

# What Are These Two Learning Types?

Machine learning systems can be categorized into two major approaches:

1. **Instance-Based Learning** (a.k.a. **Lazy Learning**)
  2. **Model-Based Learning** (a.k.a. **Eager Learning**)
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## 1. Instance-Based Learning

- **What is it?**
    - This method **memorizes the training data** and uses it to make predictions by comparing new input to stored instances.
    - Think of it like a student who memorizes examples and answers based on how similar the question looks.
  - **Key Features:**
    - Doesn't build a **general model**.
    - Stores the training examples and **relies on similarity** (like distance) to make decisions.
    - Called "**lazy learning**" because learning is delayed until a query is made.
  - **How it works:**
    - Given a new data point, it looks at the **most similar stored examples** (using something like Euclidean distance).
    - Common methods: **k-Nearest Neighbors (k-NN)**
  - **Disadvantages:**
    - **Slow at prediction time**, especially with large datasets.
    - **High memory usage**
    - **Time complexity =  $O(n)$** , where  $n$  is the number of training samples
  - **Highlights:**
    - Focuses on **individual data points**
    - Compares based on **similarity measures**
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## 2. Model-Based Learning

- **What is it?**
  - This method learns from the training data and creates a **generalized model** that can make predictions on unseen data.
  - Like a student who understands the concept and solves new problems using formulas.

➤ **Key Features:**

- Trains a **predictive model** using algorithms (e.g., linear regression, decision trees, neural networks).
- **Faster at prediction time** since the model is ready to use.
- Called "**eager learning**" because learning happens during training.

➤ **Disadvantages:**

- Might **miss fine-grained local patterns**.
- **Initial training takes time** and needs tuning.

➤ **Highlights:**

- Used effectively for placement predictions
- Creates a trained model for decision-making

➤ **Comparison Table**

Feature	Instance-Based Learning	Model-Based Learning
<b>Approach</b>	Memorizes training data	Learns a general model
<b>Learning Time</b>	Fast (lazy)	Slow (eager)
<b>Prediction Time</b>	Slow	Fast
<b>Memory Usage</b>	High	Moderate to low
<b>Example Algorithm</b>	k-Nearest Neighbors (k-NN)	Linear Regression, Decision Tree, etc.
<b>Generalization</b>	Based on similarity	Based on learned model
<b>Use Case</b>	Recommendation systems, pattern matching	Spam detection, placement prediction

## Final Thought:

- **Instance-Based Learning** = Learn nothing now, predict based on examples later.
- **Model-Based Learning** = Learn a pattern now, predict quickly later.

Both are useful depending on the task. Choose:

- **Instance-based** when data is limited and local patterns matter.
- **Model-based** when you need speed, scalability, and generalization.