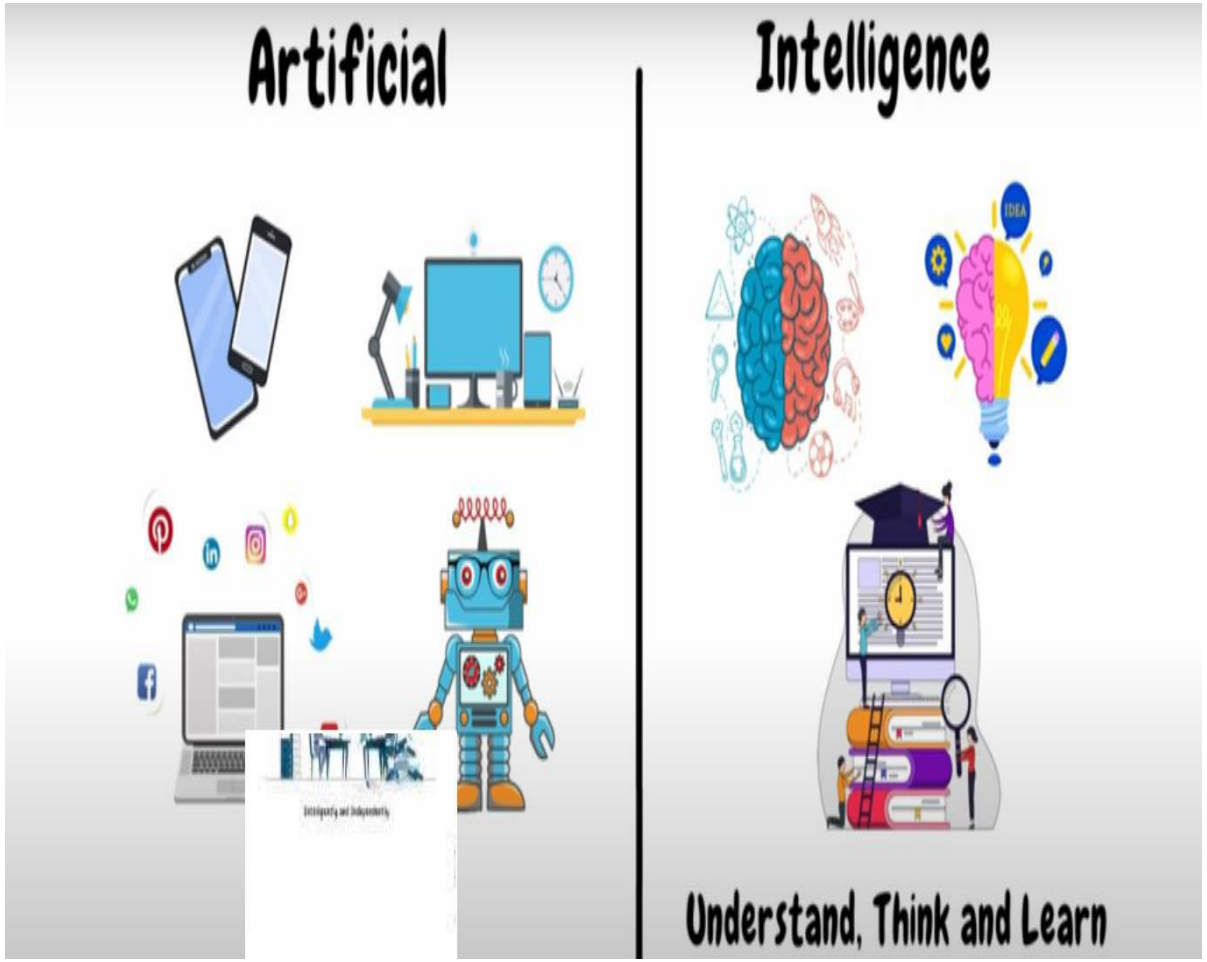
Introduction to Artificial Intelligence

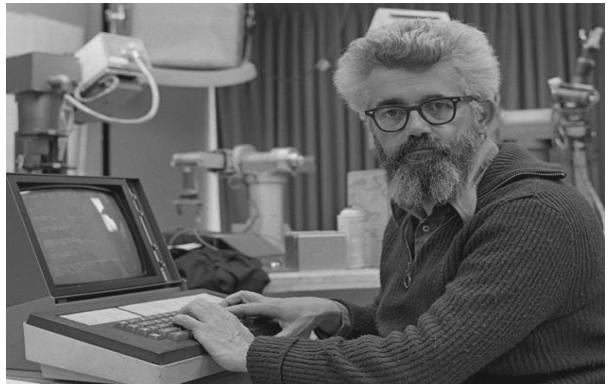
Agenda

- Basics of AI
- Applications of AI
- Agents and Environment
- The Nature of Environment.



