WEEK 2: MACHINE LEARNING CONCEPTS

DAY 6 (30/06/2025)

Defining the AI Family Tree:

- **Artificial Intelligence (AI):** The broadest field, concerned with creating machines that mimic intelligent behavior.
- **Machine Learning (ML):** A subset of AI where machines gain intelligence by **learning from data** rather than being explicitly programmed for every scenario.
- **Deep Learning (DL):** A subfield of ML that uses specialized architectures called **Neural Networks (NNs)**. These networks have multiple layers (Deep) and are modeled after the human brain's structure.

Introduction to Machine Learning:

Machine learning (ML) allows computers to learn and make decisions without being explicitly programmed. It involves feeding data into algorithms to identify patterns and make predictions on new data. It is used in various applications like image recognition, speech processing, language translation, recommender systems, etc.
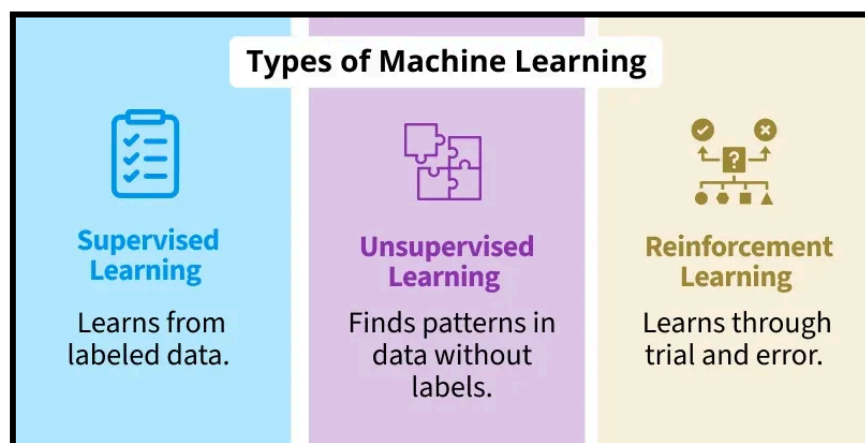
Why do we need Machine Learning?

Traditional programming requires exact instructions and doesn't handle complex tasks like understanding images or language well. It can't efficiently process large amounts of data.

Machine Learning solves these problems by learning from examples and making predictions without fixed rules.

1. Solving Complex Business Problems

Traditional programming struggles with tasks like language understanding and medical diagnosis. ML learns from data and predicts outcomes easily.

Examples:

- Image and speech recognition in healthcare.
- Language translation and sentiment analysis.

2. Handling Large Volumes of Data

The internet generates huge amounts of data every day. Machine Learning processes and analyzes this data quickly by providing valuable insights and real-time predictions.

Examples:

- Fraud detection in financial transactions.
- Personalized feed recommendations on Facebook and Instagram from billions of interactions.

3. Automate Repetitive Tasks

ML automates time-consuming, repetitive tasks with high accuracy hence reducing manual work and errors.

Examples:

- Gmail filtering spam emails automatically.
- Chatbots handling order tracking and password resets.
- Automating large-scale invoice analysis for key insights.

4. Personalized User Experience

ML enhances user experience by tailoring recommendations to individual preferences. It analyses user behavior to deliver highly relevant content.

Examples:

- Netflix suggests movies and TV shows based on our viewing history.
- E-commerce sites recommending products we're likely to buy.

5. Self Improvement in Performance

ML models evolve and improve with more data helps in making them smarter over time. They adapt to user behavior and increase their performance.

Examples:

- Voice assistants like Siri and Alexa learn our preferences and accents.
- Search engines refine results based on user interaction.
- Self-driving cars improve decisions using millions of miles of driving data.

Importance of Data in Machine Learning:

Data is the foundation of machine learning (ML) without quality data ML models cannot learn, perform or make accurate predictions.

- ❖ Data provides the examples from which models learn patterns and relationships.
- ❖ High-quality and diverse data improves how well models perform and generalize to new situations.
- ❖ It helps models to understand real-world scenarios and adapt to practical uses.
- ❖ Features extracted from data are important for effective training.
- ❖ Separate datasets for validation and testing measure how well the model works on unseen data.
- ❖ Data drives continuous improvements in models through feedback loops.