Applied Machine Learning Systems

EEL 5934
Class Periods: T, period 7, 1:55 PM – 2:45 PM,
R, period 7-8, 1:55 PM – 3:50 PM
Location: NEB 202
Academic Term: Fall 2025

Instructor:
Dr. Catia S. Silva
Email: catiaspsilva@ece.ufl.edu
Office: MALA 3122
Office Hours: Wednesdays 10:00 AM – 11:30 AM, or by appointment

Supervised Teacher (ST):
Jiaqing Zhang, jiaqing.zhang@ufl.edu, Office Hours: Tuesdays 2-3pm

Teaching Assistant (TA):
Jugal Boddu, j.boddu@ufl.edu, Office Hours: Mondays 3:30pm-5:00pm and Thursdays 4:30pm-6:00pm

Course Description
(3 credits) This course aims to provide a framework to develop real-world machine learning systems that are deployed, reliable, and scalable. The focus of this course is to introduce basic modules of machine learning systems, namely, data management, data engineering, approaches to model selection, training, scaling, monitoring, and deploying to Machine Learning systems.

Course Pre-Requisites
Students are expected to have the following background:

- Knowledge of basic programming (Python preferred)

Other: Students are expected to bring a portable computer to class meetings. Students that completed EEE 3773 or EEL4930 "Applied Machine Learning Systems" *may not* take this course.

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

- Utilize terminology for Artificial Intelligence (AI), Machine Learning (ML) and Deep Learning (DL) tools.
- Design and conduct meaningful experiments to evaluate the performance of ML models.
- Determine which ML model to use for an application and/or task.
- Identify and explain strengths and limitations of ML models.
- Select appropriate metrics of success.
- Implement in code several ML models utilizing state-of-the-art off-the-shelf libraries.

Materials and Supply Fees
None

Required Textbooks and Software
After the drop and add week, all registered students will be added to a HiPerGator group with computing resources for the entire semester. If you prefer to use your own system to participate in course activities, you will need a computer with the following software installed:

- Anaconda Distribution package
- TensorFlow Keras or PyTorch
- Git

Please also refer to the minimum and suggested specifications for a personal computing device.

Recommended Materials

All textbooks may be accessed in a digital format via the Library Couse Reserves to all students.

- *Hands-On Machine Learning with Scikit-Learn, Keras and TensorFlow*
  - Aurélien Géron
  - 2nd edition
  - O'Reilly Media, 2019
  - ISBN: 978-1-492-03264-9
  - Available for free via UF Library Course Reserves
- *Python Machine Learning – Machine Learning and Deep Learning with Python, Scikit-Learn, and TensorFlow 2*
  - Sebastian Raschka and Vahid Mirjalili
  - 3rd edition
  - Packt Publishing Ltd., 2019
  - ISBN: 978-1-78995-575-0
  - Available for free via UF Library Course Reserves

Course Schedule

The following course schedule is tentative and may vary due to time constraints or class interests.

Week	Lecture	Topic/s	Assessment
Week 1	1	Introduction machine learning, basic terminology, and the different types of learning.	HW0 Assign
Week 2	2	Exploratory data analysis. Data encoding and data cleaning.	
	3	Introduction to supervised learning for regression tasks. Regularization.	HW0 Due HW1 Assign
Week 3	4	Scikit-learn pipelines for data processing.	
	5	**HiPerGator** info session.	HW1 Due HW2 Assign
Week 4	6	Hyperparameter tuning and sampling strategies (cross-validation or CV, nested CV, stratified CV, Bootstrap).	
	7	Introduction to supervised learning for classification tasks. Logistic Regression.	HW2 Due Project 1 Assign
Week 5	8	Performance metrics (hypothesis testing, confidence intervals, ROC, F1, etc.).	
	9	Decision Trees.	
Week 6	10	Random Forests.	
	11	Bagging.	Project 1 Due HW 3 Assign
Week 7	12	Boosting. Gradient Boosting Machines (GBM).	
	13	Hard-Margin Support Vector Machines (SVM) for classification and regression tasks.	HW3 Due
Week 8	14	Soft-Margin Support Vector Machines (SVM) for classification and regression tasks.	
	15	Midterm Exam Review.	HW3 Due
Midterm Exam – Wednesday, October 14 at 7:20 PM – 9:20 PM			

