Fundamentals of Machine Learning

EEE 4773 Section 0001
Class Periods: MWF, period 9, 4:05 PM – 4:55 PM
Location: NEB 202
Academic Term: Fall 2019

Instructor: Dr. Catia S. Silva
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- Office Hours: Wednesdays 2 PM – 3 PM or by appointment

Supervised Teaching Student:
- Matthew Cook
- Office: New Engineering Building 401
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- Office Hours: Fridays 1 PM – 2 PM

Course Description
(3 credits) Overview of machine intelligence and the role of machine learning in a variety of real-world problems. Probability and statistics to handle uncertain data. Topics covered include learning models from data in both a supervised and unsupervised fashion, linear models and non-linear models for classification, and linear dimensionality reduction.

Course Pre-Requisites / Co-Requisites
- EEL 3135 or equivalent
- STA 3032 or equivalent

Course Objectives
Upon completion of this course, the student will be able to:
- Identify relevant real-world problems as instances of canonical machine learning problems
- Design and implement effective strategies for data preprocessing
- Explain and utilize concepts of machine learning for data science and electrical engineering
- Compare and contrast evaluation metrics
- Foresee and mitigate human-based liabilities of machine learning algorithms
- General level of competency in critical questioning and analysis
- Students will know how to make connections between different fields of machine learning

The main goal of this course is to equip the students with a machine learning mindset for successful practical implementations, in particular: understand, analyze and design an approach to work with a data science or electrical engineering problem.

Materials and Supply Fees
None

Required Textbooks and Software
- A laptop with Python 3.4.3 or later and Anaconda installed will be required. Please see: computer requirements
- Pattern Recognition and Machine Learning
  - Christopher Bishop
  - Springer, 2006
  - ISBN: 978-0-38731-073-2

- Christopher Bishop Webpage

Recommended Materials

- Patter Recognition
  - Sergios Theodoridis, Konstantinos Koutroumbas
  - Elsevier, 2009, 4th edition
  - ISBN: 978-1-59749-272-0

- Python Machine Learning
  - Sebastian Raschka
  - Packt Publishing, 2016
  - ISBN: 978-1-78355-513-0

Course Schedule

Week 1: Introduction to Machine Learning
Week 2: Regression Overview & Generalization
Week 3: Maximum Likelihood, Maximum A Posteriori & Regularization
Week 4: Gaussian Mixture Models
Week 5: K-means & K-Nearest Neighbors
Week 6: Curse of Dimensionality
Week 7: Principal Component Analysis
Week 8: Manifold Learning: ISOMAP and Locally Linear Embedding / **Midterm Exam**
Week 9: Linear Discriminants and the Perceptron
Week 10: Support Vector Machines
Week 11: Multilayer Perceptrons and Neural Networks
Week 12: Backpropagation
Week 13: Neural Network and Deep Learning training strategies
Week 14: Evaluations Metrics
Week 15: Exam Review and Project Discussion / **Project Due**
Week 16: **Final Exam**

Attendance Policy, Class Expectations, and Make-Up Policy

- Attendance is not required though graded evaluations, such as exercises/quizzes and participation, will happen during class.
- Students are expected to attend class.
- Students are expected to bring a portable computer to class.
- For maximum credit in any assignment, students must submit correct and elaborated answers, submitted on time, follow submission instructions and, for assignments that require code, clean, easy to read, easy to run, and well commented Python 3.4.3+ code are required.
  - Complete your assignments with care and ensure that your submission is complete and illustrates your understanding of the concepts being assessed;
  - Most assignments will be assigned via e-learning.
- Assignments turned in after the deadline but within 24 hours of due date and time will receive 50% grade penalty. Late assignments will not be accepted 24 hours after due date/time.
- 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.
  - If approved, the entire assignment or exam will be subject to complete evaluation.
- 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 sent to the Provost's Office 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 is 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

Excused absences must be consistent with university policies in the undergraduate catalog (https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx) and require appropriate documentation.

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Homework and quizzes	100 each	20%
In-class evaluations	100 each	20%
Midterm Exam	100	20%
Final Exam	100	20%
Project	100	20%
		100%

Grading Policy

The following is given as an example only.

Percent	Grade	Grade Points
93.4 - 100	A	4.00
90.0 - 93.3	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33
73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.7 - 69.9	D+	1.33
63.4 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

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.