

Artificial Intelligence

Lecture-3

- **Introduction to AI**
 - ▶ Foundations of Artificial Intelligence

- *Prepared by:*

Md. Mijanur Rahman, Prof. Dr.

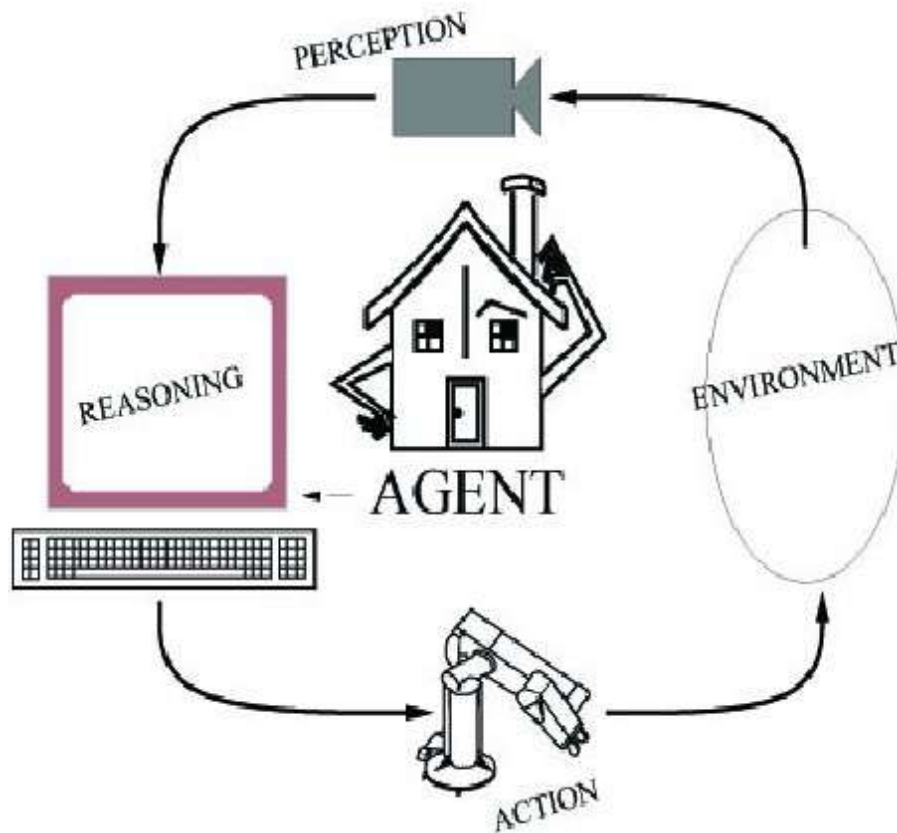
Dept. of CSE, Jatiya Kabi Kazi Nazrul Islam University

Email: mijanjkniu@gmail.com

Outlines

- **Today's lecture will be covered the topics of**
 - Components of AI System
 - How does Artificial Intelligence work?
 - Fundamental Techniques of AI
 - Types of AI
 - AI in Everyday Life

Components of AI System...



Block diagram of a traditional AI Agent

An agent perceives its environment through sensors and acts on the environment through actuators.

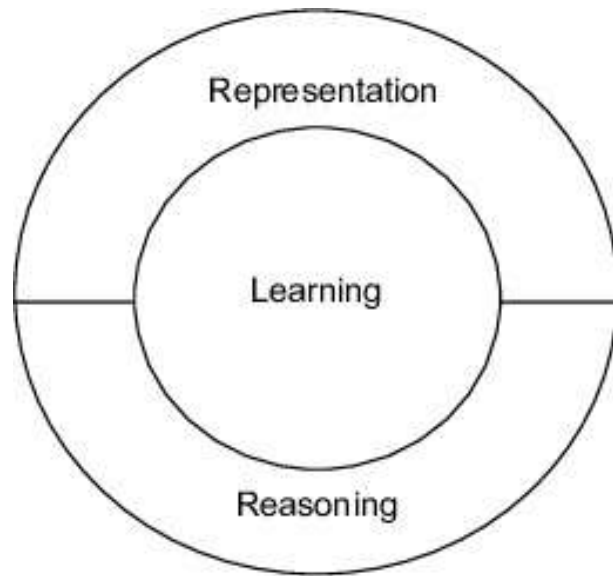
Human: sensors are eyes, ears, actuators (effectors) are hands, legs, mouth.

