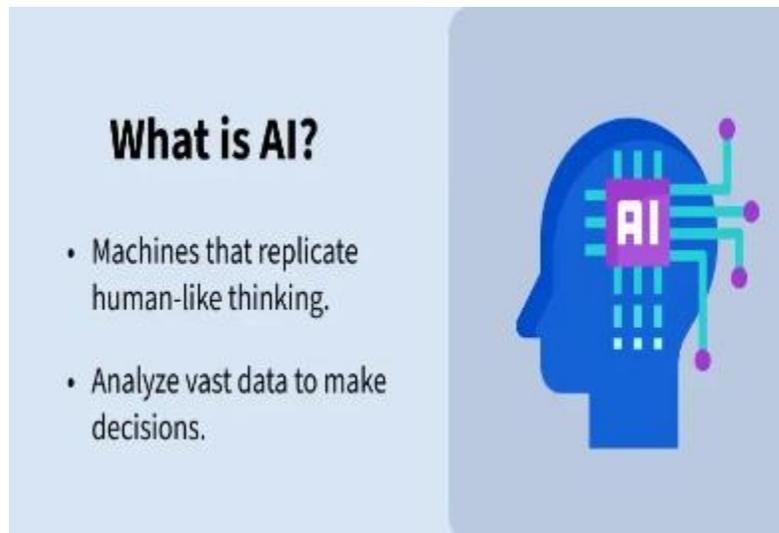


## Unit-1

### Artificial Intelligence (AI)

#### Definition and scope of AI

Artificial Intelligence (AI) is a technology that enables machines and computers to perform tasks that typically require human intelligence. It helps systems learn from data, recognize patterns and make decisions to solve complex problems. It is used in healthcare, finance, e-commerce and transportation offering personalized recommendations and enabling self-driving cars.



#### Core Concepts of AI

AI is based on core concepts and technologies that enable machines to learn, reason and make decisions on their own.

##### 1. Machine Learning (ML)

**Machine Learning** is a subset of artificial intelligence (AI) that focuses on building systems that can learn from and make decisions based on data. Instead of being explicitly programmed to perform a task, a machine learning model uses algorithms to identify patterns within data and improve its performance over time without human intervention.

## 2. Generative AI

Generative AI is designed to create new content whether it's text, images, music or video. Unlike traditional AI which typically focuses on analyzing and classifying data, it goes a step further by using patterns it has learned from large datasets to generate new original outputs. It "creates" rather than just "recognizes."

## 3. Natural Language Processing (NLP)

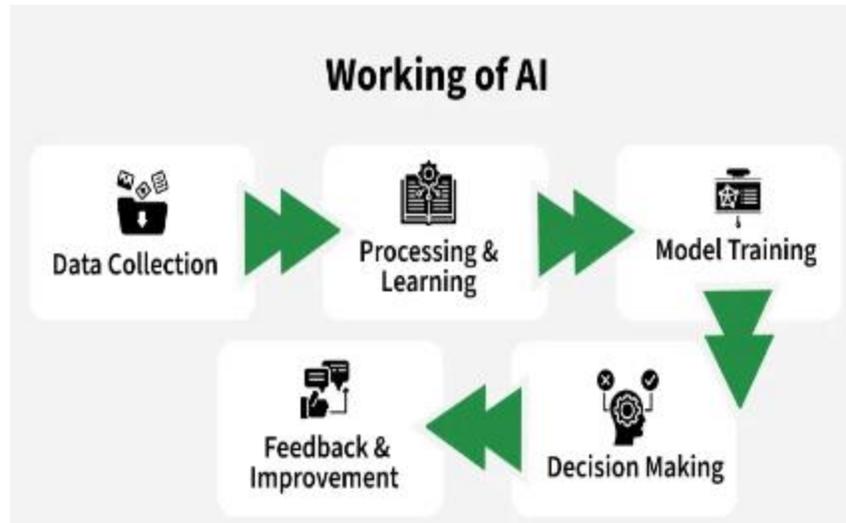
Natural Language Processing (NLP) allows machines to understand and interact with human language in a way that feels natural. It enables speech recognition systems like Siri or Alexa to interpret what we say and respond accordingly. It combines linguistics and computer science to help computers process, understand and generate human language allowing for tasks like language translation, sentiment analysis and real-time conversation.

## 4. Expert Systems

Expert Systems are designed to simulate the decision-making ability of human experts. These systems use a set of predefined "if-then" rules and knowledge from specialists in specific fields to make informed decisions similar to how a medical professional would diagnose a disease. They are useful in areas where expert knowledge is important but not always easily accessible.

