is located in Wilbur Cross, Room 204 and can be reached at (860) 486-2020 or at csd@uconn.edu. Detailed information regarding the process to request accommodations is available on the CSD website at www.csd.uconn.edu.

Policy Against Discrimination, Harassment and Inappropriate Romantic Relationships

The University is committed to maintaining an environment free of discrimination or discriminatory harassment directed toward any person or group within its community – students, employees, or visitors. Academic and professional excellence can flourish only when each member of our community is assured an atmosphere of mutual respect. All members of the University community are responsible for the maintenance of an academic and work environment in which people are free to learn and work without fear of discrimination or discriminatory harassment. In addition, inappropriate Romantic relationships can undermine the University's mission when those in positions of authority abuse or appear to abuse their authority. To that end, and in accordance with federal and state law, the University prohibits discrimination and discriminatory harassment, as well as inappropriate Romantic relationships, and such behavior will be met with appropriate disciplinary action, up to and including dismissal from the University. More information is available at <http://policy.uconn.edu/?p=2884>.

Sexual Assault Reporting Policy

To protect the campus community, all non-confidential University employees (including faculty) are required to report assaults they witness or are told about to the Office of Diversity & Equity under the Sexual Assault Response Policy. The University takes all reports with the utmost seriousness. Please be aware that while the information you provide will remain private, it will not be confidential and will be shared with University officials who can help. More information is available at <http://sexualviolence.uconn.edu/>.