Robot: sensors are cameras, sonar, lasers, ladar/lidar, bump, effectors are grippers, manipulators, motors

The agent's behavior is described by its **function that maps percept to action.**

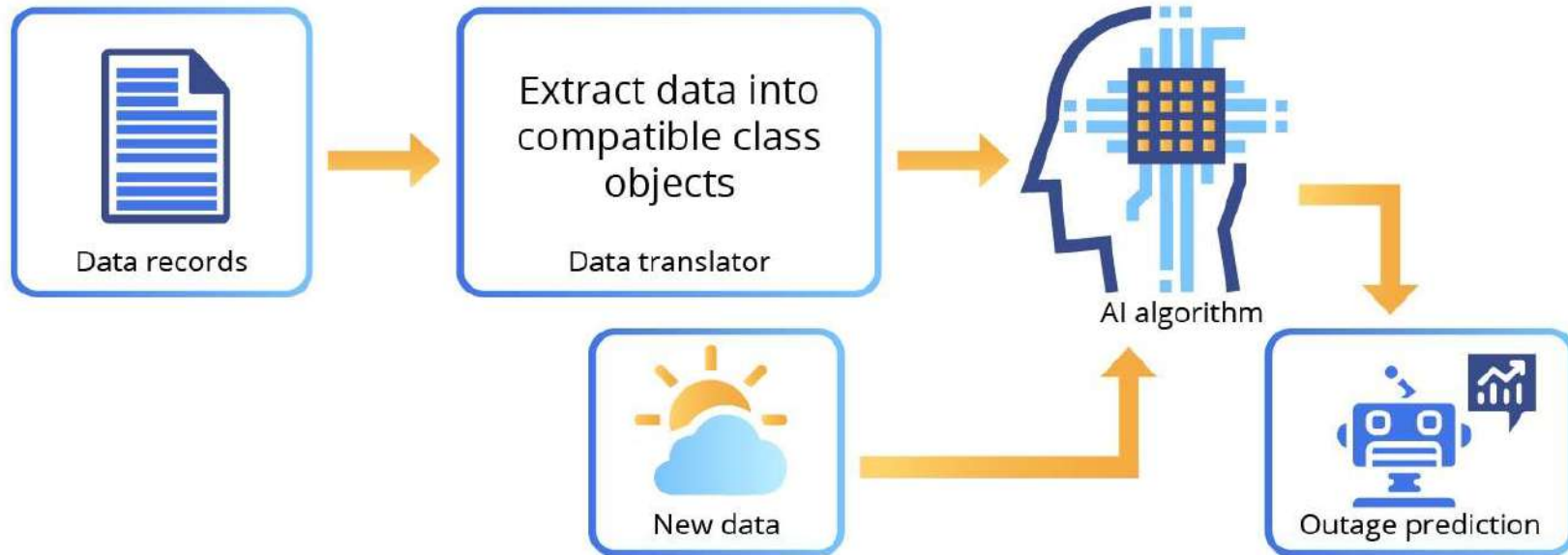
Components of AI System

- The three key components of an AI system are:
 - Representation
 - Learning
 - Reasoning



How does Artificial Intelligence work?

Computers are good at following processes, i.e., sequences of steps to execute a task. If we give a computer steps to execute a task, it should easily be able to complete it. The steps are nothing but algorithms. An algorithm can be as simple as printing two numbers or as difficult as predicting who will win elections in the coming year! The second one is AI algorithm.



Fundamental Techniques of AI...

- **AI systems can be broken into:**

- **Search**
- **Knowledge Representation**
- **Applications of the above**

- ▶ Search deals with the idea of where to look for solutions.
- ▶ Knowledge representation deals with finding a means of encoding knowledge so that a machine can use it.
- ▶ Expert systems have to work with a knowledge base as do many other reasoning tasks. Tasks such as planning, reasoning, learning, understanding basically involve some **searching and perhaps updating of a knowledge base**. Tasks such as vision, natural language understanding, speech recognition and robot planning involve **searching knowledge also**.

Fundamental Techniques of AI...

- **Search**

- ▶ How can we model the problem search space
- ▶ How can we move between steps in a decision making process?
 - How can you find the info you need in a large data set?
 - Given a choice of possible decision sequences, how do you pick a good one?
 - Heuristic functions
- ▶ Given a goal, how do you figure out what to do (planning)?
- ▶ Base-level versus meta-level reasoning
 - How can we reason about what step to take next (in reaching the goal)?
 - How much do we reason before acting?

