



# Data Science & Machine Learning for Engineering Applications

2025-26

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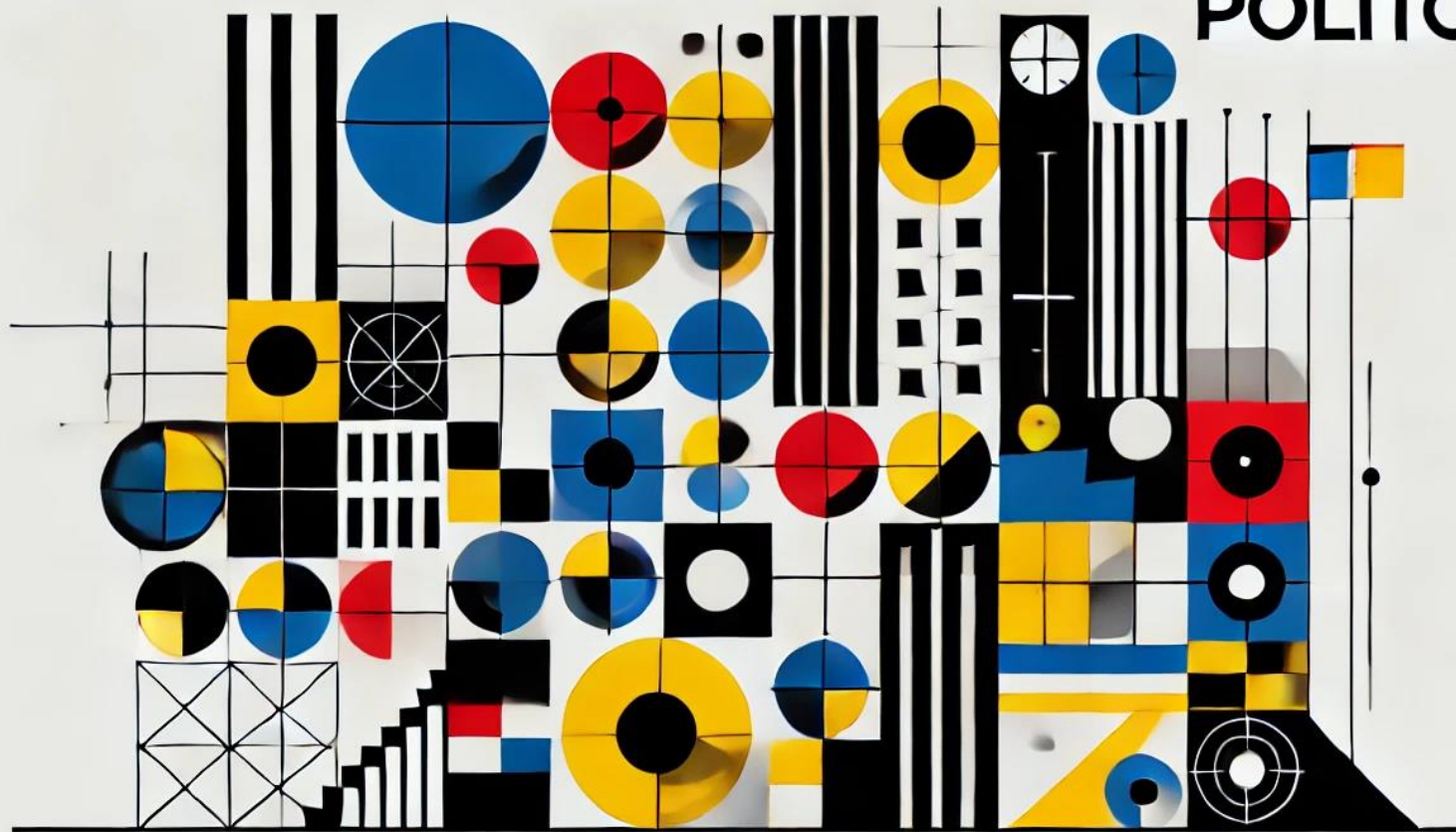