Week 9	16	The Curse of Dimensionality.	Project 2 Assign
	17	Introduction to unsupervised learning for dimensionality reduction tasks. Principal Component Analysis (PCA).	
Week 10	18	Introduction to unsupervised learning for clustering tasks. K-Means Clustering.	
	19	DBSCAN. Clustering validity measures.	
Week 11	20	Hierarchical clustering.	Project 2 Due HW4 Assign
	21	Fuzzy clustering: Fuzzy C-Means & Possibilistic C-Means.	
Week 12	22	Introduction to Deep Learning. Artificial Neural Networks. Backpropagation.	HW4 Due HW5 Assign
	23	Best practices for training artificial neural networks.	
Week 13	24	Convolutional Neural Networks (CNNs).	HW5 Due Project 3 Assign
	25	Auto-Encoders (AEs).	
Week 14	26	Recurrent Neural Networks (RNNs).	
	27	Transformers.	
Week 15	28	Final Exam Review.	Project 3 Due
Final Exam – Thursday, December 11 at 3:00 PM – 5:00 PM			

Attendance Policy, Class Expectations, and Make-Up Policy
Please carefully read the following course policies and expectations, and make-up policies:

1. **Course Communications**

General information: (a) The primary means to get help with a problem, other than office hours, will be Slack channel. We will check the board daily, to answer inquiries. Other students should feel free to post responses to these questions as well within the guidelines discussed in the sections on collation and course etiquette. **(b)** Questions about grades or personal issues may be email to me at catiaspsilva@ece.ufl.edu (or any member of the teaching team) or within Canvas. You are welcome to use the telephone (352.392.6502), talk with me during office hours, or setup an appointment. **(c)** We have a Slack page for the course uf-ece-aml-fall25.slack.com. This is an optional resource for students to discuss the course amongst each other and with the Professor. This resource is intended to supplement office hours and student interactions. No official communication/submission happens over Slack. No assignment submissions will be accepted over Slack.

Expectations: If you have an issue or need help, do not wait to ask about it! Problems are generally easier to solve sooner rather than later. You are expected to contribute to the ongoing constructive feedback that is an essential part of the learning process.

2. **Attendance Policy**

General Information: attendance is not required though summative and cumulative assessments, such as practice quizzes, collaborative teamwork, graded exercises, or participation, may happen during synchronous class meetings (including in an online setting, if any).

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.

3. **Grading Policy**

General Information: (a) All assignments will have a grading rubric and submissions will be graded based on the assignment's rubric. For maximum credit, students must submit correct and elaborated answers that follow instructions. For assignments that required code, clean, easy to read, and well commended Python code is required. **(b)** Individual assignments will not be graded on a curve. Final course grades will be graded on a curve.

Expectations: I will expect that students complete all assignments with care, ensure that submissions are complete and illustrate the understanding of the concepts being assessed.

4. **Late Work**

General Information: all submissions are accepted until the assignment solutions are posted but will lose the "on-time" points listed in the rubric (generally listed at 10% of the grade).

Expectations: I will expect students to follow all deadlines. In case of conflict, I expect that students will communicate with me and let me know well in advance about any conflicting issues to avoid losing the "on-time" points.

5. **Make-Up Policy**

General Information: (a) If you feel that any graded assignment needs to be re-graded, you must discuss this with the instructor or the TA team within one week of grades being posted for that assignment. If approved, the entire assignment will be subject to complete evaluation. **(b)** If you have an academic conflict with any assignment or exam date/time, please let the instructor know well in advance so we can make the necessary changes and make the appropriate accommodations available.

Expectations: I will expect that students will communicate with me and let me know well in advance about any conflict or time/date change requests. 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/graduate/regulations/.

