Foundations of Machine Learning

EEL 5840

Class Periods: Tuesday 10:40-11:30AM and Thursday 10:40AM-12:35PM

Location: NEB 100

Academic Term: Fall 2020

Instructor:

Alina Zare
azare@ece.ufl.edu; However, please contact through the Canvas for all course-related communication.
Office Hours: Fridays, 1-2pm

Teaching Assistant/ Supervised Teaching Student:

Please contact through the Canvas

- Kang Yang, Office Hours: Mondays, 9:30-10:30am
- Yiming Cui, Office Hours: Tuesdays, 1-2pm
- Weihuang Xu, Office Hours, Wednesdays, 9:30-10:30am
- Xiaolei Guo, Office Hours, Thursdays, 2-3pm

Course Description

Engineering and hardware concepts pertaining to design of intelligent computer systems.

Course Objectives

Understand and utilize the concepts of machine learning for data science and electrical engineering. Focus on tools for multivariate data analysis and how to handle uncertain data with probability models.

Required Textbooks and Software

- Pattern Recognition and Machine Learning
- Christopher Bishop
- Springer 2006
- 978-0387310732
- A laptop with Python 3.4.3 or later, Pytorch and Git installed will be required. Please see: https://www.eng.ufl.edu/students/resources/computer-requirements/

Approximate Course Schedule

Week 1: Overview of machine learning with polynomial curve fitting
Week 2: Polynomial curve fitting, Overfitting and Experimental Design
Week 3: Maximum Likelihood, Maximum A-Posteriori, Regularization and Bayesian Prior Equivalence
Week 4: Probabilistic Generative Models
Week 5: Gaussian Mixture Models
Week 6: Non-parametric approaches: K-means, K-Nearest Neighbors, Fuzzy C-Means, Possibilistic C-Means
Week 7: Curse of Dimensionality
Week 8: Principal Components Analysis / **Mid-term Exam**
Week 9: Multi-dimensional Scaling and ISOMAP
Week 10: Linear Discriminants and the Perceptron
Week 11: Multilayer Perceptrons and Neural Networks
Week 12: Backpropagation
Week 13: Deep Learning
Week 14: Deep Learning and Hidden Markov Models (if time)
Week 15: Exam Review and Project Discussion / **Project Due**
Week 16: **Final Exam**

Online Course Recording
Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

Attendance Policy, Class Expectations, and Make-Up Policy
Assignment Requirements: Requirements for all assignments in this class are listed below. For maximum credit, along with correct, substantial answers, I expect high quality professional looking code and documents. Complete your assignments with care and ensure that your submission illustrates that you understand the concepts the assignment is trying to emphasize.

- For all assignments that require submission of code, turn in clean, easy to read, easy to run, and well commented Python 3.4.3+ code. Points will be taken off if code cannot be run and/or easily understood. For example, do not use one letter variable names, do not include “magic” numbers/parameters in your code that are unexplained, etc.

- Complete all assignments in the format assigned. For example, if a PDF document is requested and a Word DOC is submitted instead, you will lose points.

- Assignments will be assigned (and will need to be submitted) via GitHub or Canvas. In Github, each assignment will have its own subfolder that will be pushed to your homework repositories. You should keep all files associated with an assignment within its subfolder. Be sure to pay attention and follow any required file naming convention for all assignments.

- For full credit, assignments should be turned in on time. Assignments turned in after deadline but within 48 hours of due date and time will receive a 25% grade penalty. Late assignments will not be accepted 48 hours after due date/time.

This class will primarily be taught asynchronously - meaning you do not need to meet at a certain time to successfully complete the course. However, assignments and materials will be covered on a schedule. In order to do well in the course, all assignments must be submitted in a timely manner. The *optional - but strongly encouraged* - synchronous components of the class will be presented online using Zoom and requires access to a working webcam and stable internet connection. During these synchronous sessions, questions about material being covered, homework assignments, projects and midterms will be answered as well as working through some interactive examples. I recommend that you keep your camera on during the class so that I can see you as I would during normal face-to-face classes. Studies show that if we can see each other’s faces then we will have more engagement, more student success, and more faculty success. However, this is not a requirement. I understand if on certain days you can’t have your camera on due to internet bandwidth limitations, other family members, health issues, or any other reasons.

Excused absences must be in compliance with university policies in the Graduate Catalog (http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#attendance) and require appropriate documentation.

Evaluation of Grades

Assignment	Points	Percentage of Final Grade
Homework (5 with one assignment drop)	10 each	40%
Quiz (15 with two drops)	10 each	20%
Midterm Exam	100	10%
Final Exam	100	10%
Project	100	20%
		100%

Grading Policy

Percent	Grade	Grade Points
93.0 - 100.0	A	4.00
90.0 - 92.9	A-	3.67
87.0 – 89.9	B+	3.33
83.0 – 86.9	B	3.00
80.0 - 82.9	B-	2.67
77.0 - 79.9	C+	2.33
73.0 – 76.9	C	2.00
70.0 - 72.9	C-	1.67
67.0 - 69.9	D+	1.33
63.0 - 66.9	D	1.00
60.0 - 62.9	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:
http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades

For full credit, assignments should be turned in on time. Assignments turned in after the deadline but within 24 hours of due date and time will receive a 50% grade penalty. Late assignments will not be accepted 24 hours after due date/time. Each homework assignment will be weighted equally. The lowest homework assignment grade will be dropped. If you feel a graded assignment or exam needs to be re-graded, you must discuss this with the instructor within one week of grades being posted for that assignment/exam. After one week, items will not be considered for re-grading. The class will be graded on a curve.

Any student found to have cheated or plagiarized on an exam or assignment will be given a grade of 0 for that exam or assignment and the evidence will be reported to the Dean of Students for the determination of any additional disciplinary action. Unless an assignment is specifically structured as a group project, duplicate assignments written in collaboration with others are not acceptable. Although it is permissible to discuss the homework with others, these discussions should be of a general nature. All work at a detailed level must be done on your own. Students submitting the same or similar solutions to the homework will be considered as having cheated. No statements or actions made by anyone can alter this policy. Please review what constitutes plagiarism:
https://guides.uflib.ufl.edu/copyright/plagiarism

Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, https://www.dso.ufl.edu/drc) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course Evaluation
Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at https://evaluations.ufl.edu/evals. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at https://evaluations.ufl.edu/results/.

University Honesty Policy
UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment
The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:
- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use
All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy
There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: https://registrar.ufl.edu/ferpa.html

Campus Resources:
Health and Wellness

U Matter, We Care:
Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: http://www.counseling.ufl.edu/cwc, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence
If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/.

Academic Resources

E-learning technical suppor*t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. https://www.crc.ufl.edu/.

Library Support, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.

Writing Studio, 302 Tigert Hall*,* 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

Student Complaints Campus*:* https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

On-Line Students Complaints*:* http://www.distance.ufl.edu/student-complaint-process.