Fundamental Techniques of AI

- **Knowledge Representation**

- ▶ Knowledge representation deals with finding a means of encoding knowledge so that a machine can use it.
- ▶ Intelligence/intelligent behavior requires knowledge, which is:
 - Voluminous
 - Hard to characterize
 - Constantly changing
- ▶ How can one capture formally (i.e., computerize) everything needed for intelligent behavior? Some questions...
 - How do you store all of that data in a useful way?
 - Can you get rid of some?
 - How can you store decision making steps?
- ▶ Characteristics of good data representation techniques:
 - Captures general situation rather than being overly specific
 - Understandable by the people who provide it
 - Easily modified to handle errors, changes in data, and changes in perception
 - Of general use

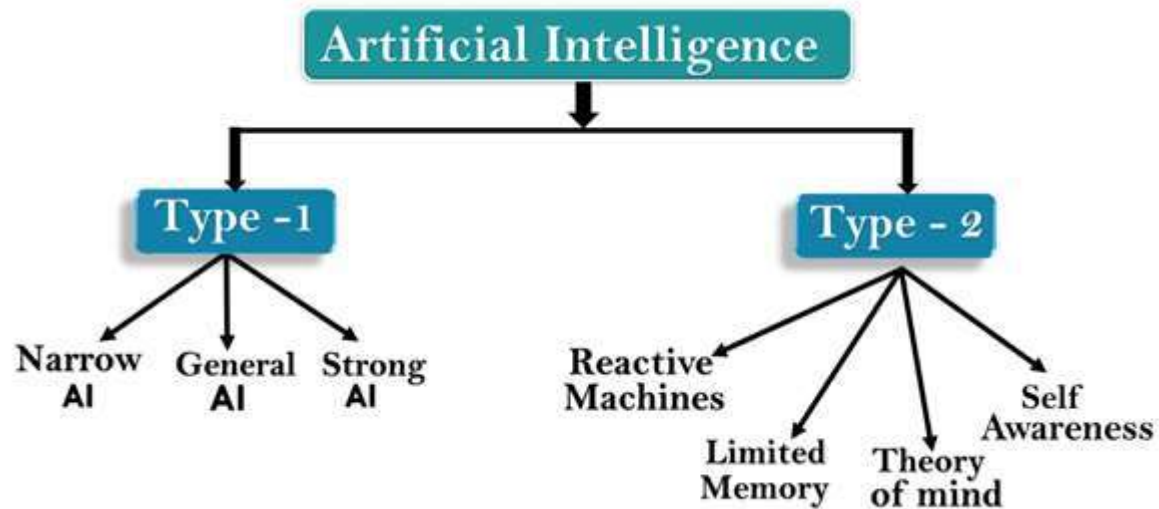
Types of AI...

- Artificial intelligence (AI) is the mainstream. It's like, how Google ranks pages, Amazon knows what we like, bots like Siri chat, and computers play Chess and so on.
- The AI landscape is crowded, so, how do we make sense of everything. How do we categorize the types of AI?
- As we know, the definition of AI is “AI mimics human intelligence or behavior”. With a definition this vague, it's no wonder AI is a confusing topic.

Types of AI...

- We can categorise AI in several ways, including:
 - Its capacity to mimic human characteristics.
 - The technologies enabling human characteristics to be mimicked.
 - The real-world applications of the system.
 - Theory of Mind.

Types of AI...



Type-1 (Based on Ability/Capabilities):

- Artificial Narrow Intelligence (ANI)
- Artificial General Intelligence (AGI), and
- Artificial Super Intelligence (ASI)

Type-2 (Based on Functionality):

- Reactive AI Machines
- Limited Memory AI
- Theory of Mind AI, and
- Self Awareness AI

Types of AI...

Type-1 Artificial Intelligence (AI) [Based on Ability]

- **Narrow AI:**
 - Narrow AI is a type of AI which is able to perform a dedicated task with intelligence, as it is only trained for one specific task.
 - The most common and currently available AI is Narrow AI in the world of Artificial Intelligence. It is also known as **Weak AI**.
 - Apple Siri is a good example of Narrow AI. IBM's Watson supercomputer also comes under Narrow AI, as it uses an Expert system approach combined with Machine learning and natural language processing.
 - Some Examples of Narrow AI are: playing chess, purchasing suggestions on e-commerce site, self-driving cars, speech recognition, image recognition, and voice assistants (only act upon voice commands).

Types of AI...

Type-1 Artificial Intelligence (AI) [Based on Ability]

- **General AI:**
 - General AI is a type of intelligence which could perform any intellectual task with efficiency like a human. The idea behind the general AI to make such a system which could be smarter and think like a human by its own.
 - Currently, there is no such system exist which could come under general AI and can perform any task as perfect as a human.
 - The worldwide researchers are now focused on developing machines with General AI. As systems with general AI are still under research, and it will take lots of efforts and time to develop such systems.

