2. AI Vs ML Vs DL

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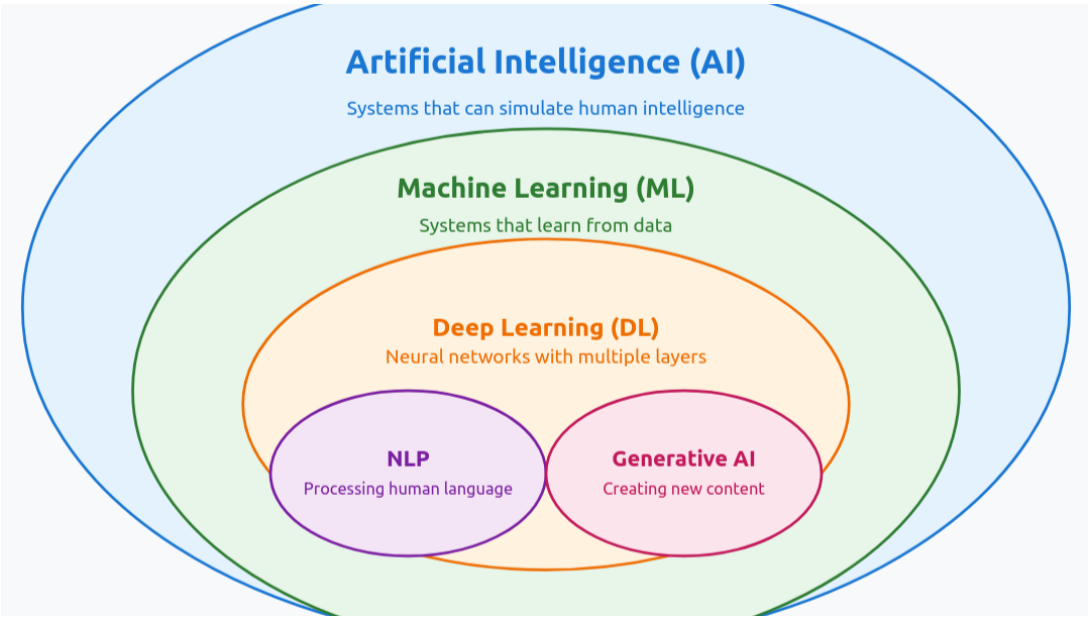

Introduction to Artificial Intelligence (AI)

What is AI?

AI stands for Artificial Intelligence.
The goal of AI is to **make machines intelligent**, similar to the **human brain**, so that they can **think, learn, and make decisions**.
AI is not about making machines human, but about making them **smart enough to solve problems**.

What is Intelligence?

Intelligence is a complex concept, which includes:

- Pattern recognition
- Problem solving
- Logical reasoning
- Learning from experience
- Creativity and imagination
- Emotional intelligence (understanding emotions)

Humans have **general intelligence**, which means we can do many different tasks.

Can We Create Human-Like Intelligence?

- We are trying to create **General Intelligence** like humans
- But it is **very difficult**
- Currently, AI systems are **narrow**:
  - They are good at **specific tasks**
  - Not truly creative or emotional

Today, AI mainly focuses on:

Pattern recognition and decision making

Symbolic AI (Rule-Based AI)

What is Symbolic AI?

- In **Symbolic AI**, we write **explicit rules** for every condition
- Logic is written manually using **if–else**
- Knowledge is hard-coded into the system

From Symbolic AI, **Expert Systems** were created.

Expert Systems

Expert System:

- Knowledge is taken from a **human expert**
- That knowledge is converted into **rules**
- System behaves like an expert

Example:

- **Chess Game**
- Developers take strategies from chess experts
- Encode those strategies into rules

In the **1980s**, expert systems were very popular
People believed:
"The future of AI is expert systems"

Flaws of Expert Systems

Expert systems have **limited capabilities**:

1. **Chess Play**
   - Works only for predefined situations
2. **Language / Pattern Detection**
   - Cannot handle uncertainty
   - Cannot adapt to new cases

Writing rules for every scenario is **not scalable**

Problem Example (Fuzzy Situation)

"Inside an image, find a dog."

- Dog shape varies
- Size, color, angle change
- Writing rules is **impossible**

This is where **Symbolic AI fails**.

Machine Learning (ML)

What is Machine Learning?

Machine Learning is a subset of AI where:

- We do **not write explicit rules**
- We give **data (input + output)**
- The system **learns patterns automatically**

ML replaces **rule-based programming** with **data-based learning**.

Biggest Advantage of Machine Learning

- No need to change code again and again
- Model adapts when data changes
- Can handle complex patterns
- If data changes → **logic changes automatically**

Deep Learning (DL)

Why Deep Learning?

Why Deep Learning?

Question:

If Machine Learning was successful, why do we need Deep Learning?

- ML works well for **simple problems**
- But for **images, speech, text**, ML struggles
- Deep Learning solves **complex, high-dimensional problems**
- After **2012**, Deep Learning became very popular due to:
- Big data
- Powerful GPUs
- Internet & smartphones

What is Deep Learning?

- Deep Learning is a **subset of Machine Learning**
- Uses **deep neural networks**
- Inspired by **biological neurons**

Important:

Deep Learning is inspired by the brain, but it does **not work exactly like the human mind** (We still don't fully understand our brain)

ML vs Deep Learning (Simple Explanation)

Machine Learning

- Features must be **manually given**
- Example:
  - Dog image → ears, tail, color, size
- Developer decides what is important

Deep Learning

- Takes **raw data**
- Automatically extracts features
- Learns hierarchical patterns

Example: Dog vs Cat Image

Machine Learning

- Input features needed:
  - Shape
  - Size
  - Color
  - Texture

Deep Learning

- Input: **raw image**
- Model automatically learns:
  - Edges → shapes → object

Resume Screening Example

Human Thinking

- CGPA
- Backlogs
- Certificates
- Skills

Machine Learning

- You must **pass parameters explicitly**
- Example:
  - CGPA ≥ 8
  - No backlogs

    - No backlogs
    - More than 2 certificates

Deep Learning

- Provide **raw resume text**
- Model learns:
    - Patterns
    - Keywords
    - Context

Important Points About Deep Learning

- More **layers of neurons** → better learning capacity
- More **data** → better performance
- Works best for:
    - Image recognition
    - Speech recognition
    - NLP (text)

In Deep Learning:

More data + deeper network = higher accuracy

Conclusion:

- **AI**: Goal to make machines intelligent
- **Symbolic AI**: Rule-based, expert systems
- **Machine Learning**: Learns patterns from data
- **Deep Learning**: Learns features automatically using neural networks