Basics of AI

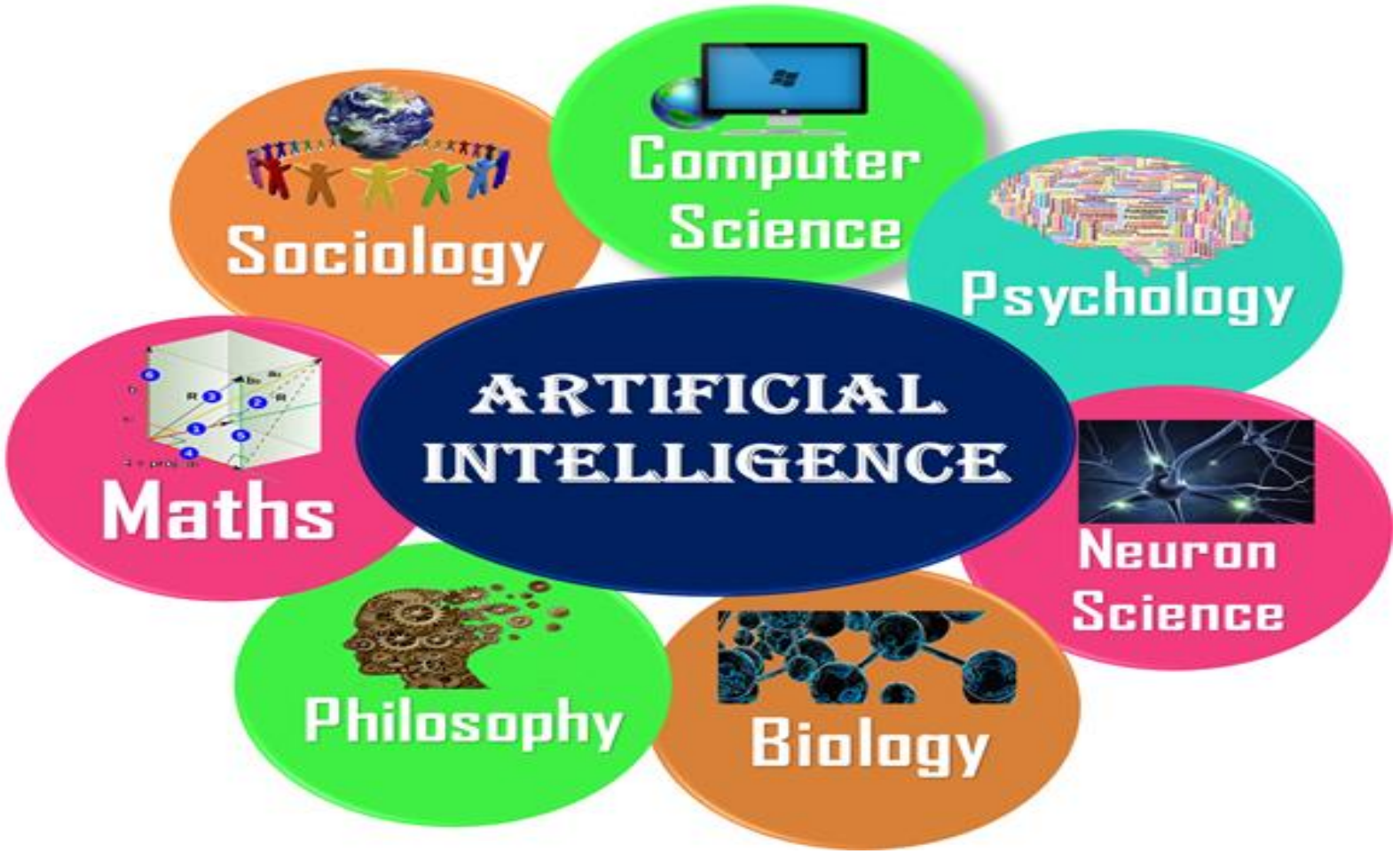
- In 1956, The word "Artificial Intelligence" first adopted by American Computer scientist John McCarthy at the Dartmouth Conference. For the first time, AI coined as an academic field.
- Artificial Intelligence is an approach to make a computer, a robot, or a product to think how smart humans think.
- AI is a study of how the human brain thinks, learns, decides and works, when it tries to solve problems. And finally this study outputs intelligent software systems.
- The aim of AI is to improve computer functions which are related to human knowledge, for example, reasoning, learning, and problem-solving.



