FLORIDA POLYTECHNIC
UNIVERSITY

CAP 5610.01 – Machine Learning and Practice

Disclaimer: This syllabus is tentative and may be subject to change. Everything in the syllabus might change except for *1) Course Description; 2) Textbook; and 3) Grading Scale*.

Course Information
- **Course Number and Title**: CAP 5610.01 – Machine Learning and Practice
- **Credit Hours:** 3
- **Academic Term:** Spring 2025

Instructor Information
- **Instructor:** Dr. Ayesha S. Dina
- **Office Location:** BARC - 2229
- **Office Hours**: M- 1-2 pm, TR - 11-12 pm
- **Email address**: adina@floridapoly.edu

Course Delivery and Course Description

- **Delivery Mode**: Face-to-face, TR, 1 pm – 2.15 pm
- **Course Website**: https://floridapolytechnic.instructure.com/courses/8932
  - **Official Catalog Course Description**: This course introduces the students to the theory and practice of machine learning. The course provides the theory of this data-driven process to construct the mathematical models and use those models in performing data evaluation, classification, pattern recognition, detection, and prediction based on the observed data. Also, it introduces the students to the methods of features selection and data wrangling.
  - **Course Pre and/or Co-Requisites**: Graduate Standing
  - **Communication/Computation Skills Requirement (6A-10.030)**: N
- **Reference Texts and Materials:**
  - Machine Learning : A probabilistic Perspective, ISBN-13 : 978-0262018029
  - Probabilistic Machine Learning: An Introduction, ISBN-13 : 978-0262046824
  - Probabilistic Graphical Models: Principles and Techniques, 1st edition, ISBN-13 978-0262013192
  - Christopher M. Bishop "Pattern Recognition and Machine Learning", 1st Edition, 2006, ISBN-13:9780387310732
  - Aurelien Geron "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", 2nd Edition, 2019, ISBN-13:9781492032649
  - Deep Learning: A Visual Approach by Andrew Glassner, ISBN-13: 978-1718500723

Course Objectives and Outcomes

- **Course Objectives**:
  - At the end of this course, students should be able to know the differences between the machine learning algorithms (such as supervised, reinforcement, and unsupervised), implement the machine learning algorithm and evaluate the performance of an algorithm on real-world dataset.

- **Course Learning Outcomes**:

Course Learning Outcome	Master of Science in Computer Science	Master of Science in Engineering	Learning Level * (Bloom's Taxonomy)
Demonstrate strong understanding of supervised and unsupervised machine learning paradigms	1, 4	3	**Comprehension (2)**: Ability to grasp meaning, explain, and restate ideas.
Evaluate and compare different machine learning algorithms.	3, 1	2	**Evaluation (6)**: Ability to judge the worth of material against stated criteria.
Identify the strengths and weaknesses of a diverse set of machine learning methods.	1, 4	4	**Analysis (4)**: Ability to separate material into component parts and show relationships between parts.
Identify and choose the best machine learning algorithm to be used for a given set of data or problem.	1	4	**Evaluation (6)**: Ability to judge the worth of material against stated criteria.

* learning level as described in Bloom's taxonomy and Anderson and Krathwohl's taxonomy.

- o **Alignment with Program Outcomes**:
- o Master of Science in Computer Science:
    1. Demonstrate mastery in analyzing complex problems and applying knowledge of computer and/or data science to formulate solutions.
    2. Communicate computer and/or data science information clearly and effectively through presentations and technical writings to both expert and non-expert audiences.
    3. Demonstrate critical evaluation of recent research literature.
    4. Identify a novel relevant research problem in a chosen computer and/or data science research field, perform the literature survey for the problem, create a plan to solve the problem, carry on the plan, and defend the research.
    5. Recognize appropriate practices in the different fields of computer science and their ethical implications.

- o Master of Science in Engineering:
    1. Acquire and apply knowledge using appropriate, discipline-based learning strategies drawn from relevant research.
    2. Develop methodology of the proposed body of research that produces solutions and further inquiry.
    3. Identify, formulate, and solve engineering problems of single or multidisciplinary nature by applying principles of engineering, science, mathematics, and analytics; and
    4. Develop and conduct appropriate experimentation with a systematic approach, analyze and interpret data, and use foundations of engineering to draw conclusions.