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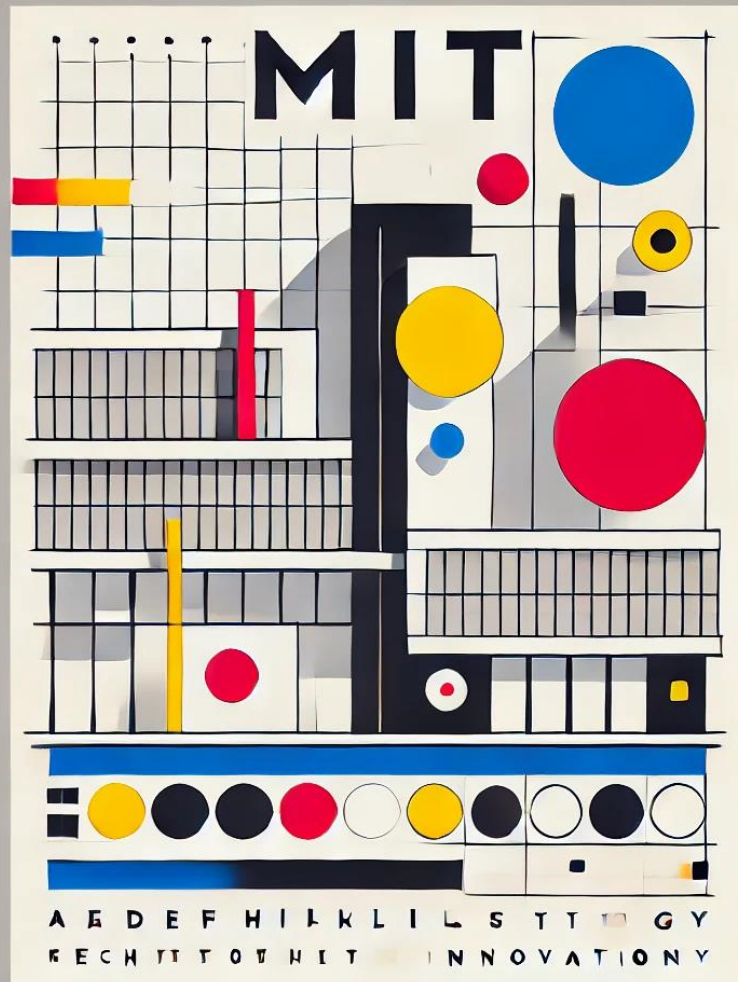
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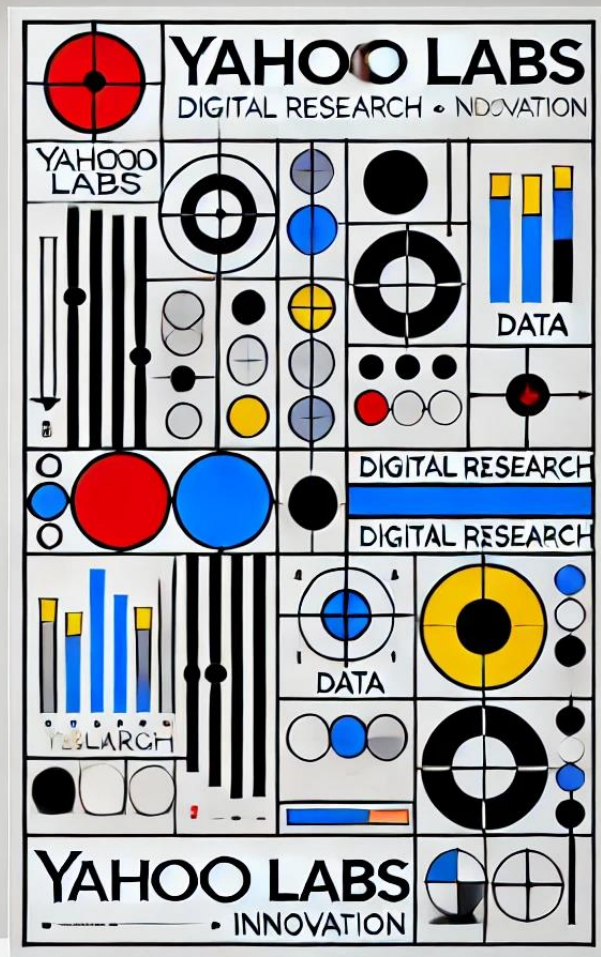