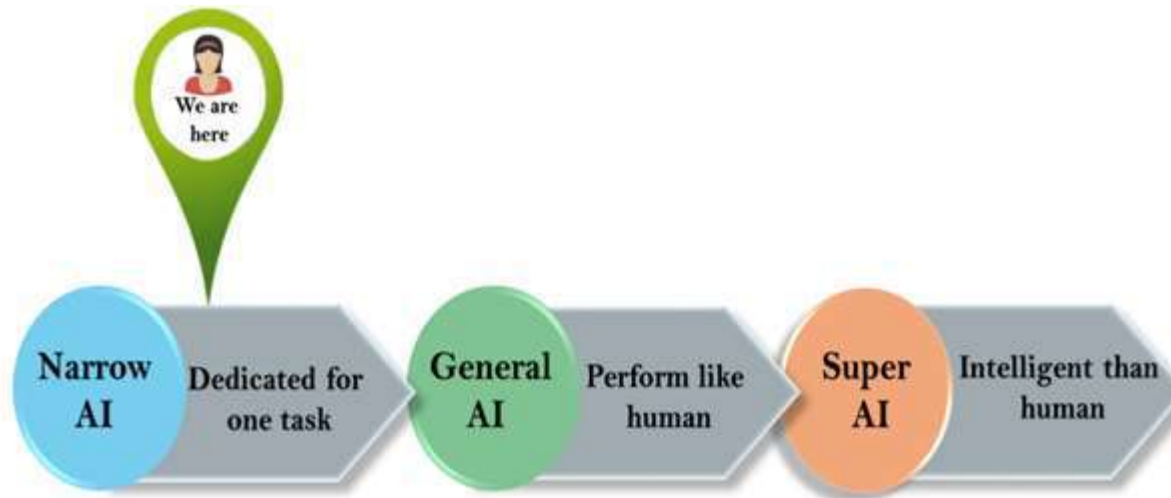
Types of AI...

Type-1 Artificial Intelligence (AI) [Based on Ability]

- **Super AI:**
 - Super AI is a level of Intelligence of Systems at which machines could surpass human intelligence, and can perform any task better than human with cognitive properties. it can think about abstractions which are IMPOSSIBLE for humans to think. It is an outcome of general AI.
 - Some key characteristics of strong AI include capability include the ability to think, to reason, solve the puzzle, make judgments, plan, learn, and communicate by its own.
 - Super AI is still a hypothetical concept of Artificial Intelligence. Development of such systems in real is still world changing task.

Types of AI...

Type-1 Artificial Intelligence (AI) [Based on Ability]



Types of AI...

Type-2 Artificial Intelligence (AI) [Based on functionality]

- **Reactive Machines**
 - Purely reactive machines are the most basic types of Artificial Intelligence.
 - Such AI systems do not store memories or past experiences for future actions. These machines only focus on current scenarios and react on it as per possible best action.
 - For example: IBM's Deep Blue system and Google's AlphaGo

Types of AI...

Type-2 Artificial Intelligence (AI) [Based on functionality]

- **Limited Memory AI**
 - Limited memory machines can store past experiences or some data for a short period of time. These machines can use stored data for a limited time period only.
 - Self-driving cars are one of the best examples of Limited Memory systems. These cars can store recent speed of nearby cars, the distance of other cars, speed limit, and other information to navigate the road.

Types of AI...

Type-2 Artificial Intelligence (AI) [Based on functionality]

- **Theory of Mind AI**
 - Theory of Mind AI should understand the human emotions, people, beliefs, and be able to interact socially like humans.
 - This type of AI machines are still not developed, but researchers are making lots of efforts and improvement for developing such AI machines.

Types of AI

Type-2 Artificial Intelligence (AI) [Based on functionality]

- **Self-Awareness AI**
 - Self-awareness AI is the future of Artificial Intelligence. These machines will be super intelligent, and will have their own consciousness, sentiments, and self-awareness. These machines will be smarter than human mind.
 - Self-Awareness AI does not exist in reality still and it is a hypothetical concept.

AI in Everyday Life

- **AI techniques are used in many common applications**
 - ▶ Intelligent user interfaces
 - ▶ Search Engines
 - ▶ Spell/grammar checkers
 - ▶ Context sensitive help systems
 - ▶ Medical diagnosis systems
 - ▶ Regulating/Controlling hardware devices and processes (e.g, in automobiles)
 - ▶ Voice/image recognition (more generally, pattern recognition)
 - ▶ Scheduling systems (airlines, hotels, manufacturing)
 - ▶ Error detection/correction in electronic communication
 - ▶ Program verification / compiler and programming language design
 - ▶ Web search engines / Web spiders
 - ▶ Web personalization and Recommender systems (collaborative/content filtering)
 - ▶ Personal agents
 - ▶ Customer relationship management
 - ▶ Credit card verification in e-commerce / fraud detection
 - ▶ Data mining and knowledge discovery in databases
 - ▶ Computer games

THE END

Introduction to Artificial Intelligence