Academic Support Resources

- **Library**: Students can access the Florida Polytechnic University Library through the University website and Canvas, on and off campus. Students may direct questions to library@floridapoly.edu.
- **Peer Learning Strategists (PLS)**: Are specially trained student leaders who help their peers strategize approaches to course content and work through solution methods. PLS work in collaboration with the courses they support so the content and methods are aligned with your instructors' expectations. Students can meet with a PLS in The Learning Center, which is located on the first floor of the Innovation, Science and Technology (IST) building in room 1019.

- **Academic Success Coaches**: All students at Florida Poly are assigned an Academic Success Coach. Your Academic Success Coach can assist you with academic success strategies. Please visit the Student Success Center on the second floor of the IST building to meet with an Academic Success Coach.
- **Writing Center**: Located on the second floor of the IST (2059/2061), the Writing Center helps students to develop their writing and presentation skills. Consultations are available in person and virtually. For more detail, visit https://floridapoly.edu/writingcenter.

Civility and Collegiality

Faculty and students come to the university for the same reason, which is to participate in a highly professional educational environment. To that end, both students and faculty are expected to treat each other with mutual regard and civility. Communication, written, oral and behavioral, between faculty and students must remain respectful. Within and outside of the classroom, students must refrain from derogatory comments toward the faculty member and their fellow students, and faculty as well must refrain from derogatory comments toward their students. Faculty and students should address each other with respect, in accordance with the wishes of the faculty and the students: for example, no one should be addressed by their last name alone.

Faculty from the outset of a course can and should specify what constitutes activities and behavior that take away from, that diminish, the educational environment. An individual student's distracting behavior impedes the education of fellow students, which itself is a form of disrespect. Civility and collegiality also include respecting each other's time: for example, neither students nor faculty should arrive late to class (unless unforeseen, pressing circumstances prevail); faculty should be present at the posted office hours; and students and faculty should be punctual when meeting times are scheduled. In more general terms, collegiality means respecting the right of both faculty and students to participate fully and fairly in the educational enterprise.

Course Policies

Attendance

Students in **face-to-face (this includes labs and C-courses)** courses are expected "to attend all of their scheduled University classes and to satisfy all academic objectives as defined by the instructor" (University Policy, FPU-5.0010AP). If you know that you will miss a class for any reason discuss the situation with your instructor in a timely manner. Exceptions to any attendance requirements may be made on a case-by-case basis. *A+ Attendance* will be used to track attendance. Falsifying attendance for yourself or for another student is an act of academic dishonesty and is considered a violation of the university's academic integrity policy.

Participation

Students are expected to participate in the classroom experience. The use of earbuds/headphones during class is specifically not allowed and students who engage in this behavior may be asked to leave the class for the day (noting exceptions for authorized accommodations). In addition, students who routinely do not bring materials to class that are required for participation, will not be given credit for class attendance, and if this becomes a pattern of behavior, may be asked to leave the class for the day. Persistent problems with participation may result in a code of conduct referral.

Late Work/Make-up work

Make-up exams will be given only in extreme circumstances with a documented excuse. If you miss an exam because you are participating in a college-sponsored activity, inform your instructor at least 72 hours before the exam and provide them with documentation. Late homework will receive a **20%** penalty if received up to **one** day late. Homework received more than one day after the due date will not receive credit.

Grading Scale

A	above 93%	B	83% - 86%	C	73% - 76%	D	63% - 66%
A-	90% - 92%	B-	80% - 82%	C-	70% - 72%	D-	60% - 62%
B+	87% - 89%	C+	77% - 79%	D+	67% - 69%	F	below 60%

- *The grades of "A" through "C," and "SR" are passing grades. The grades of "B-," "C+," and "C" are considered passing for graduate students but indicate weak performance for a graduate student and may not be accepted for some programs.*
- *The grades of "C-," "D+," "D," "D-," "F," and "UR" are failing grades.*

Assignment/Evaluation Methods

Quizzes	15%
Attendance	10%
Assignments	15%
Midterm Exam	20%
Team Project	20%
Final Exam	20%
Total	100%

Team Project: There will be a group project that requires both a comprehensive report and a presentation.

University Policies

Reasonable Accommodations

The University is committed to ensuring equal access to all educational opportunities. The University, through the Office of Disability Services (ODS), facilitates reasonable accommodations for students with disabilities and documented eligibility. It is the student's responsibility to self-identify as a student with disabilities and register with ODS to request accommodations.