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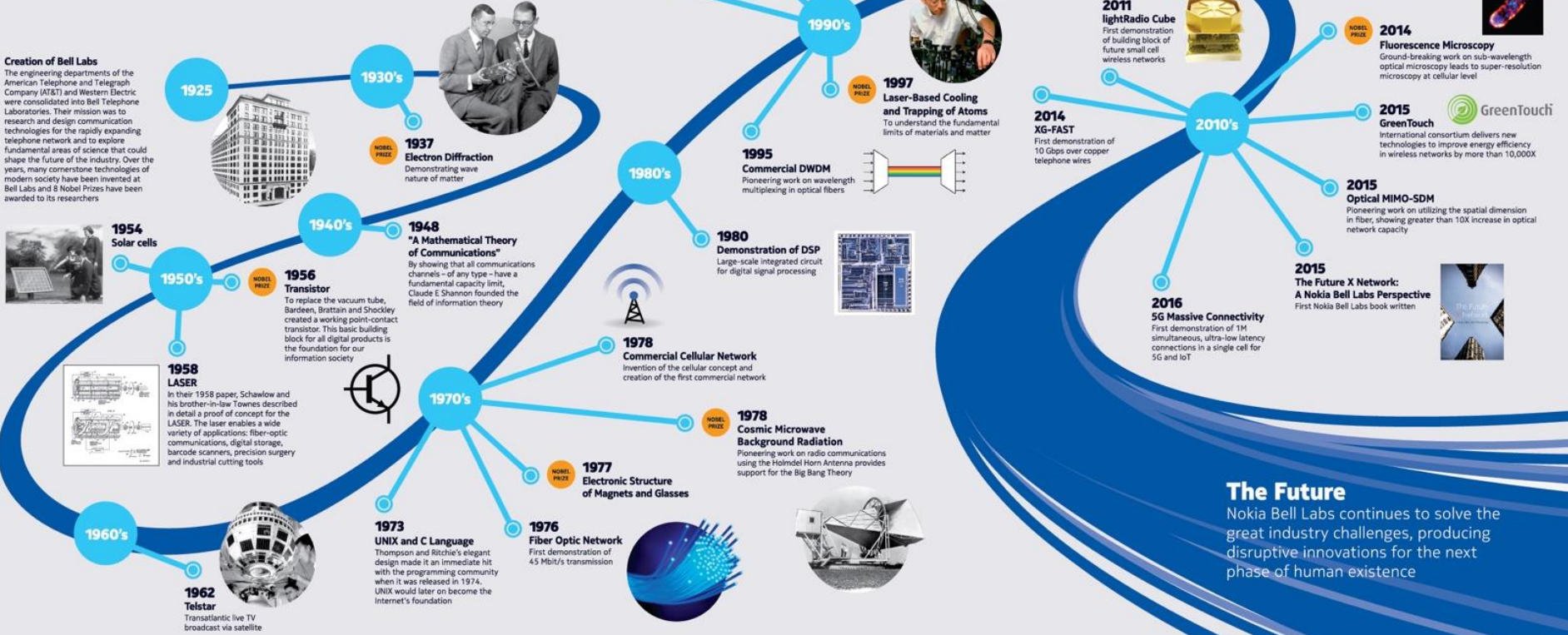
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# Inventing the Future X Network

