Applied Machine Learning II

EEE 6778 Section 26778
Class Periods: Tuesdays, 1:55PM-2:45PM, period 7, Thursdays, 1:55PM-3:50PM, periods 7-8
Location: NSC 0520
Academic Term: Fall 2025

Instructor:
Dr. Andrea Ramirez-Salgado
Email Address: aramirezsalgado@ufl.edu
Office Location: MALA 4112
Office Hours: Thursdays 11:45am-1:45pm or by appointment

Teaching Assistant/Peer Mentor/Supervised Teaching Student:
None

Course Description
(3 credits) This course offers an advanced, application-oriented study of machine learning and deep learning. Students will build both theoretical understanding and practical expertise through hands-on labs and projects. Topics include graphical models, computer vision, recursive neural networks, transformer architectures, and edge AI, all aimed at solving real-world problems.

Course Pre-Requisites / Co-Requisites
Prereq: EGN 5776 Applied Machine Learning I
Coreq: None
Other: Students are expected to bring a portable computer to class meetings

Course Objectives
Upon completion of this course, students will be able to:

1. Design and implement neural networks using foundational principles of machine learning and optimization.
2. Apply probabilistic graphical models, including directed models (e.g., Bayesian networks) and undirected models (e.g., Markov Random Fields), to represent and reason under uncertainty in real-world systems.
3. Fine-tune and evaluate deep learning architectures, including CNNs, Autoencoders, and GANs, for tasks such as image classification, compression, and generation.
4. Leverage sequence modeling techniques, such as RNNs, LSTMs, and Transformers, to analyze time series and natural language data, selecting appropriate architectures based on problem constraints.
5. Deploy and optimize deep learning models on edge devices, using techniques like pruning, quantization, and distillation to meet performance, power, and memory requirements in real-time applications.
6. Integrate advanced architectures, including Graph Neural Networks (GNNs), multimodal systems (e.g., CLIP), and diffusion models, to design innovative solutions to open-ended problems across domains.
7. Effectively communicate technical insights and project outcomes, presenting design decisions, model performance, and implications to both technical and non-technical stakeholders through written reports and oral presentations.

Materials and Supply Fees
None

Required Textbooks and Software
Software:
- Python 3+
- Git

- PyTorch
- Anaconda (recommended)

The course slides and materials are developed by the instructor.

Recommended Materials

All reading materials will be available as electronic copies with Course Reserves

- Deep Learning: Foundations and Concepts
  - Christopher M. Bishop and Hugh Bishop
  - Springer, 2023
- Deep Learning
  - Ian Goodfellow and Yoshua Bengio and Aaron Courville
  - The MIT Press, 2016
- Machine Learning with PyTorch and Scikit-Learn: Develop machine learning and deep learning models with Python
  - Sebastian Raschka, Yuxi (Hayden) Liu, and Vahid Mirjalili
  - Packt Publishing, 2022

Required Computer

Recommended Computer Specifications: https://it.ufl.edu/get-help/student-computer-recommendations/
HWCOE Computer Requirements: https://www.eng.ufl.edu/students/advising/fall-semester-checklist/computer-requirements/

Course Schedule

Week	Subject	Assignments
1	Course Introduction and Introduction to Advanced Machine Learning and Deep Learning	
2	Optimization Techniques: Gradient Descent and Introduction to CNNs	Project Proposal (5%)
3	Probabilistic Graphical Models: Directed (Bayesian Networks)	
4	Probabilistic Graphical Models: Undirected (Markov Random Fields)	Elevator Pitch (10%) Elevator Pitch Peer-Feedback (5%)
5	Convolutional Neural Networks (CNNs)	
6	Autoencoders and GANs	Project Delivery 1 (10%)
7	Recurrent Neural Networks (RNNs)	
8	Transformers	Project Delivery 2 (10%)
9	Transformers	Project Peer-Feedback (5%)
10	Advanced Generative Models and Multimodal Architectures	
11	Advanced Generative Models and Multimodal Architectures	Project Delivery 3 (10%)
12	Graph Neural Networks (GNNs)	
13	Modern Approaches in Recommendation Systems	Project Delivery 4 (10%)
14	Model Compression and Edge AI	Project Final Code Repository (10%)
Thanksgiving		
15	Final Project Reports and Presentations	Project Final Report (10%) Final Presentation (10%)

		Final Presentation Peer Feedback (5%)

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Project deliverables	Specified in the table above	65%
Presentations		20%
Peer Feedback		15%
		100%

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

Academic Policies & Resources
Please refer to the academic policies and campus resources included on the website: https://go.ufl.edu/syllabuspolicies.

Code Policy
In this course, students are expected to write their own code for all assignments. You are the one who is being tasked with coming up with a solution to the various AI problems in this course—not your friend, not your roommate, not a stranger on the Internet or any AI-code generators. The reasoning behind this is that later in your educational career it will be expected that you are capable of solving problems on your own, if and when the need arises. Even in a team-based environment, each member of that team must be capable of carrying their own weight**. Unless otherwise noted, there are no group or collaborative assignments in this course**. When working on assignments, discussion of those assignments with your classmates is not only inevitable, but it is strongly encouraged! (We often learn very effectively in social environments.) That said, you should discuss the problem in high level terms, not telling someone else (or being told) how to complete the work. Here are some examples of what could be considered acceptable and unacceptable:

If you're unsure about the acceptable use of AI tools for your work, ask for clarification! Always refer to the "Policy for Use of AI Tools" information available on Canvas to ensure you stay within the guidelines. Don't hesitate—it's better to ask than to risk violating the policy.

Expectations
I expect all students to be bound to the honor pledge as indicated in the student honor code. If you are not capable of completing an assignment on your own, that's okay. Lots of things in life can take time to really "click" for us, and we all learn at different rates. Under no circumstances should you ever consider cheating—that is, submitting someone else's work as your own—as an option. The consequences for doing so will be far worse than if you

simply did not do the assignment. Students will complete this course with honor and integrity, or not at all. Submissions which are believed to be not entirely a student's own work will be reported to administration for disciplinary action. Students who commit any of the unacceptable acts listed above will also be reported. In ALL cases, I will recommend the following sanctions be imposed on that student or students:

1. **A failing grade (an 'E') for the course**
2. **That you not be allowed to drop the course for any reason**

Commitment to a Positive 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.

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 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