

# ADVANCED TOPICS OF MACHINE LEARNING

## Course Description

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Full-time Adjunct Professor  
Computer Engineering Program  
School of Engineering  
Universidad Distrital Francisco José de Caldas

2026-I



# Outline

- 1 You don't know who I am
- 2 Course Overview
- 3 Grading & Rules
- 4 Bibliography



# Outline

1 You don't know who I am

2 Course Overview

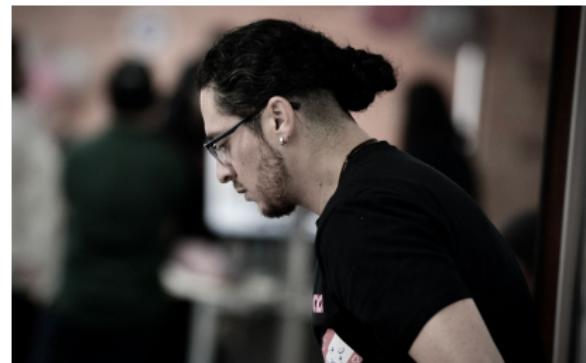
3 Grading & Rules

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# Academic Experience

- **Computer Engineer**, M.Sc. in Computer Engineering, and *researcher* for **16 years**.
- 8 years as **full-time associate professor** at colleges, in **Computer Engineering programs**.
- 3 years as **lecturer professor** for both colleges and **government STEM programs**.
- Speaker at **IEEE** events and colleges in Colombia, Brazil, and Bolivia.



# Non-academic Experience



- PyCon Colombia and Python Bogotá **co-organizer**.
- 3 years as **software engineer** for several **tech companies** in Colombia.
- 3 years as **Technical Leader** of Machine Learning and Data Science at a USA startup.
- 1.5 years as **MLOps Engineer** for a **Fintech** company in LATAM.
- Currently, **Senior Engineering Manager** of Data Engineering and Machine Learning at Blend 360.



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# Overview

This course is designed to **introduce undergraduate students** to **advanced machine learning techniques** as part of the foundation for becoming an experienced *AI engineer* capable of developing *intelligent solutions*.

The course starts with a **comprehensive study** of **reinforcement learning** and **generative models**. Then, it transitions into **advanced unsupervised learning** and **deep learning optimization techniques**. Finally, we will focus on **online learning**, **transfer learning**, and **model interpretability** for both **research** and **industry applications**.

Classes will consist of **theoretical lectures**, **algorithm implementation sessions**, and **cutting-edge research projects**. Also, you must complete some readings from *advanced ML research papers* and *deep learning*. In addition, there will be a **semester-long research project**, **one final course test**, and **four practical challenges**.



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# Goals

The **main goal** of this course is to **provide students with advanced concepts and cutting-edge techniques** for **intelligent systems design** capable of analyzing data, optimizing processes, and improving **human-machine interactions**.

At the end of this course you should be able to **implement advanced ML models** including reinforcement learning, generative models, and **transfer learning techniques**. Also, you should be able to **develop complete AI solutions** that solve real-world problems using **state-of-the-art algorithms** and optimization techniques.



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# Prerequisites

This is an advanced course, so you must have some knowledge in:

- **Programming in Python** (advanced level), including libraries like NumPy, Pandas, and Scikit-learn.
- Mathematics fundamentals: linear algebra, calculus, and probability theory.
- Statistics and statistical inference: hypothesis testing, distributions, and regression analysis.
- Basic Machine Learning concepts: supervised/unsupervised learning, model evaluation, and cross-validation.
- Git usage, Jupyter Notebooks, and experience with ML frameworks like TensorFlow or PyTorch.
- Recommended: Experience with Docker containers and research paper reading.



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# Syllabus

Period	Topic	Time
Period I	Introduction to Machine Learning	2 sessions
	Reinforcement Learning Fundamentals	7 sessions
	Generative and Probabilistic Models	5 sessions
	Advanced Unsupervised Learning I	3 sessions
	Course Project Catch-Up	2 sessions
Period II	Advanced Unsupervised Learning II	4 sessions
	Deep Learning	4 sessions
	Online Learning	2 sessions
	ML Interpretability Techniques	3 sessions
	Final Test	1 session
Period III	Project Dissertation	2 sessions



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# Grades Percentages

Period	Item	Percentage
Period I	Mini-Projects	20%
	Project Catch-Up	15%
Period II	Mini-Projects	15%
	Course Test	20%
Period III	Paper + Poster	15%
	Report + Implementation	10%
	Presentation	5%



# Don't hate the player, hate the game

- All assignments must be submitted **on time**, and in **English**. Grammar and spelling will **not** be evaluated.
- Copying and pasting from the internet are **forbidden**. Please **develop your own ideas and solutions**.
- Class attendance is **not mandatory**. If you **miss** classes, you must study *independently*.
- No cell phones, smartwatches, WhatsApp, Tinder, or **smart devices**. **Just you and your brain**. **Pay attention in class**.
- Communication with me must be via **email** or **Slack**. I will **not** answer any questions via *WhatsApp*.



# Code of Conduct

- Always be **respectful** to your **classmates** and to me. You must be **kind** to everyone inside (*and outside*) the classroom.
- There is **no** best **programming language**, **tool**, or **technology**. There are only **better** or **worse** solutions.
- You must be **honest** with your work. If you **don't know something**, just **ask** me. I will be **glad** to help you.
- You must be **responsible** with your work. If you don't submit **on time**, please **don't complain**.
- You must not be **disruptive** or **negatively affect** the **classroom environment**. If you do, I will **ask you** to **leave** the classroom.



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# Bibliography

Recommended bibliography:

- **Reinforcement Learning: An Introduction**, by Richard S. Sutton & Andrew G. Barto.
- **Deep Learning**, by Ian Goodfellow, Yoshua Bengio, & Aaron Courville.
- **Generative Deep Learning**, by David Foster.
- **Pattern Recognition and Machine Learning**, by Christopher M. Bishop.
- **The Elements of Statistical Learning**, by Trevor Hastie, Robert Tibshirani, & Jerome Friedman.
- **Interpretable Machine Learning**, by Christoph Molnar.
- **Online Learning and Online Convex Optimization**, by Shai Shalev-Shwartz.
- **Bayesian Reasoning and Machine Learning**, by David Barber.



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# Thanks!

# Questions?



**My Profile:** [www.linkedin.com/in/casierrav](https://www.linkedin.com/in/casierrav)

