Chapter Three

Intoroduction to Artificial Intelligence

Outline

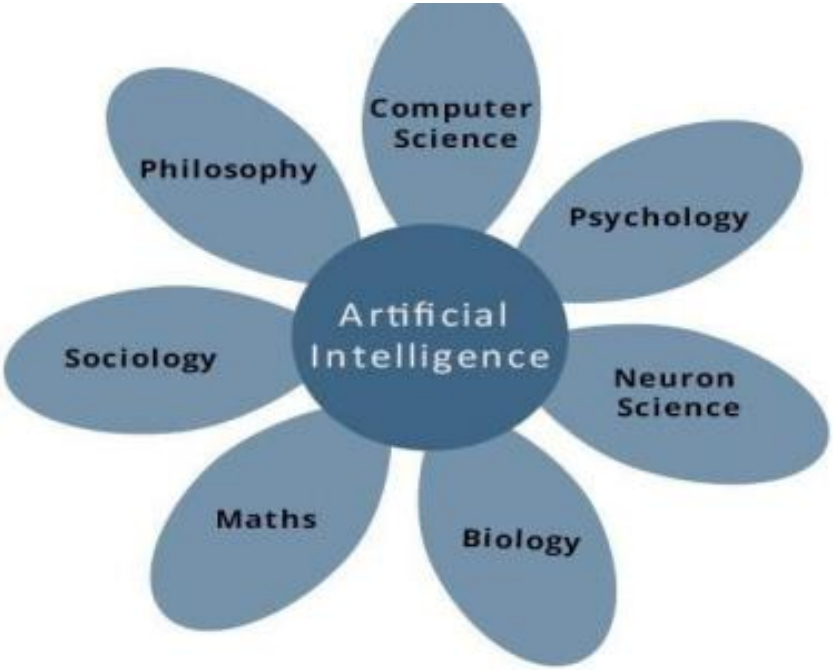
- Overview of AI
- Components of AI Systems
- History of AI
- Types of AI
- Appliations of AI

Overview of AI

- It is started in 1950's by computer scientists
- The goal is creating machine with human capablities
  - Natural language, reasoning, learning etc
- Later, it become a multidisciplinary field with applications in nearly every aspect of human life.

Creating intellegent machine requires understanding the nature of

- knowledge representation,
- reasoning,
- learning,
- perception, and
- problem solving.



What is Artificial Intelligence?

- *The field of Artificial Intelligence started to answer the question:*
  - *"is it possible to build a machine that has intelligence, specifically a human level of intelligence?"*
- Some definations of Artificial Intelligence
  - "The science and engineering of making intelligent machines, especially intelligent computer programs."
  - AI is the creation of a computer program that can learn to think and function on its own, kind of like robots that don't need to be told what to do all the time.
  - "The theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages. "

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- Most advanced AI systems use machine learning technology to analyze current conditions and learn from experience.

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- **Examples** of technologies that uses AI
  - Machine Learning
  - Robotics
  - Machine Automation
  - Virtual Reality
  - Cloud Computing
  - Augmented Reality
  - Neural Networks
  - Big Data
  - Internet of Things
  - Computer Vision

Components of an AI System

1. **Applications**: Image recognition, Speech recognition, Chatbots, Natural language generation, and Sentiment analysis.
2. **Types of Models**: Machine learning, Deep learning, and Neural Networks.
3. **Software/Hardware for training and running models**: Graphic Processing Units (GPUs), Parallel processing tools (like Spark), Cloud data storage and computer platforms.
4. **Programming languages for building models**:
   - Python, TensorFlow, Java, and C/C++, etc.