**Creation of Bell Labs**  
The engineering departments of the American Telephone and Telegraph Company (AT&T) and Western Electric were consolidated into Bell Telephone Laboratories. Their mission was to research and design communication technologies for the rapidly expanding telephone network and to explore fundamental areas of science that could shape the future of the industry. Over the years, many cornerstone technologies of modern society have been invented at Bell Labs and 8 Nobel Prizes have been awarded to its researchers







**Daniele Quercia**  
Eager to join forces on  
urban computing and  
responsible AI



**Sanja Šćepanović**  
Let's make AI for Earth  
Observation and AI for  
Public Health  
responsible together



**Marios Constantinides**  
Open to collaborate on  
projects about  
Responsible AI and  
Future of Work



**Adam Ke Zhou**  
Keen on teaming up  
for ethical and  
transparent NLP  
collaboration



**Ali Septiandri**  
Open to collaborative  
opportunities in the  
fields of Healthcare  
and Responsible AI



**Edyta Bogucka**  
Seeking partners to  
make AI responsible  
through data  
visualization and  
design



**Do you want to join us?**  
We welcome applications from outstanding PhD students and scholars to join  
us in 2024 as summer interns, self-funded visitors or project collaborators

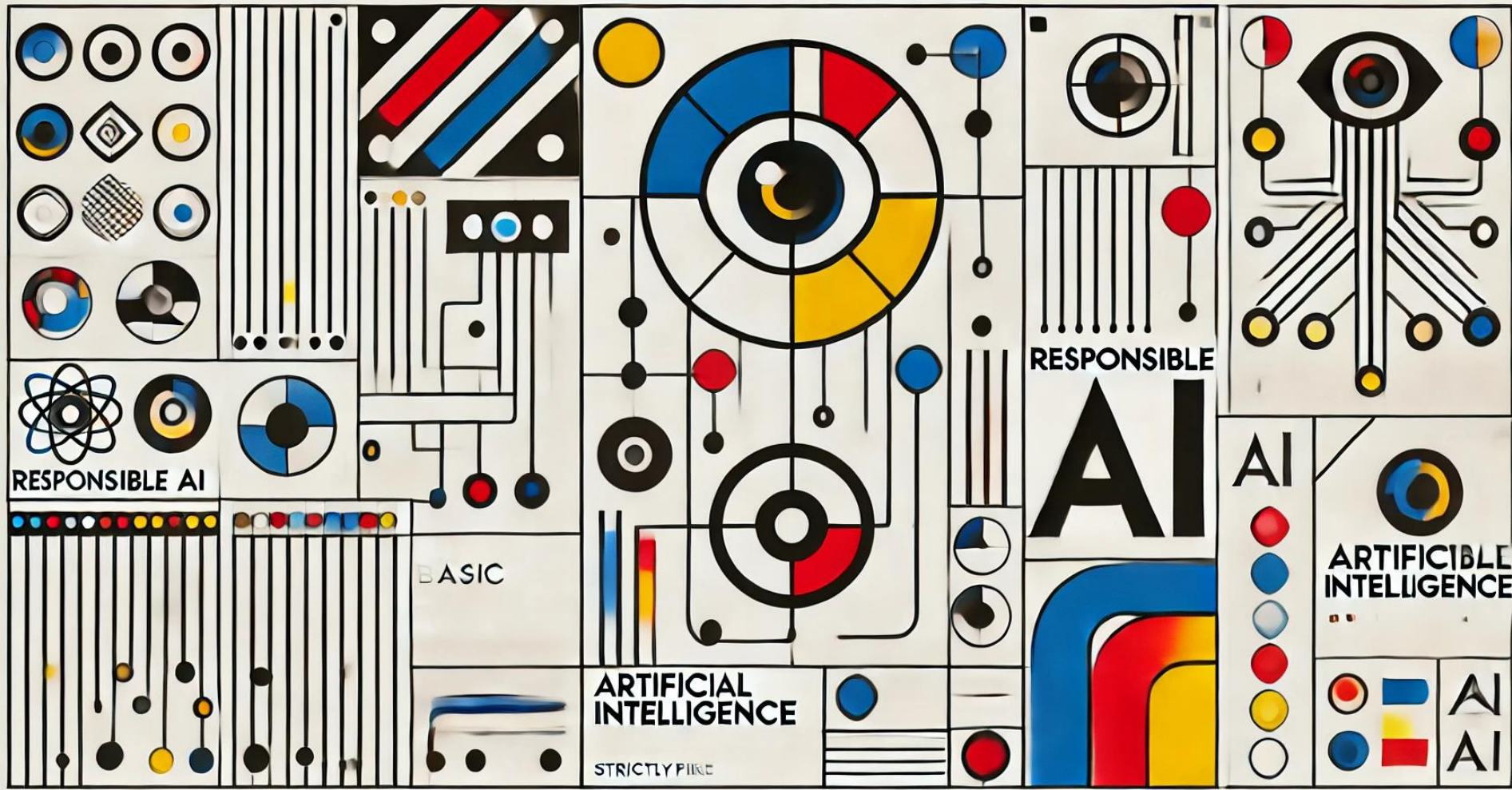


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RESPONSIBLE AI

RESPONSIBLE

RESPONSIBLE AI





# Data Science & Machine Learning

## What's This About?

Data Science and Machine Learning (ML) are how computers learn from data -like how your phone predicts your next text, but on a much larger scale. This course teaches you to **turn raw data into useful insights** and apply it to engineering problems.

## What Will You Learn?

1. The **data science process** – collecting, cleaning, and making sense of data.
2. How to use **Python** and top **data science libraries** (because no one does this by hand anymore).
3. Key **machine learning and deep learning algorithms** – the things that make AI work.

## How's It Taught?

Data Science

& Machine Learning

**1. Theory** – so you know what's actually happening.

**2. Hands-on labs** – because real learning happens when you *do* it.

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**3. Python experiments** – you'll run code, test models, and see how ML works in action.

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& Machine Learning



## Why Should You Care?

By the end of this course, you'll:

1. Understand how **data science and machine learning** power real-world applications.
2. Know how to **analyze data**, build ML models, and evaluate their performance.
