Intro to Machine Learning

CIS4930

Class Periods: M, W, F (3:00 pm - 3:50 pm)

Location: CSE A101

Academic Term: Spring 2024

Instructor: Aashish Dhawan
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Office Hours: TBA

Teaching Assistant/Peer Mentor/Supervised Teaching Student:

- TBA

Course Description

(3 credits) This course will introduce machine learning concepts with as little mathematics as possible. We will introduce topics like supervised and unsupervised learning, classification, regression, and prediction techniques. Various Algorithms including different regression types, KNN, and K-means clustering will be discussed. You will learn about various issues with machine learning algorithms like overfitting and underfitting. You'll also learn some methods for improving your model's training and performance, such as vectorization, feature scaling, feature engineering, and polynomial regression.

Course Pre-Requisites / Co-Requisites

COP 3503, Python

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 workflow, including key steps and design choices
- Compare and contrast evaluation metrics
- Train Various machine learning models
- Effectively use Python libraries for this, including NumPy, scikit-learn, Tensorflow, Keras, etc

Materials and Supply Fees

None

Required Textbooks and Software :

1. ***Required Software:***
    a. **Python 3.6 or later**
    b. **Anaconda**
    c. **Jupyter Notebook**
    d. **Git**
2. **Recommended Textbooks:**
    a. **Deep Learning by** Ian Goodfellow
    b. **Hands-on machine learning with scikit-learn and tensorflow**: concepts, tools, and techniques to build intelligent systems, by urélien géron, o'reilly media
    c. **Introduction to Machine Learning by** Ethem Alpaydim

Course Schedule

WEEK	TOPIC
1	Introduction, Definition and Concepts • Types of Machine Learning and application
2	• Setting up Anaconda environment (python libraries, scikit-learn) • Application demo – iris dataset/logistic regression and introduction to Jupyter Notebook • Exploring Datasets using pandas
3	• Linear regression – mathematics, cost function • Cost function – objective • Gradient Descent • Linear Regression with multiple features • Feature scaling, feature engineering • Classification -> logistic regression, gradient descent, logistic loss function
4	• Overfitting, underfitting • Regularization • KNN, Naïve Bayes • Evaluation metrics • Unsupervised learning - K means, Anomaly detection.
5	• SVM, decision trees • Dimensionality reduction • Project Overview
6	• Ensemble learning • Random forest, ADAboost, XgBoost
7	• Midterm Review • Midterm exam • Reinforcement learning
8	• Deep learning – introduction and application • Perceptron, MLP • Neural Networks – Forward propagation
9	• Project part 1 due • Backpropagation • Types of gradient descent • Vanishing Gradient descent
10	• Fine tuning neural networks • Dropouts • Activation functions in Neural Networks
11	• Weight initialization techniques – Xavier/glorot • Convolutional Neural Networks- pooling, padding, strides
12	• CNN demos

	• CNN variations – Imagenet, resnet • Transfer learning
13	• GAN and RNN - introductions
14	Presentation week
15	Presentation week, Project Due

Attendance Policy, Class Expectations, and Make-Up Policy

Attendance is not mandatory, but strongly encouraged. Students will be assigned programming assignments which will be handled through the E-learning platform (elearning.ufl.edu). Assignments turned in late will incur a lateness penalty of 15% per day, up to a maximum of 3 days (after which the grade will be 0).

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies. Click here to read the university attendance policies:
https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Assignments (2)	100 each	20%
Presentation	100	10%
Midterm Exam	100	30%
Project (mid)	100	10%
Project (final)	100	20%
Participation		10%
Total		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 who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting https://disability.ufl.edu/students/get-started/. It is

important for students to share their accommodation letter with their instructor and discuss their access needs, 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/.

In-Class Recording
Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

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/process/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 varied perspectives and lived experiences within our community and is committed to supporting the University's core values, including the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of race, creed, color, religion, age, disability, sex, sexual orientation, gender identity and expression, marital status, national origin, political opinions or affiliations, genetic information, and veteran status.

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
• HWCOE Human Resources, 352-392-0904, student-support-hr@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: https://counseling.ufl.edu, 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 Connections Center, Reitz Union, 392-1601. Career assistance and counseling; https://career.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://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/;https://care.dso.ufl.edu.

On-Line Students Complaints*:* https://distance.ufl.edu/getting-help/; *https://distance.ufl.edu/state-authorization-status/#student-complaint*.