History of Artificial Intelligence (AI)

- AI formally initiated in 1956 and the name **AI** was coined by **John McCarthy**.
  - However, other efforts were there before him
- The advent of general purpose computers provided a vehicle for creating artificially intelligent entities.
  - Used for solving general-purpose problems
- Which one is preferred?
  - General purpose problem solving systems
  - Domain specific systems

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Year	Description
1956	The term "artificial intelligence" is coined by John McCharty at a Dartmouth conference and ***AI is founded as an academic discipline***
1956–1974	***The golden years of AI enjoy government funding*** in promising, logic-based problem-solving approaches.
1974–1980	Overly high expectations coupled with the limited capacities of AI programs leads to ***the first "AI winter"***, with ***reduced funding and interest in AI research.***
1980–1987	***The rise of knowledge-based expert systems*** brings new successes and a change in the focus of research and funding toward this form of AI.
1987–1993	***The second "AI winter" starts*** with the sudden collapse of the specialized hardware industry in 1987. The AI hype brings with it negative perceptions by governments and investors, ***as expert systems show their limitations and prove expensive to update and maintain.***

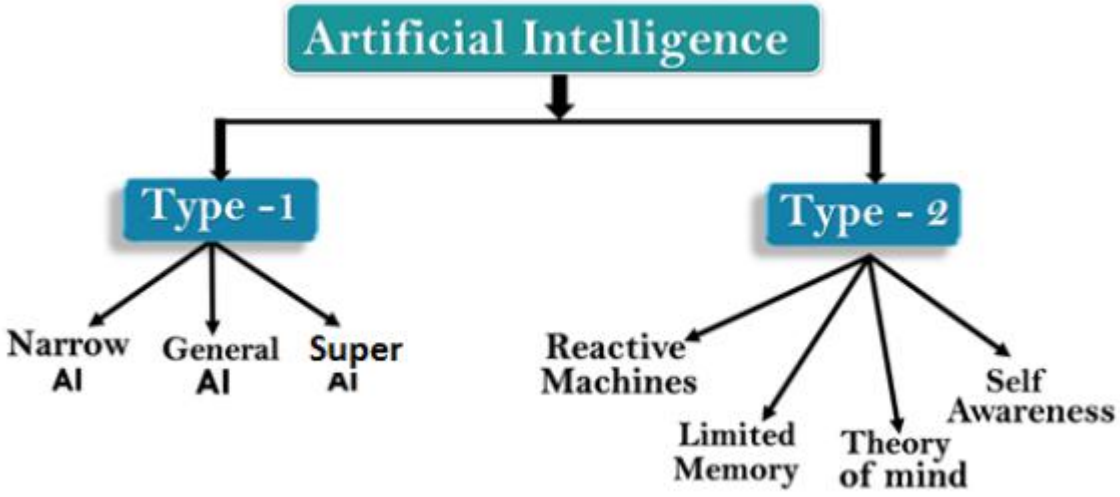
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1993–2011	***Optimism about AI returns and increases.*** New successes are marked with the help of ***increased computational power and AI becomes data-driven.***
	In 1997, IBM's ***DeepBlue*** beats world champion Gary Kasparov at ***chess***.
	In 2002, **Amazon** uses automated systems to provide ***recommendations.***
	In 2011, ***Apple releases Siri*** and ***IBM Watson beats*** two human champions at the ***TV quiz*** Jeopardy.
2012–today	Increased availability of data, connectedness and computational power allow for breakthroughs in machine learning, mainly in neural networks and deep learning, heralding ***a new era of increased funding and optimism about the AI potential.***
	In 2012, ***Google driverless cars*** navigate autonomously and in ***2016 Google AlphaGo*** beats a world champion in the complicated board game Go.

