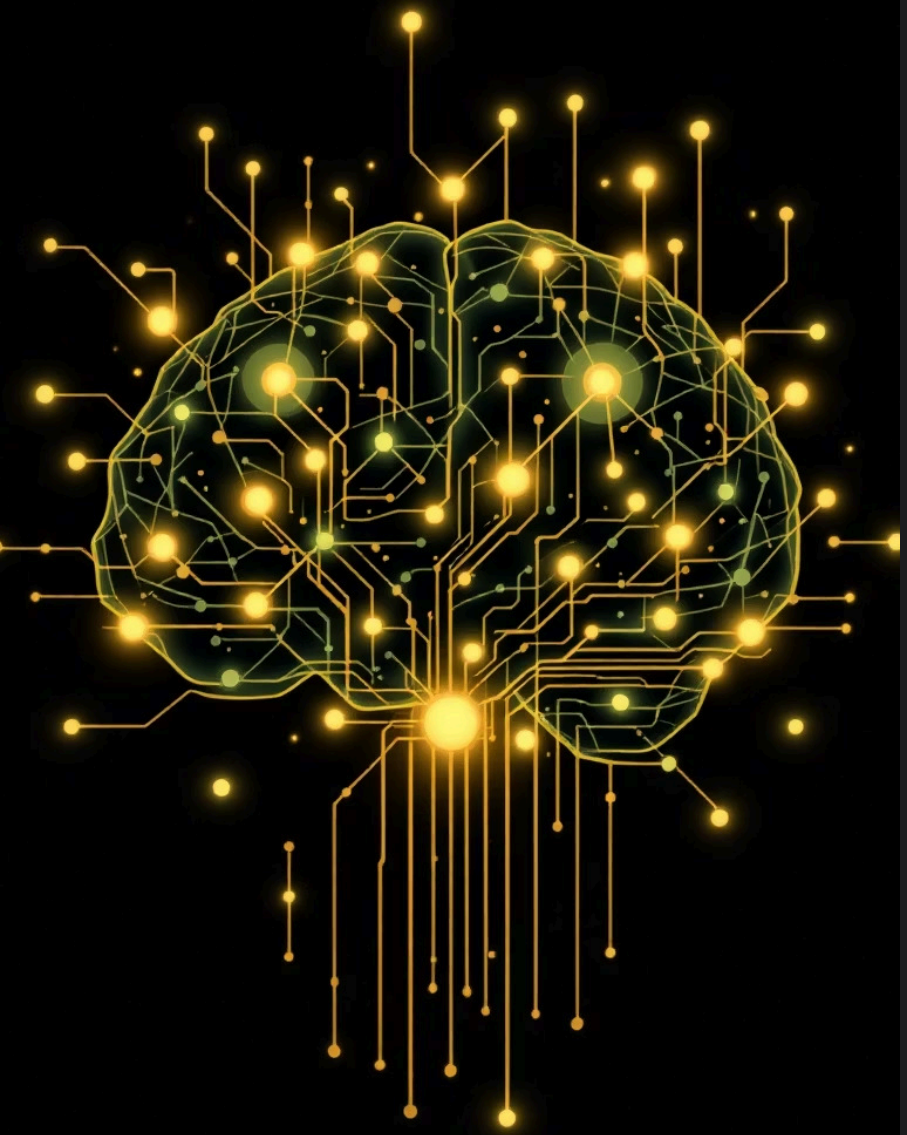


Basics of Classification, Regression & Learning Types

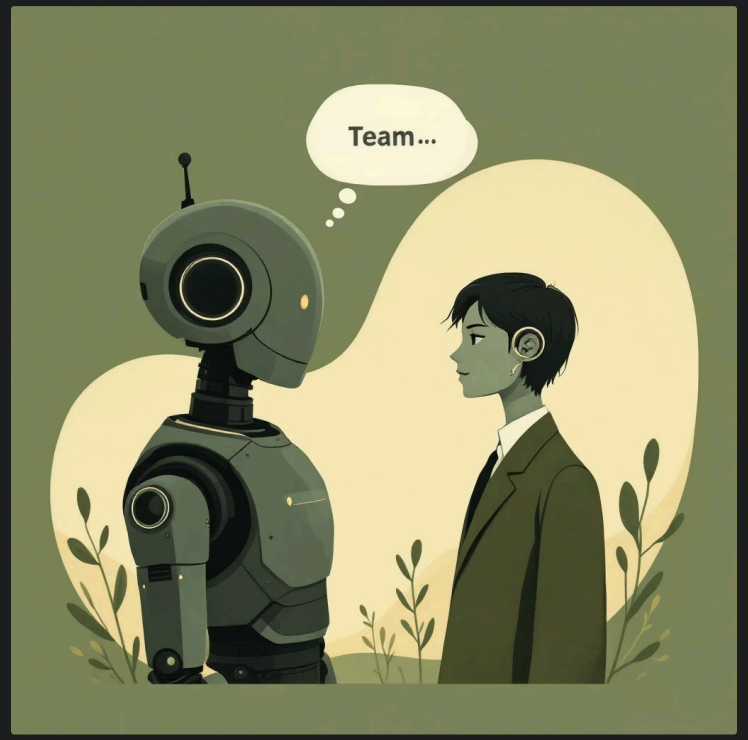
Welcome to your first journey into artificial intelligence! Today we'll explore how machines learn to think, predict, and discover patterns just like humans do.

