Machine Learning Engineering

CAI 4104   Section: 1XYZ

Class Periods: M,W,F | Period 4 (10:40 AM - 11:30 AM)

Location: TUR L011

Academic Term: Spring 2025

Instructor:

Prof. Vincent Bindschaedler

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352-294-1016

Office Hours: TBD

Teaching Assistant/Peer Mentor/Supervised Teaching Student:

Please contact through the Canvas website

1. Wenxuan Bao (TA)
2. TBD

Course Description

Covers foundational machine learning concepts with an emphasis on applying these concepts on real-world data through programming exercises and assignments using relevant industry-standard Python tools, libraries, and frameworks.

Course Pre-Requisites / Co-Requisites

- COP3530

Experience with Python is a plus but not required.

Course Objectives

Successful students will have learned foundational concepts of machine learning and be able to:
- describe the machine learning workflow, including key steps and design choices;
- explain how various types of machine learning models work;
- identify suitable machine learning models depending on the task; and
- choose metrics suited to evaluating the performance of a model on a specific task

In addition, successful students will have acquired experience in applying these techniques to real-world data using Python following the machine learning workflow. This includes knowing how to:
- preprocess and clean data;
- do feature engineering;
- tune hyperparameters;
- train various machine learning models (incl. neural networks);
- assess the performance of a machine learning model; and
- effectively use Python libraries for this, including NumPy, scikit-learn, Pytorch, Keras, etc.

Materials and Supply Fees

None

Relation to Program Outcomes (ABET):

The table below is an example. Please consult with your department's ABET coordinator when filling this out.

Outcome	Coverage[*]
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of	Medium

engineering, science, and mathematics		
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	Medium	
3. An ability to communicate effectively with a range of audiences		
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	Medium	
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives		
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	High	
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	Medium	

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

Required Textbooks and Software
- Python3 with the following dependencies: numpy sklearn matplotlib jupyter h5py tensorflow torch

Recommended Materials
- Géron, Aurélien. "Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow: Concepts, tools, and techniques to build intelligent systems." 2nd edition. O'Reilly Media, 2019.

Required Computer
UF student computing requirement: *https://news.it.ufl.edu/education/student-computing-requirements-for-uf/*

The computer needs to be able to run Python3 and jupyter notebook in an environment with the dependencies stated above are installed.

Course Schedule
Course Schedule *(Tentative & Subject to change)*
Week 1:   Overview & Introduction: What is Machine Learning?

            Part 1 – Fundamental Algorithms & Basic Practice
Week 2:   Machine Learning Engineering – Part 1
Week 3:   Machine Learning Engineering – Part 2
Week 4:   Linear Regression, Logistic Regression, SVM
Week 5:   Decision Trees & Ensemble Learning
Week 6:   Optimization and Gradient Descent
Week 7:   Model Performance Evaluation   Midterm Exam
Week 8:   Unsupervised Learning

            Part 2 – Neural Networks

Week 9:	Feed-forward Neural Networks
Week 10:	Training Deep Neural Networks
Week 11:	Convolutional Neural Networks
Week 12:	Recurrent Neural Networks and Language Models
Week 13:	AutoEncoders & Generative Adversarial Networks

Part 3 – Machine Learning & Society

| Week 14: | Adversarial Examples & Privacy Threats | |
| Week 15: | Fairness & Interpretable/Explainable ML | Project Due |

Attendance Policy, Class Expectations, and Make-Up Policy

Attendance is *strongly recommended* but not mandatory. Due to the course format, students who miss many lectures will be at a *significant* disadvantage.

Students are expected to have done the reading before class and actively participate during lectures and discussions (e.g., by asking questions or by volunteering their opinions).

Students will be assigned written, hands-on assignments related to course topics and the course research project. Assignments will be announced in class and 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
Homeworks & Project	100	50%
Midterm Exam	100	20%
Final Exam	100	30%
		100%

Grading Policy
The following is given as an example only.

Percent	Grade	Grade Points
92.0 - 100	A	4.00
87.0 – 91.9	A-	3.67
83.0 - 86.9	B+	3.33
79.0 - 82.9	B	3.00
75.0 - 78.9	B-	2.67
71.0 - 74.9	C+	2.33
67.0 – 70.9	C	2.00
63.0 - 66.9	C-	1.67
59.0 - 62.9	D+	1.33
55.0 – 58.9	D	1.00
50.0 - 55.0	D-	0.67
0 - 49.9	E	0.00

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

Academic Integrity

Students are required to follow the university guidelines on academic conduct and the student honor code (https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/) at all times. Students failing to meet these standards will be reported to the Dean of Students, *which can result in the student receiving an 'E' for the semester*. In particular, students are explicitly forbidden from copying anything off of the Internet (e.g., source code, text, slides) without proper attribution or citation. This includes *unauthorized use of AI tools to produce text or code*. Students are also forbidden from copying code/answers from each other for the purposes of completing any assignment.

CISE Department Academic Integrity Policy

Academic integrity violations (i.e., cheating, plagiarism) will be reported to SCCR! The CISE department policy for such offenses is a course grade of E. But additional sanctions may be imposed by SCCR.

Reminder of the Honor Pledge: 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."

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 Undergraduate Coordinator
• HWCOE Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu
• Pam Dickrell, Associate Dean of Student Affairs, 352-392-2177, pld@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 support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://elearning.ufl.edu/.

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*.