Types of AI systems

There are mainly two types of main categorization which are based on

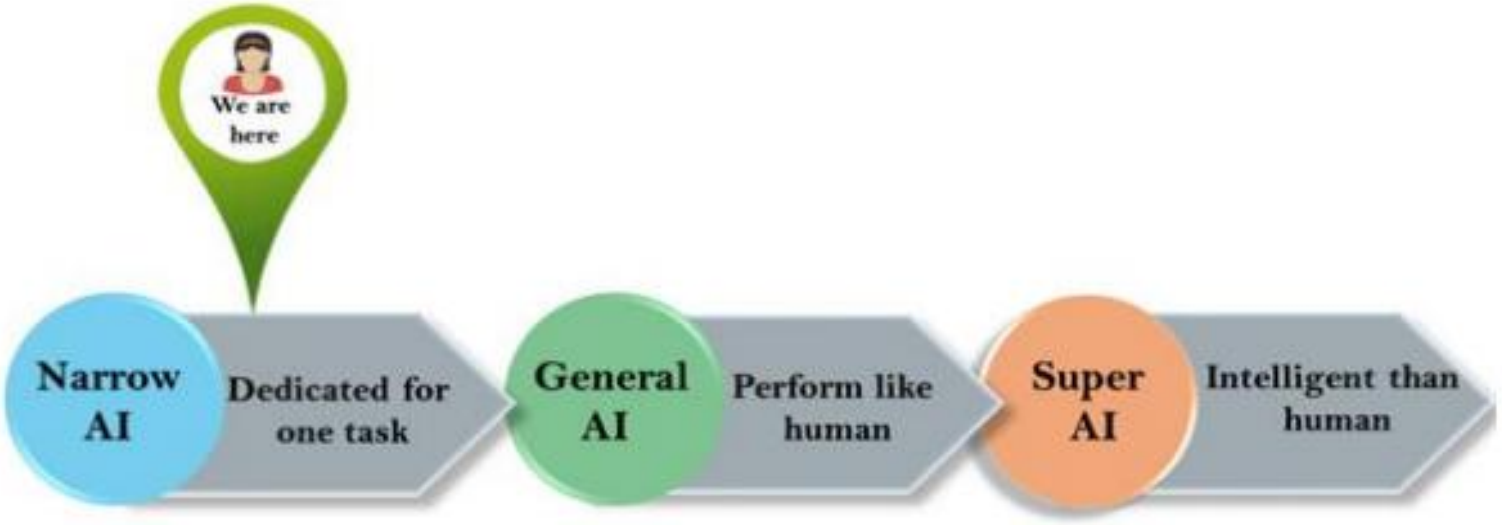
- Capabilities (Type1) and
- Functionally of AI (Type-2)



Types of Artificial Intelligence(AI)

Based on the level of intelligence embedded into a machine(based on capablities).

1. **Artificial Narrow Intelligence (Weak AI or Narrow AI)**
2. **Artificial General Intelligence (General AI or Strong AI)**
3. **Artificial Super Intelligence (Super AI)**



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1. Artificial Narrow Intelligence (Weak AI or Narrow AI)

- a type of AI which is able to perform a dedicated task with intelligence.
- The most common and currently available.
- It is only trained for one specific task, cannot perform beyond its field or limitations

Example of narrow AI

- Playing chess,
- Purchasing suggestions on e-commerce site,
- Self-driving cars,
- Speech recognition, and
- Image recognition.

2. Artificial General Intelligence (General AI or Strong AI)

- A type of intelligence which could perform any intellectual task with efficiency like a human.
- The idea is to make a system which could be smarter and think like a human by its own.
- General AI systems are still under research.

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3. Artificial Super Intelligence (Super AI)

- System that can perform any task better than human with cognitive properties.
  - machines could surpass human intelligence
- It is an outcome of general AI.
- Super AI is still a hypothetical concept of Artificial Intelligence
  - Development of such systems in real is still world changing task.

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- Classification of AI based on functnalities(Type-2)
  1. **Reactive Machines**: Purely reactive machines are the most basic types of Artificial Intelligence.
  - 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.
  - ***IBM's Deep Blue*** system and Google's ***AlphaGo*** is an example of reactive machines.

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2. **Limited Memory**:

- 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.

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3. Theory of Mind: 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
  - It is under development and improvements
- ***Sophia*** – the humanoid robot is one example of such effort where a number of young Ethiopians have contributed on the development.

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4. Self–Awareness:

- 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.
- It does not exist in reality still and it is a hypothetical concept.