What is Artificial Intelligence?

AI in Simple Terms

AI is when machines mimic aspects of human intelligence - like learning from experience, making decisions, and solving complex problems.

Think of it as teaching computers to be smart helpers that can recognize patterns and make predictions.



Google Maps

Predicts traffic patterns and finds optimal routes

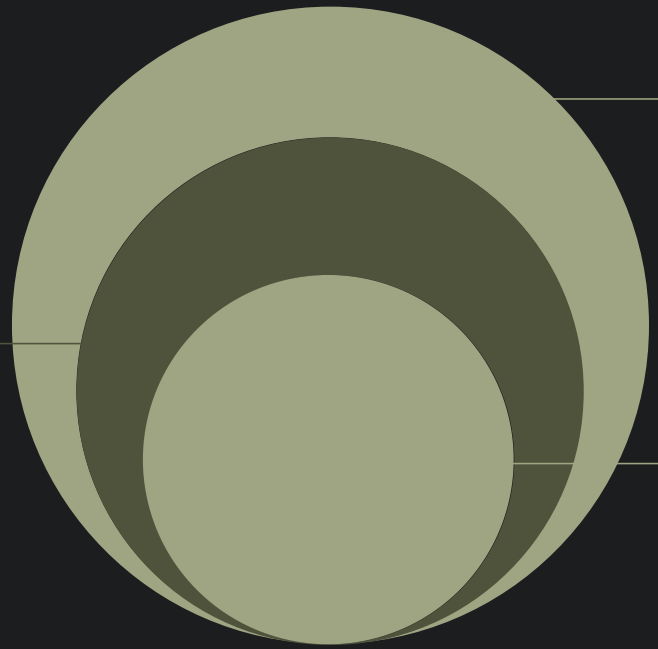
Netflix & Spotify

Recommends content based on your viewing habits

Siri & Alexa

Understands speech and responds naturally

Understanding the AI Family Tree



Artificial Intelligence
Broad field enabling machines to perform intelligent tasks

Machine Learning
Algorithms that learn from data to make predictions

Deep Learning
Neural networks learning complex patterns from large data

Artificial Intelligence

The broad concept of making machines "smart" and capable of human-like tasks

Machine Learning

Computers that learn patterns from data without being explicitly programmed

Deep Learning

Advanced ML using neural networks that mimic the human brain

Supervised Learning: Learning with a Teacher

The Concept

Supervised learning is like having a patient teacher who shows you many examples along with the correct answers, helping you learn patterns to make predictions on new, unseen data.

Think of it as teaching a child to recognize animals by showing them hundreds of pictures labeled "cat" or "dog" until they can identify new animals on their own.

Classification: Sorting Things into Categories

What is Classification?

Classification predicts which category something belongs to. It answers the question: **"Which group does this fit into?"**

How Models Learn

Feed the model thousands of examples with correct labels, let it find patterns, then test with new data to see predictions.

01

Input Data

Pictures of cats and dogs

02

Add Labels

Humans tell the model which is which

03

Find Patterns

Model notices cats have pointy ears, dogs have floppy ears

04

Make Predictions

Model guesses categories for new images

Regression: Predicting Numbers

What is Regression?

Regression predicts numerical values. It answers **"How much?"** or **"How many?"**