If you have already registered with ODS, please ensure that you have requested an accommodation letter for this course through the ODS student portal and communicate with your instructor about your approved accommodations as soon as possible. Arrangements for testing accommodations must be made in advance. Accommodations are not retroactive.
If you are not registered with ODS but believe you have a temporary health condition or permanent disability requiring an accommodation, please contact ODS as soon as possible.

> The Office of Disability Services (ODS):
> DisabilityServices@floridapoly.edu
> (863) 874-8770
> The Access Point
> ODS website: www.floridapoly.edy/disability

Accommodations for Religious Observances, Practices and Beliefs

The University will reasonably accommodate the religious observances, practices, and beliefs of individuals in regard to admissions, class attendance, and the scheduling of examinations and work assignments. (See University Policy.)

Title IX

Florida Polytechnic University is committed to ensuring a safe, productive learning environment on our campus that prohibits sex discrimination and sexual misconduct, including sexual harassment, sexual assault, dating violence, domestic violence and stalking. Resources are available if you or someone you know needs assistance. You may speak to your professor, but your professors have an obligation to report the incident to the Title IX Coordinator. Please know, however, that your information will be kept private to the greatest extent possible. You will not be required to share your experience. If you want to speak to someone who is permitted to keep your disclosure confidential, please seek assistance from the Florida Polytechnic University Ombuds Office, BayCare's Student Assistance Program, 1-800-878-5470 and locally within the community at Peace River Center, 863-413-2707 (24-hour hotline) or 863-413-2708 to schedule an appointment. The Title IX Coordinator is available for any questions to discussion resources and options available.

Academic Integrity

The faculty and administration take academic integrity very seriously. Violations of academic integrity regulation include actions such as cheating, plagiarism, use of unauthorized resources (including but not limited to use of Artificial Intelligence tools), illegal use of intellectual property, and inappropriately aiding other students. Such actions undermine the central mission of the university and negatively impact the value of your Florida Poly degree. Suspected violations will be fully investigated, possibly resulting in an academic integrity hearing and sanctions against the accused student if found in violation. Sanctions range from receiving a zero on the exam or assignment, to expulsion from the university. Repeat offenders are subject to more severe sanctions and penalties.

Recording Lectures

Students may, without prior notice, record video or audio of a class lecture for a class in which the student is enrolled for their own personal educational use. Recordings may not be used as a substitute for class participation or class attendance. Recordings may not be published or shared in any way, either intentionally or accidently, without the written consent of the faculty member. Failure to adhere to these requirements is a violation of state law (subject to civil penalty) and the student code of conduct (subject to disciplinary action).

Recording class activities other than class lectures, including but not limited to lab sessions, student presentations (whether individually or part of a group), class discussion (except when incidental to and incorporated within a class lecture), and invited guest speakers is **prohibited**.

Course Schedule (*Tentative*)

Week	Topics	Assignments
1	Introduction to Machine Learning Introduction of the Python ML Framework	
2	Introduction (Probability Theory and Decision Theory)	**Quiz-1**
3	Introduction (Information Theory) Probability Distributions (Binary Variables and The Gaussian Distribution)	**Assignment 1**
4	Probability Distributions (Nonparametric Methods) Linear Models for Regression (Linear Basis Function Models and Bias-Variance Decomposition) Introduction (Polynomial Curve Fitting)	**Quiz-2**
5	Linear Models for Classification (Discriminant Functions and Probabilistic Discriminative Models)	**Assignment 2 (project proposal)**
6	**Career Day – No class on Tuesday** Graphical Models (Bayesian Networks, Inference in Graphical Models)	
7	Graphical Models (EM, semi supervised learning) Sparse Kernel Machines(Maximum Margin Classifiers)	**Assignment 3**
8	Mixture Models (K-means Clustering and Mixtures of Gaussians)	**Midterm Exam**
9	Continuous Latent Variables (Principal Component Analysis and Nonlinear Latent Variable Models)	
10	**Spring Break**	

11	Sequential Data
	     Markov Models
	     Hidden Markov Models	

12	Combining Models (Bayesian Model Averaging, Boosting, and Tree-based Models)	**Quiz-3** (Unsupervised and PCA)
13	Neural Networks (Feed-forward Network Functions and Network Training, Error Backpropagation)	**Assignment 4**
14	Deep Neural Networks Convolutional Neural Networks Attention and Transformers	**Quiz-4**
15	Generative Adversarial Networks	**Project submission**
16	Presentations for Final Projects **Reading Days - No class on Thursday**	