

# Applied Deep Learning

EGN 6217 Section 25380

**Class Periods:** Tuesdays, period 5-6, 11:45 AM – 1:40 PM and Thursdays, period 6, 12:50 AM – 1:40 PM

**Location:** NEB101

**Academic Term:** Spring 2025

## **Instructor:**

Dr. Andrea Ramirez-Salgado

Email Address: [aramirezsalgado@ufl.edu](mailto:aramirezsalgado@ufl.edu)

Office Phone Number: MALA 4112

Office Hours: Tuesdays 10:00am – 11:00am, Thursdays 10:00am-11:00am or by appointment

Slack: [uf-egn6217-AppliedDL-Spring25](#)

## **Supervised Teaching Student:**

None

## **Course Description**

This course provides a comprehensive exploration of deep learning architectures, starting with foundational concepts and advancing to cutting-edge topics in neural networks and artificial intelligence. Students will gain theoretical knowledge and practical skills through hands-on labs and projects, equipping them to tackle real-world problems in computer vision, natural language processing, speech recognition, recommendation systems, and edge AI. (3 credit hours)

## **Course Pre-Requisites / Co-Requisites**

Prereq: EGN 5216 Machine Learning for AI Systems

EGN 6216 AI Systems

Coreq: - None

## **Course Objectives**

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

1. Design and implement neural networks, applying foundational concepts and optimization techniques
2. Fine-tune and evaluate advanced deep learning models, including Convolutional Neural Networks (CNNs), Autoencoders, and Generative Adversarial Networks (GANs), for tasks such as image classification, compression, and generation.
3. Apply Recurrent Neural Networks (RNNs), Long Short-Term Memory (LSTM) networks, and Transformer-based architectures to process sequential and natural language data effectively.
4. Optimize and deploy deep learning models for edge devices using techniques like pruning, quantization, and distillation to enhance scalability and performance in real-world applications.
5. Integrate advanced architectures, such as Graph Neural Networks (GNNs), multimodal models (e.g., CLIP), diffusion models, and meta-learning frameworks, to solve domain-specific problems innovatively.
6. Present end-to-end deep learning projects, effectively communicating technical decisions, results, and solutions to diverse audiences.

## **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

### **Course Schedule**

**Note:** The course schedule may be subject to change.

| Week | Date | Subject                                                            | Assignment                                                                                                                           |
|------|------|--------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| 1    | 1/14 | Course Introduction and Introduction to Deep Learning              | Lab 1: Setting up your portfolio                                                                                                     |
|      | 1/16 |                                                                    |                                                                                                                                      |
| 2    | 1/21 | Optimization Techniques: Gradient Descent and Introduction to CNNs | Lab 2: Build a simple neural network using PyTorch and Implement optimization techniques on a neural network + Theoretical Questions |
|      | 1/23 |                                                                    |                                                                                                                                      |
| 3    | 1/28 | Convolutional Neural Networks (CNNs)                               | Lab 3: Build a CNN for image classification + Theoretical Questions                                                                  |
|      | 1/30 |                                                                    | Lab 3 (continued): Fine-tune a pre-trained CNN for a custom dataset.<br>Project 1 Assigned                                           |
| 4    | 2/4  | Autoencoders and GANs                                              | Lab 4: Implement an autoencoder for image compression.<br>Implement a GAN for image generation (e.g., MNIST dataset).                |
|      | 2/6  |                                                                    |                                                                                                                                      |
| 5    | 2/11 | Recurrent Neural Networks (RNNs) and Introduction to Transformers  | Lab 5: Implement an RNN/LSTM for sentiment analysis.                                                                                 |
|      | 2/13 |                                                                    |                                                                                                                                      |
| 6    | 2/18 | Transformers                                                       | Lab 6: NL Implementation<br>Project 2 Assigned                                                                                       |
|      | 2/20 |                                                                    |                                                                                                                                      |
| 7    | 2/25 | Transformers and Midterm Review                                    | Lab 7: Implement a transformer-based model (e.g., BERT or Vision Transformer).                                                       |
|      | 2/27 |                                                                    |                                                                                                                                      |
| 8    | 3/4  | Midterm Exam                                                       |                                                                                                                                      |
|      | 3/6  | Project Time                                                       |                                                                                                                                      |

|    |      |                                                                                           |                                                                                                                                                                              |
|----|------|-------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9  | 3/11 | Graph Neural Networks (GNNs)                                                              | Lab 8: Build a GNN for node classification or molecular property prediction.                                                                                                 |
|    | 3/13 |                                                                                           |                                                                                                                                                                              |
| 10 | 3/18 | Spring Break (No class)                                                                   |                                                                                                                                                                              |
|    | 3/20 |                                                                                           |                                                                                                                                                                              |
| 11 | 3/25 | Modern Approaches in Recommendation Systems                                               | Lab 9: Recommendation Systems Application Project 3 Assigned                                                                                                                 |
|    | 3/27 |                                                                                           |                                                                                                                                                                              |
| 12 | 4/1  | Model Compression and Edge AI                                                             | Lab 10: Apply pruning and quantization to compress a model for edge deployment.                                                                                              |
|    | 4/3  |                                                                                           |                                                                                                                                                                              |
| 13 | 4/8  | Advanced Generative Models and Multimodal Architectures                                   | Lab 11: Implement a simple diffusion model for image generation (e.g., Stable Diffusion). Combine text and image data using a multimodal Transformer (e.g., CLIP or DALL-E). |
|    | 4/10 |                                                                                           |                                                                                                                                                                              |
| 14 | 4/15 | Advanced Neural Architectures – Lifelong Learning and Meta-Learning and Final Exam Review | Lab 12 AutoML implementation                                                                                                                                                 |
|    | 4/17 |                                                                                           |                                                                                                                                                                              |
| 15 | 4/22 | Poster Presentations                                                                      |                                                                                                                                                                              |
| NA | 5/1  | Final Exam                                                                                |                                                                                                                                                                              |