House Prices

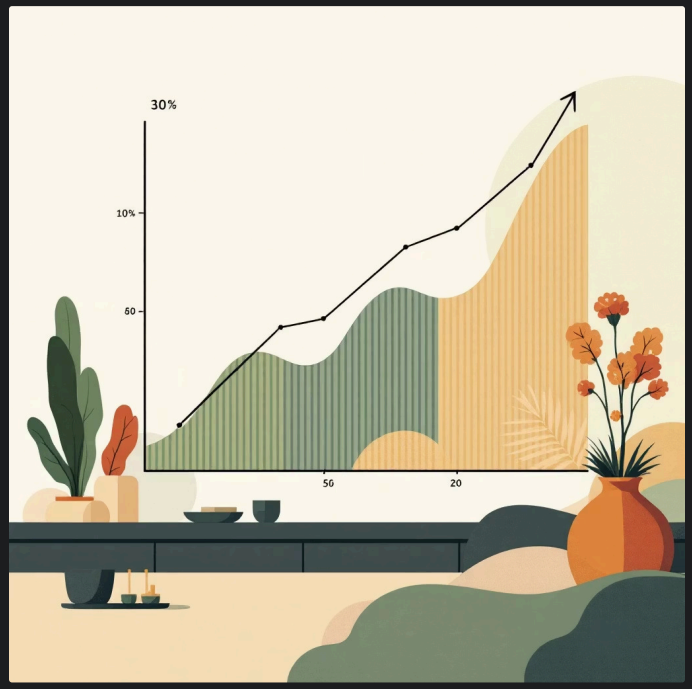
Based on size and location

Weather

Tomorrow's temperature

Business

Forecasting sales numbers



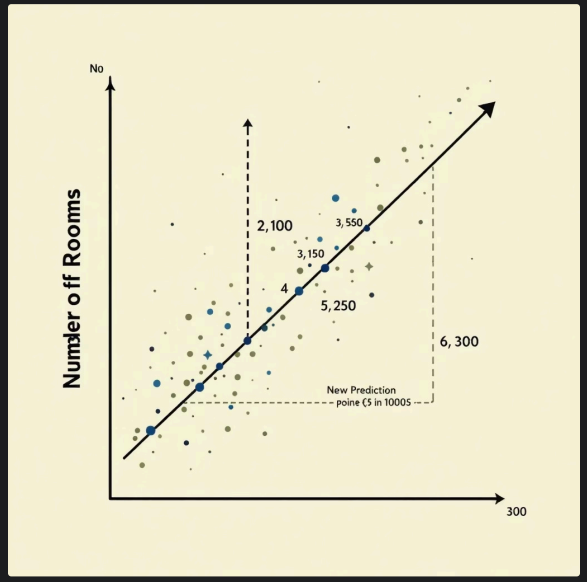
Interactive Example: If houses of 1,000 sq ft cost $100k, and 2,000 sq ft cost $200k, what would a 2,500 sq ft house cost? The regression model would predict around $250k!

Regression Example: Predicting House Price Based on Number of Rooms

Dataset Example:

Room Counts	Price
1	50
2	100
3	150
4	200
5	250

As the number of rooms increases, the price consistently increases.



Regression draws a "best-fit line" through existing data points to predict future values. In this example, it helps estimate the price of a house with more rooms.

How Regression Models Learn

Find Best Line

Regression models identify the optimal "line" or "curve" that best represents the relationship between input and output data.

Minimize Errors (MSE)

This line is refined by minimizing prediction errors, often using Mean Squared Error (MSE), to ensure accuracy.

Predict New Values

Once established, the model uses this optimized line to accurately predict values for new, unseen data points.

Unsupervised Learning: Discovering Hidden Patterns

The Mystery Solver

Unlike supervised learning, here the machine finds patterns in data without being told what to look for. It's like being a detective discovering hidden connections.

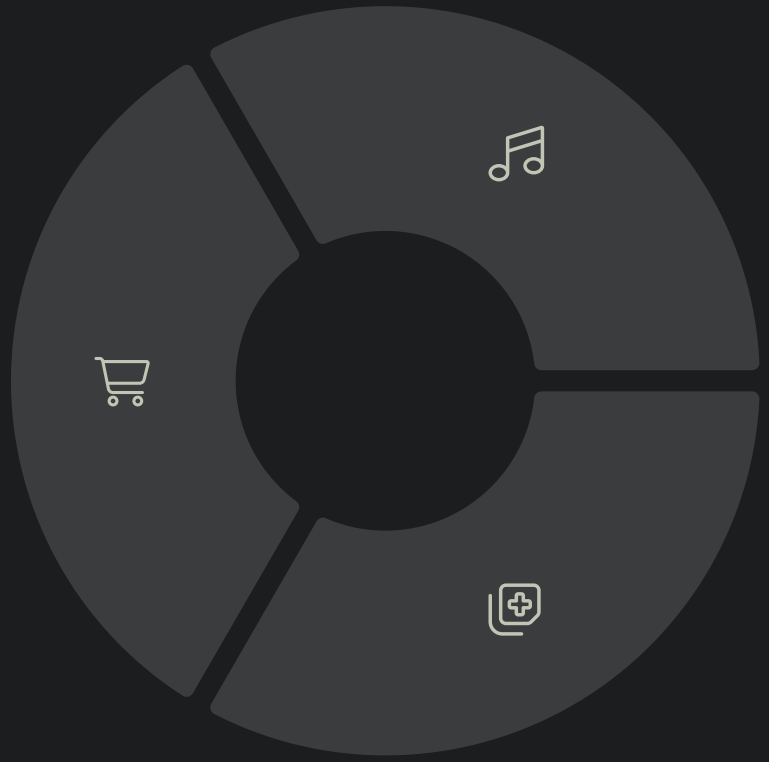
No Right Answers

There are no "correct" labels provided. The algorithm explores data to uncover natural groupings and relationships that humans might miss.