John McCarthy developed AI

- Artificial Intelligence is composed of two words **Artificial** and **Intelligence**, where Artificial defines *"man-made,"* and intelligence defines *"thinking power"*, hence AI means *"a man-made thinking power.“*
- Definition of AI : It is a branch of computer science by which we can create intelligent machines which can behave like a human, think like humans, and able to make decisions.
- By IBM developer: AI is about imparting the ability to think and learn on the machines.
- Some definitions of AI. they are organized into four categories as below:
    1. Systems that think like humans.
    2. Systems that think rationally.
    3. Systems that act like humans.
    4. Systems that act rationally.
- Artificial Intelligence exists when a machine can have human based skills such as learning, reasoning, and solving problems.

- To achieve the above factors for a machine or software Artificial Intelligence requires the following discipline:



Why Artificial Intelligence?

Before Learning about Artificial Intelligence, we should know that what is the importance of AI and why should we learn it. Following are some main reasons to learn about AI:

- With the help of AI, you can create such software or devices which can solve real-world problems very easily and with accuracy such as health issues, marketing, traffic issues, etc.
- With the help of AI, you can create your personal virtual Assistant, such as Google Assistant, Siri, Windows 10 Cortana, etc.
- With the help of AI, you can build such Robots which can work in an environment where survival of humans can be at risk.
- AI opens a path for other new technologies, new devices, and new Opportunities.

https://www.youtube.com/watch?v=D5VN56jQMWM

Advantages of Artificial Intelligence

- **Reduction in Human Error:**

The phrase "**human error**" was born because humans make mistakes from time to time. Computers, however, do not make these mistakes if they are programmed properly. With Artificial intelligence, the decisions are taken from the previously gathered information applying a certain set of algorithms. So errors are reduced and the chance of reaching accuracy with a greater degree of precision is a possibility.

Example: In Weather Forecasting using AI they have reduced the majority of human error.

- **Takes risks instead of Humans:**

This is one of the biggest advantages of Artificial intelligence. We can overcome many risky limitations of humans by developing an AI Robot which in turn can do the risky things for us. Let it be going to mars, defuse a bomb, explore the deepest parts of oceans, mining for coal and oil, it can be used effectively in any kind of natural or man-made disasters.

Example: Have you heard about the **Chernoby**l nuclear power plant explosion in Ukraine? At that time there were no AI-powered robots that can help us to minimize the effect of radiation by controlling the fire in early stages, as any human went close to the core and was dead in a matter of minutes.

AI Robots can be used in such situations where intervention can be hazardous.

- **Helping in Repetitive Jobs:**

In our day-to-day work, we will be performing many repetitive works like sending a thank you mail, verifying certain documents for errors and many more things. Using artificial intelligence we can productively automate these mundane tasks and can even remove "**boring**" tasks for humans and free them up to be increasingly creative.

Example: In banks, we often see many verifications of documents to get a loan which is a repetitive task for the owner of the bank. Using AI Cognitive Automation the owner can speed up the process of verifying the documents by which both the customers and the owner will be benefited.

- **Digital Assistance:**

Some of the highly advanced organizations use digital assistants to interact with users which saves the need for human resources. The digital assistants are also used in many websites to provide things that users want. We can chat with them about what we are looking for. Some chatbots are designed in such a way that it's become hard to determine that we're chatting with a chatbot or a human being.