### ***Attendance Policy, Class Expectations, and Make-Up Policy***

Excused absences must be consistent with university policies in the Graduate Catalog (<https://catalog.ufl.edu/graduate/regulations>) and require appropriate documentation. Additional information can be found here: <https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/>.

**Expectations:** I will prepare course lectures with the expectation that students will attend class synchronously and bring a computer to follow along with any practical implementations. Makeups for exams, homework assignments, and weekly assignments are NOT normally allowed. If you cannot attend an exam, you must contact the instructor well in advance (at least 7 days before an announced exam date). Failure to contact the instructor prior to the exam will result in a zero. Please also note that late submission of an exam, homework assignment, or weekly assignment will result in a zero. Arrangements will be made for students on a case-by-case basis for excused reasons. It is every student's responsibility to honor and respect the given deadlines posted on the Canvas course site (<https://elearning.ufl.edu>).

### ***Evaluation of Grades***

The course evaluation will be based on two exams, three project assignments and lab reports.

**Exams.** The course exams will be based on Deep Learning concepts covered in class (see course schedule). Exams will not be cumulative.

**Projects.** The three individual projects will be defined by the course instructor who will provide the necessary data for each. For each project, the students are expected to present a record demo and to submit their code repository. The code should be uploaded to a software repository, such as GitHub, in a form that can be downloaded and run readily.

Labs. Lab reports are based on hands-on activities that are initiated and primarily completed during class, with finalization done individually by students before submission. A total of 12 labs are assigned, but only 10 will count toward the final grade, allowing students to drop any 2 of their choice. Late submissions will not be accepted. At the end of the semester, **poster presentations** will showcase the individual projects, grouped by their respective project themes.

| Assignment          | Total Points | Percentage of Final Grade |
|---------------------|--------------|---------------------------|
| Exam 1              | 100          | 15 %                      |
| Exam 2              | 100          | 15 %                      |
| Project 1           | 100          | 15 %                      |
| Project 2           | 100          | 20 %                      |
| Project 3           | 100          | 20 %                      |
| Poster Presentation | 100          | 5 %                       |
| Labs (10)           | 100          | 10 %                      |
|                     |              | 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         |

More information on UF grading policy may be found at:

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

**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:

#### **ACCEPTABLE:**

- Talking about the problem
- Using a whiteboard (or paper, or something similar) to draw out the problem

- Looking at someone else's work to help them identify or fix a bug, AFTER you have already completed that portion for yourself

#### **UNACCEPTABLE:**

- Splitting an assignment's work into multiple parts with other students
- Asking someone to send you their work
- Copying someone else's work into your own submission
- Giving another student your work for ANY reason—once you send your work to someone else, you have no control over where it ends up
- Giving another student step-by-step instructions on how to structure a solution to a problem
- Looking up solutions to problems and using those solutions yourself verbatim
- Viewing solutions to the problems and mimicking those solutions

**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**

#### ***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 Conduct 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. 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
- Jennifer Nappo, Director of Human Resources, 352-392-0904, [jpennacc@ufl.edu](mailto:jpennacc@ufl.edu)
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, [taylor@eng.ufl.edu](mailto:taylor@eng.ufl.edu)
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, [nishida@eng.ufl.edu](mailto: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](mailto: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](mailto: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/>.

### **COVID-19**

- You are expected to wear approved face coverings at all times during class and within buildings even if you are vaccinated.
- If you are sick, stay home and self-quarantine. Please visit the UF Health Screen, Test & Protect website about next steps, retake the questionnaire and schedule your test for no sooner than 24 hours after your symptoms began. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email [covid@shcc.ufl.edu](mailto:covid@shcc.ufl.edu)) to be evaluated for testing and to receive further instructions about returning to campus.
- If you are withheld from campus by the Department of Health through Screen, Test & Protect, you are not permitted to use any on campus facilities. Students attempting to attend campus activities when withheld from campus will be referred to the Dean of Students Office.
- UF Health Screen, Test & Protect offers guidance when you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Visit the [UF Health Screen, Test & Protect website](#) for more information.
- Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.

### Academic Resources

**E-learning technical support**, 352-392-4357 (select option 2) or e-mail to [Learning-support@ufl.edu](mailto:Learning-support@ufl.edu).  
<https://lss.at.ufl.edu/help.shtml>.

**Career Resource 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>.