Questions

- Which type of AI system understand human emotions

  A. Reactive B.Theory of mind

  C. limited memory D. All

- Pick two AI systems that are better in use today that others

  A. Reactive B.Theory of mind

  C. limited memory D. Self-awared systems

Applications of AI

- AI is being applied across several industries.
- However, AI isn't replacing humans
  - just making the work of human beings more efficient.

1. Agriculture

AI technologies are being used in agriculture to

- *yield healthier crops*,
- *control pests*,
- *monitor soil and growing conditions*,
- *organize data for farmers* and
- improve a wide range of agriculture-related tasks in the entire food supply chain.

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Applications of AI in agriculture can be classified into 3 broad categories:

1. **Agricultural Robots**

- Autonomous robots to handle essential agricultural tasks such as ***harvesting crops at a higher volume*** and ***faster pace*** than ***human laborers.***
- Examples of AI applications in the agriculture sector.
  - **See & Spray Robot**
    - Precise spraying of weeds
    - help prevent herbicide resistance.
  - **Harvest CROO Robotics**
    - Crop Harvesting robot helps to address challenges in the labor force.

2. Crop and Soil Monitoring

Applies computer vision and deep learning algorithms to process data captured by drones and/or software-based technology to monitor crop and soil health.

- ***Example:***
  - PEAT, a Burline based startup, has developed a deep learning application called ***Plantix*** that reportedly **identifies potential defects** and **nutrient deficiencies** in soil.

3.Predictive Analytics

Machine learning models are being developed to *track and predict various environmental impacts on crop yield such as weather changes.*

i) aWhere – uses machine learning algorithms in connection with satellites to predict weather, analyze crop sustainability and evaluate farms for the presence of diseases and pests.

ii) FarmShots – focused on analyzing agricultural data derived from images captured by satellites and drones to detect diseases, pests, and poor plant nutrition on farms.

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2. **Health**

- AI revolutionizing how the health sector works to reduce spending and improve patient outcomes.
- Companies are applying machine learning to *make better and faster diagnoses than humans.*
- One example of healthcare technologies is ***IBM Watson.***
  - Understands Natural language
  - Makes hypothesis after mining petient's data with confidence score
- Other AI applications include chatbots.

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Areas where AI is used in health care include:

1. **Personal Health Virtual Assistant**

Examples of AI applications in the health sector.

- **Dip.io**
- **Apple Watch**

2. **Medical Imaging Analysis**

- Examine medical images like X-rays, CT scans, MRIs, etc. and can *provide feedback on what it thinks a human eye can miss.*
- **Examples of such applications**
  - **IBM Watson**
  - **IDx** software
  - Viz.ai

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3. **Precision Medicine**
   - *Diagnose the disease from the information obtained from the DNA.*
   - **Predict the health issues the patients might face based on their genes.**
4. **Healthcare Bots**
   - Helps to schedule appointments with the patient's healthcare provider.
   - These bots can help patients with their medication as well.
   - improve customer service by offering 24 x 7 support
5. **Operational applications of AI**
   - managing health care centers is very complex
   - AI helps with high utilization of assets and low wait times for patients

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3. Business (Emerging market)

- AI augment human intelligence and to radically alter *how we access products and services*, gather information, *make products,* and interact.

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Examples of AI applications in the Business sector.

- **Improve Customer Services**
- **Improve Marketing and Advertising**
- **Optimize Logistics**
- **Predict Performance**
- **Predict Behavior**
- **Manage and Analyze Data**
- **Automate Workloads**
- **Increase Manufacturing Output and Efficiency**
- **Prevent Outages**

4. **Education**

- AI can automate grading, giving educators more time, and can also assess students and adapt to their needs, helping them work at their own pace.
- AI tutors can provide additional support to students, ensuring they stay on track.

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Examples of AI applications in the Education sector.

- **Administrative Tasks Automation**
- **Smart Content**
- **Smart Tutors and Personalization**
- **Virtual Lectures and Learning Environment**
- **Teachers' Support**
- **Students' Communication**

Next Time!

Chapter 4: Internet of Things (IoT)