## Working of Artificial Intelligence

AI works by simulating intelligent behavior to perform tasks autonomously. The process involves several steps that help machines learn, make decisions and improve over time:

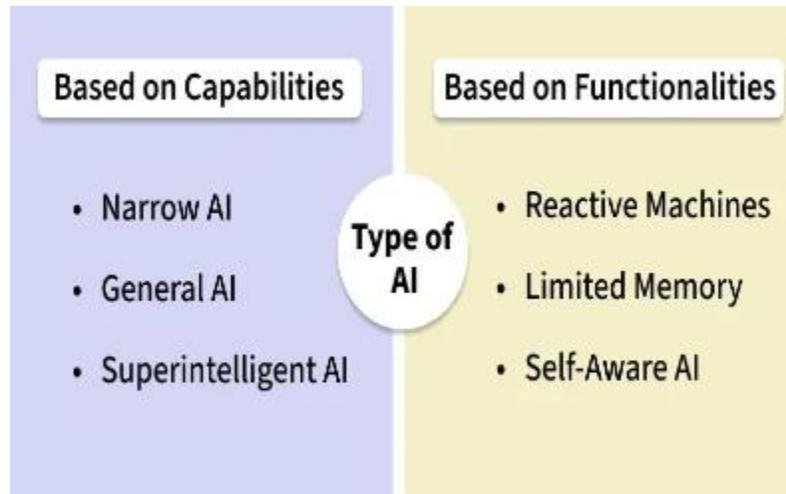


1. **Data Collection:** AI systems rely on large sets of data which could include images, text or sensor readings. For example, teaching an AI to recognize cats, we collect a dataset of labeled cat images.
2. **Processing and Learning:** It uses algorithms to analyze data and identify patterns. For example, it learns to recognize key features like a cat's shape, ears or whiskers helping it understand the data.
3. **Model Training:** The AI model is trained using the data, adjusting its internal settings to improve its predictions. With more data, the model becomes more accurate and better at recognizing new examples like unseen images of cats.
4. **Decision Making:** Once trained, it can use what it has learned to make decisions. For example, it can find whether a new image contains a cat based on the patterns it learned during training.
5. **Feedback and Improvement:** It can improve through feedback, especially in methods like reinforcement learning. In

this case, the AI receives rewards or penalties, refining its ability to make better decisions over time.

## Types of Artificial Intelligence

AI can be classified into two main categories based on its capabilities and functionalities.



### 1. Based on Capabilities:

- **Narrow AI (Weak AI):** This type of AI is designed to perform a specific task or a narrow set of tasks such as voice assistants or recommendation systems. It is good in one area like recommending products or recognizing speech but lacks general intelligence.
- **General AI (Strong AI):** It is a theoretical concept where AI can perform any intellectual task that a human can do. It shows human-like reasoning and understanding across multiple domains, making it capable of tackling a variety of tasks.
- **Superintelligent AI:** It is a hypothetical form of AI that would surpass human intelligence in all areas. It would be capable of performing tasks more efficiently and effectively than humans.

### 2. Based on Functionalities:

- **Reactive Machines:** These AI systems only react to specific tasks without storing past experiences. They don't learn from previous actions but respond in a set way. For example is a

- chess-playing AI that evaluates the board and makes a move based on the current position.
- **Limited Memory:** These AI systems can use past data to improve future decisions. Self-driving cars are a good example, as they use data from previous trips to navigate roads and avoid obstacles.
  - **Theory of Mind:** The theory of mind is a theoretical type of AI that would be able to understand emotions, beliefs, intentions and other mental states. This would allow the AI to interact with humans in a more natural and empathetic manner.
  - **Self-Aware AI:** It is a hypothetical form of AI that possesses consciousness and self-awareness. It would have an understanding of its own existence and could make decisions based on that awareness.

### Advantages of AI

AI offers a range of benefits that improve productivity, decision-making and user experience across multiple sectors. Let's see some key advantages:

1. **Efficiency and Automation:** AI automates repetitive tasks, smoothen workflows and reducing human errors. This helps us save time and concentrate on more strategic and innovative tasks.
2. **Improved Decision Making:** AI's ability to process and analyze large datasets helps businesses and individuals make informed, data-driven decisions. This is beneficial in sectors like healthcare, finance and retail.
3. **Personalization:** It helps personalize experiences by analyzing user preferences and customizing recommendations. This enhances user satisfaction, as seen in platforms like Netflix, Amazon and social media feeds.
4. **24/7 Availability:** Unlike humans, AI can operate continuously without rest, making it ideal for round-the-clock tasks such as customer support, security monitoring and data collection.
5. **Data Analysis and Pattern Recognition:** It is proficient at analyzing large volumes of data and identifying patterns that

may be difficult for humans to recognize. This capability helps in areas like healthcare diagnostics, fraud detection and market analysis.

### **Real-World Applications of AI**

Artificial Intelligence has many practical applications across various industries and domains including:

1. **Healthcare:** AI helps in early diagnosis and treatment recommendations by analyzing medical data such as images and patient history, improving preventative care.
2. **Retail:** It personalizes shopping experiences by recommending products based on user behavior. It also helps optimize inventory management and predict demand, ensuring efficient stock control and better customer satisfaction.
3. **Customer Service:** AI-powered chatbots handle routine customer inquiries, provide support 24/7 and escalate more complex issues to human agents. This improves efficiency and reduces wait times, enhancing overall customer experience.
4. **Manufacturing:** It improves production efficiency by predicting machine maintenance needs, preventing downtime and also enhances supply chain management by forecasting demand, optimizing operations and reducing waste.
5. **Finance:** AI in finance detects fraud, analyzes market data and automates risk management. It also assists in personalized investment advice, helping individuals make smarter financial decisions.