Clustering: Finding Natural Groups

Customer Segmentation

Grouping shoppers by purchasing behavior to create targeted marketing campaigns



Music Recommendations

Spotify groups similar songs to suggest new music you might enjoy

Healthcare Patterns

Identifying patients with similar symptoms to improve diagnosis and treatment

Clustering answers: **"What natural groups exist in this data?"** - without anyone telling the algorithm what groups to look for.

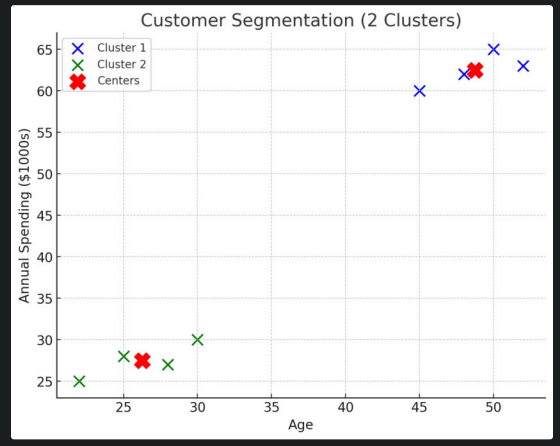
Customer Segmentation with Clustering (2 Groups)

Unsupervised learning automatically groups customers into distinct clusters, revealing hidden patterns without prior knowledge of those groups.

Example Dataset:

#	Age	Annual Spending (1K $)
C1	22	25
C2	25	28
C3	28	27
C4	30	30
C5	45	60
C6	48	62
C7	50	65
C8	52	63

The model analyzes this data to find two natural groups of customers.



This scatterplot illustrates how the clustering algorithm identifies distinct segments: younger, lower-spending customers and older, higher-spending customers.

How Clustering Works (K-Means)

Initial Centers

Randomly place initial cluster centers in the data space.

Assign Points

Each data point is assigned to the nearest cluster center.

Move Centers

Centers are recalculated to be the average position of their assigned points.

Repeat Until Stable

Steps 2 and 3 are repeated until cluster assignments no longer change significantly.

Supervised vs Unsupervised Learning

Aspect	Supervised Learning	Unsupervised Learning
Data Type	Labeled examples with correct answers	Unlabeled data, no correct answers
Main Tasks	Classification & Regression	Clustering & Pattern Discovery
Goal	Predict outcomes for new data	Discover hidden structures
Example	Spam email detection	Customer behavior grouping

Supervised

Learning with examples and answers

Unsupervised

Discovering patterns without guidance

Key Takeaways: AI is Already Around You

Classification

Predicting which category something belongs to

Regression

Predicting numerical values and quantities

Supervised

Learning from examples with correct answers

Unsupervised

Finding hidden patterns without guidance

> **Reflection Question:** Where in your daily life do you notice classification, regression, or clustering? Think about your smartphone apps, online shopping, or streaming services!

Closing Message: AI isn't just science fiction - it's already woven into your daily life. Today you learned the fundamental building blocks that power the smart technology around you. The future is here, and now you understand how it works!

🛠️ How Do We Build an AI Model?

Building an AI model involves a structured, iterative process that applies to various tasks like classification, regression, and clustering:

1. Define the Problem

Clearly state what we aim to predict or discover (e.g., spam email, house price, customer group).

2. Collect Data

Gather relevant, high-quality examples (e.g., emails, housing data, customer information).

3. Exploratory Data Analysis (EDA)

Understand data patterns, distributions, and identify missing values or outliers. For example: "Most houses with more rooms cost more."

4. Preprocessing & Feature Engineering

Clean data, handle missing values, convert data types, and scale or normalize values into usable features.

5. Choose the Right Model

Select the appropriate algorithm for the task: Classification (Decision Trees), Regression (Linear Regression), Clustering (K-Means).

6. Train the Model

Feed the prepared data (and labels if supervised) to the model so it can learn underlying patterns and relationships.

7. Evaluate Performance

Test the model with new data to check its accuracy, error rate, or the quality of its clustering results.

8. Deploy & Use the Model

Integrate the trained model into real-world applications such as spam filters, price predictors, or recommendation engines.

Thank You!
See you next session ...