Fundamentals of Machine Learning

EEL 5840 Section 0001
Class Periods: T, period 8-9, 3:00 PM – 4:55 PM
R, period 9, 4:05 PM – 4:55 PM
Location: LAR 239
Academic Term: Spring 2020

Instructor: Dr. Catia S. Silva
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- Office Hours: Thursdays 10:40 AM – 11:40 AM, or by appointment

Supervised Teaching Student:
Please contact through the Canvas website
- Ayobami Edun
- Email: aedun@ufl.edu
- Office Hours: Fridays 10:40 AM – 11:40 AM in NEB 589

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

Course Pre-Requisites / Co-Requisites
None

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.

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

Materials and Supply Fees
None

Required Textbooks and Software
- Pattern Recognition and Machine Learning
    - Christopher Bishop
    - Springer, 2006
    - ISBN: 978-0-38731-073-2
    - Christopher Bishop Webpage

- A laptop with Python 3.4.3 or later and Anaconda installed will be required. Please see: computer requirements

Recommended Materials

- Python Data Science Handbook – Essential Tools for Working with Data
  - Jake VanderPlas
  - O'Reilly Media, 2017
  - ISBN: 978-1-491912-05-8
  - https://jakevdp.github.io/PythonDataScienceHandbook/

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

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

Course Schedule
Week 1:   Introduction to Machine Learning problems and methods
Week 2:   Linear Regression & Generalization
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 and K-Nearest Neighbors
Week 7:   Curse of Dimensionality
Week 8:   Principal Components Analysis / **Mid-term Exam**
Week 9:   Manifold Learning; Multidimensional Scaling, ISOMAP and Local Linear Embedding
Week 10: Linear Discriminants and the Perceptron
Week 11: Multilayer Perceptron and Neural Networks
Week 12: Backpropagation
Week 13: Neural Network and Deep Learning training strategies
Week 14: Hidden Markov Models
Week 15: Exam Review and Project Discussion / **Project Due**
Week 16: **Final Exam**

Attendance Policy, Class Expectations, and Make-Up Policy
- While attendance is not graded, lectures will include regular homework help and in-class discussions and in-class lab assignments.
- Students are expected to attend class.
- Students are expected to bring a portable computer to class.
- Excused absences are 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	Percentage of Final Grade
Homework and quizzes	30%
In-class evaluations	10%
Midterm Exam	20%
Final Exam	20%
Project	20%

	100%

- Each homework and in-class assignment will be weighted equally.
- **Late Assignments will not be accepted**.
- 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.
- After one week, items will not be considered for re-grading.
- 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.

Grading Policy

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:
http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades

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 professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-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.

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

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://care.dso.ufl.edu.

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