6. **Collaboration**

General Information: in solving any individual assignments, healthy discussion and collaboration amongst classmates is encouraged. Healthy collaboration includes: **(a)** discussing and explaining general course material; **(b)** discussing assignments for better understanding; **(c)** aiding for general programming and debugging issues.

Expectations: If another student contributes substantially to your understanding of a problem, you should cite this student to let myself and the teaching team be aware of your similar interpretations of a problem. You will not be negatively judged for citing another student.

7. **Cheating and Plagiarism**

General Information: while collaboration is encouraged, you are expected to submit your own work and follow the student honor code. Submitting work completed by another student is considered plagiarism and will be dealt according to university policy. In general, if you do not understand your solution, the work is not your own. Examples of plagiarism include: **(a)** copying (or allowing someone to copy), even partially, an assignment solution or program from the course; **(b)** submitting material taken from another source without proper citation; **(c)** obtaining solutions to assignments or exams through inappropriate means. Note that I may elect to use a plagiarism detection service in this course, in which case you will be required to submit your work to such a service as part of your assignment.

Expectations: I expect all students to be bound to the honor pledge as indicated in the student honor code. If you are suspected of dishonest academic activity, I will invite you to discuss it further in private. Academic dishonesty will likely result in grade reduction, with severity depending on the nature of the dishonest activity. I am obligated to report on academic misconduct with a letter to the department, college and/or university leadership. Repeat offences will be treated with significantly greater severity.

8. Course Etiquette

- Be present. This will allow you to get the most out of class time as well as for your classmates to get the most out of their collaborations with you.
- Put your cell phone away unless you are actively using it to further the class activities.
- Be prepared. The readings and videos are carefully chosen to support the in-class activities.
- Listen carefully and do not interrupt others.
- Give quality feedback. What constitutes "quality" will be discussed in class.
- Respect the opinions of others, even when you do not agree.
- Keep an open mind, embrace the opportunity to learn something new.
- Avoid monopolizing the discussion. Give others a chance to contribute and be heard.
- Do not be afraid to revise your ideas as you gather more information.
- Try to look at issues from more than one perspective.
- Respect others by learning and using the name and pronoun they prefer.
- Do not use offensive language.

Evaluation of Grades

Assignment	Total Points	Total	Percentage of Final Grade
Homework	100 each	6	20%
Attendance	100	random	5%
Project 1	100	1	15%
Project 2	100	1	15%
Project 3	100	1	15%
Midterm Exam	100	1	15%
Final Exam	100	1	15%
			100%

Assignment descriptions

Description of assignments:

- **Homework:** will consist of practical and theoretical understanding of the topics covered in class. A typical homework will have two components: Part I – consists of a quiz that will assess theoretical understanding; Part II – consists of practical problem/s to be implemented in Python.

- **Exams:** (1) The exams will be drawn evenly from all lectures, assignments, and readings that occurred up to that point in the course. The content to be covered in the exams are listed in the schedule above. None of the exams will cover any other topics outside of the ones listed, although some concepts are in nature cumulative. (2) Exams will have 2 parts: Part I – theoretical questions to be solved on paper; part II – simulation questions to be solved using Python and Jupyter Notebooks.

- **Projects:** Each project will be based on concepts covered in class (see schedule above). All projects are individual assignments. For each project, students are expected to write a report, submit their code and create a written demo (README file) on how to use their code. The code should be pushed to a GitHub repository in a form that can be cloned and run readily.

Note: Undergraduate and graduate sections are co-listed; graduate students will have additional questions on exams and projects and will be graded on a separate final grade curve.

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

Academic Policies & Resources
For academic policies and campus resources, go to https://go.ufl.edu/syllabuspolicies.

AI Policy
In this course, generative AI should be regarded as if you are collaborating with a human. The same rules apply; you may discuss ideas, explore approaches, and use AI as a partner in problem-solving. However, just as you would not copy another person's assignment, you may not copy work directly from AI. All submitted work must reflect your own understanding and effort. Copying work directly from AI, just like copying another person's assignment, is prohibited and considered academic dishonesty.