3. Have **practical experience** with Python and ML libraries—valuable skills in almost any field.
4. Be able to talk about AI without sounding clueless.

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# How This Course Works

## Course Structure

1. Lectures – You'll learn the theory
2. Hands-on labs – apply what you learn
3. Real-world projects

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& THEORY LECTURES

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# How This Course Works

## How You'll Be Graded

1. **Homework (4 points)** – Small exercises to make sure you can apply what you've learned.
2. **Group Project (20 points)** – Work with a team to build a full **data science process** for a real engineering problem. Your project needs to be accurate, well-documented, and not fall apart under scrutiny. Teams must be formed no later than the 30<sup>th</sup> of March.
3. **Written Exam (10 points)** – Multiple-choice questions **No notes, no phones—just you and your brain.**

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## How This Course Works

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👉 **Rules?** You need at least **12/20 on the project**, or **6/10 on the exam** to qualify for a pass. Homework points only count if you've hit 18+ overall. Oh, and if you somehow score over 31 (yes, that's possible), you'll get **30 with honors**.

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## Course Topics: What You'll Actually Learn

This course is about learning how to **make data work for you**. Here's what we'll cover:

### 1/ The Data Science Process

- A. How to collect, clean, and transform data (because raw data is a mess).
- B. Feature engineering – picking the right details that actually matter.

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## Course Topics: What You'll Actually Learn

### 2/ Data Science Algorithms

- A. **Classification** – Teaching machines to put things into categories.
- B. **Clustering** – Grouping things together based on similarities (like Netflix recommending “quirky indie films” when all you watch is Marvel).
- C. **Association rules** – Finding hidden patterns in data (think: “People who buy chips also buy salsa”).



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## Course Topics: What You'll Actually Learn

### 3/ Machine Learning & Deep Learning

The magic behind **automatic learning** - because why program everything manually when you can make computers do it for you?

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## Course Topics: What You'll Actually Learn

### 4/ Python & Data Science Libraries

- A. Learn **Python**, the language everyone in AI and data science swears by.
- B. Use top libraries like **scikit-learn** - so you don't have to reinvent the wheel.

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## Course Topics: What You'll Actually Learn

### 5/ Real-World Applications & Case Studies

- A. You'll design and build a complete **data science process**, applying ML & Deep Learning to real engineering problems.
- B. Basically, you'll take what you've learned and make it actually *useful*.

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# How You'll Be Graded (a.k.a. Proving You Actually Learned Something)

**The Breakdown.** Your final grade is based on three things:

**1. Homework (4 points)** – Small hands-on tasks to practice Python, data science, and ML algorithms.

**2. Group Project (20 points)** – Work in a team to design and implement a full data science process for an actual engineering problem. You'll write a report explaining your choices and prove your model works.

**3. Written Exam (10 points)** – Multiple-choice questions covering data mining, machine learning, and deep learning.

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## The Rules (Yes, There Are Rules)

1. Project must score at least 12 points (out of 20)
2. Exam must score at least 6 points (out of 10)
3. Homework points only count if your project + exam is at least 18
4. If you somehow score over 31, congrats—you get 30 with honors

Basically, **do the work, understand the material, and don't rely on luck.**

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## What's Actually Being Tested?

1. Can you **design and implement** a data science process?
2. Do you know how to **evaluate ML algorithms**?
3. Can you use **Python and ML libraries** effectively?
4. Do you understand **key concepts in data mining and machine learning**?

**In short:** You're being tested on **what you can actually do**, not just what you can memorize.

## Final Thought

If you put in the effort, you'll leave this course with **real skills that matter**. If you don't... well, machine learning won't learn itself.



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## Homework: Yes, You Actually Have to Do It

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Homework is your chance to practice **Python**, **machine learning algorithms**, and **data science techniques**.

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### The Breakdown

1. **7 assignments** throughout the course.
  - A. **First 6** = 0.5 points each (if submitted on time).
  - B. **Final one** = 1 point (because it's tougher and involves **advanced ML on an image dataset**).
2. **Total possible points: 4** (not much, but enough to make a difference).

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## Homework: Rules (Because We Have to Have Some)

1. Deadlines matter - late submissions = no points.
2. Homework is directly related to lab work - so if you pay attention, it's easy.
3. Points are only valid until January 2026 (included).

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## Homework: Why Bother?

1. You get **hands-on experience** with real-world ML problems.
2. You practice using **Python and ML libraries**—which, let's face it, is why you're here.
3. It's a **free 4 points** if you do the work.

### Final Thought

Do the homework, and the final project/exam will feel a lot easier. Skip it, and well... good luck.

## Group Project: Work Together

This is where you prove you can **apply data science and machine learning** to a real engineering problem - without breaking your group apart in the process ;)

### The Assignment

1. **Teams of 6-8 students** (yes, you have to work with others - welcome to real life).
2. **Design and implement a full data science process** using ML algorithms.
3. **Write a report** explaining what you did and why.



## Group Project: When & How?

1. Assigned after ~ **7-8 weeks**—so you actually know what you're doing.
2. Evaluated based on **performance, accuracy, completeness, and robustness** (basically, how good, well-documented, and stable your solution is).
3. The **better your model, the better your score**—so maybe don't just copy-paste random code from the internet.

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## Group Project: Grading (a.k.a. Why This Matters)

1. Worth **20 points**—so it's a big deal.
2. Your model must actually work **with real data**.
3. If your project score is **below 12**, you fail.

### Final Thought

... If you work well as a team, you'll build something impressive. If you don't... well, hopefully you made friends in the process.

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## The Written Exam

This is where we check if you actually understand **data science and machine learning**—or if you've just been nodding along the whole time.

## What's on It?

1. Multiple-choice questions.
2. Covers **data preparation, classification, regression, clustering, and association rule mining**.
3. Includes **machine learning and deep learning for engineering applications**—so don't skip the lectures.

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## The Written Exam: Rules

1. **60-minute time limit**—so no time for daydreaming.
2. **No textbooks, notes, or electronic devices**—it's just you and your brain.
3. If you score **below 6/10, you fail.**

## Final Thought

.. If you've been paying attention and doing the work, this will be fine. If not... well, at least it's only 60 minutes.

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