Example: We all know that organizations have a customer support team that needs to clarify the doubts and queries of the customers. Using AI the organizations can set up a Voice bot or Chatbot which can help customers with all their queries. We can see many organizations already started using them on their websites and mobile applications.

- **Faster Decisions:**

Using AI alongside other technologies we can make machines take decisions faster than a human and carry out actions quicker. While taking a decision humans will analyze many factors both emotionally and practically but an AI-powered machine works on what it is programmed and delivers the results in a faster way.

Example: We all have played Chess games in Windows. It is nearly impossible to beat the CPU in the hard mode because of the AI behind that game. It will take the best possible step in a very short time according to the algorithms used behind it.

- **Daily Applications:**

Daily applications such as Apple's **Siri**, Windows **Cortana**, Google's **OK Google** are frequently used in our daily routine whether it is for searching a location, taking a selfie, making a phone call, replying to a mail and many more.

Example: Around 20 years ago, when we are planning to go somewhere we used to ask a person who already went there for the directions. But now all we have to do is say "**OK Google** where Visakhapatnam is". It will show you Visakhapatnam's location on google map and the best path between you and Visakhapatnam.

- **New Inventions:**

AI is powering many inventions in almost every domain which will help humans solve the majority of complex problems.

Example: Recently doctors can predict breast cancer in the woman at earlier stages using advanced AI-based technologies.

Disadvantages of Artificial Intelligence

- **High Cost**:

  The hardware and software requirement of AI is very costly as it requires lots of maintenance to meet current world requirements.

- **Can't think out of the box**:

  Even we are making smarter machines with AI, but still they cannot work out of the box, as the robot will only do that work for which they are trained, or programmed.

- **No feelings and emotions**:

  AI machines can be an outstanding performer, but still it does not have the feeling so it cannot make any kind of emotional attachment with human, and may sometime be harmful for users if the proper care is not taken.

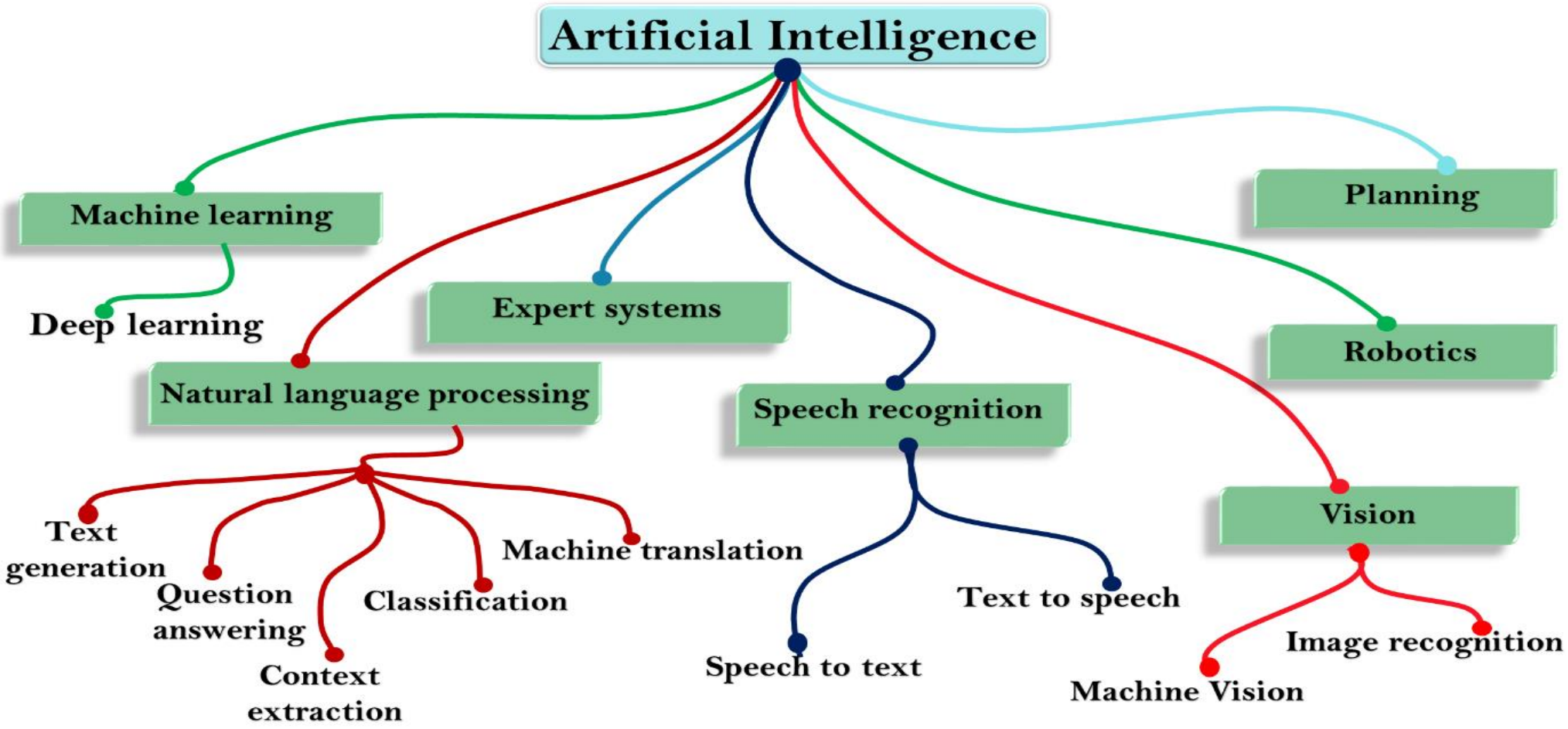
- **Increase dependency on machines**:

  With the increment of technology, people are getting more dependent on devices and hence they are losing their mental capabilities.

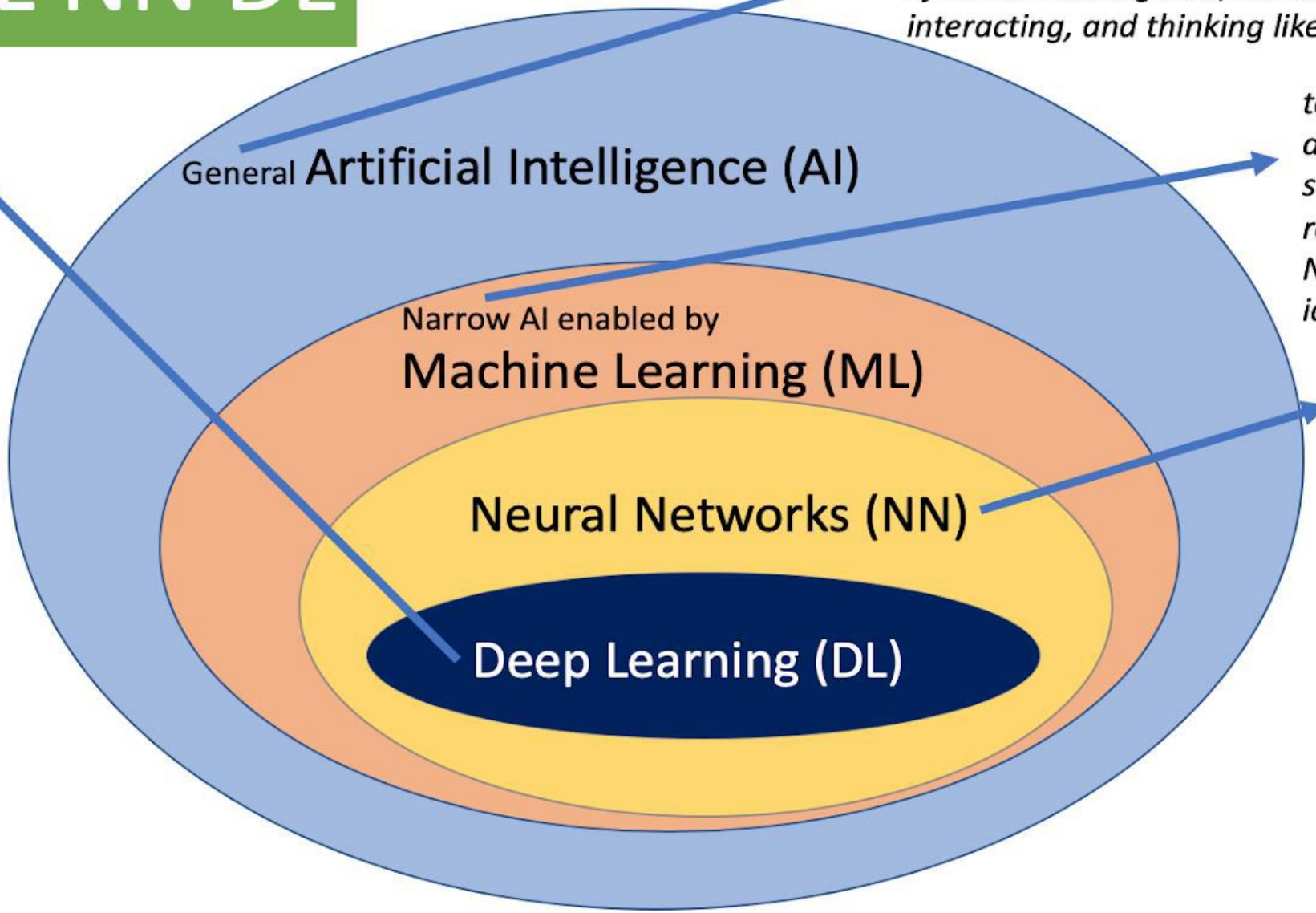
- **No Original Creativity**:

  As humans are so creative and can imagine some new ideas but still AI machines cannot beat this power of human intelligence and cannot be creative and imaginative.

Subsets of Artificial Intelligence



AI ML NN DL



computers possessing the same characteristics of human intelligence, including reasoning, interacting, and thinking like we do

technologies that can accomplish specific tasks such as playing chess, recommending your next Netflix TV show, and identifying spam emails

neural networks are a specific group of algorithms used for machine learning that model data using graphs of Artificial Neurons. Those neurons are a mathematical model that "mimics approximately how a neuron in the brain works"

the word "deep" comes from the fact that DL algorithms are trained/run on deep neu ral networks. These are just neural networks with (usually) three or more "hidden" layers

Artificial Intelligence/Machine Learning/ Deep Learning

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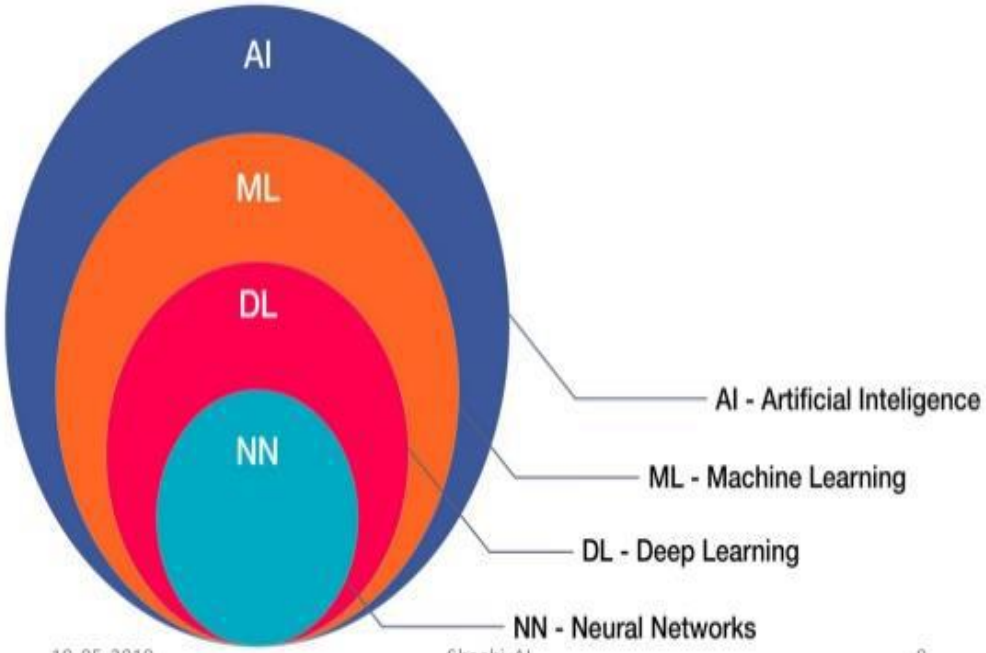

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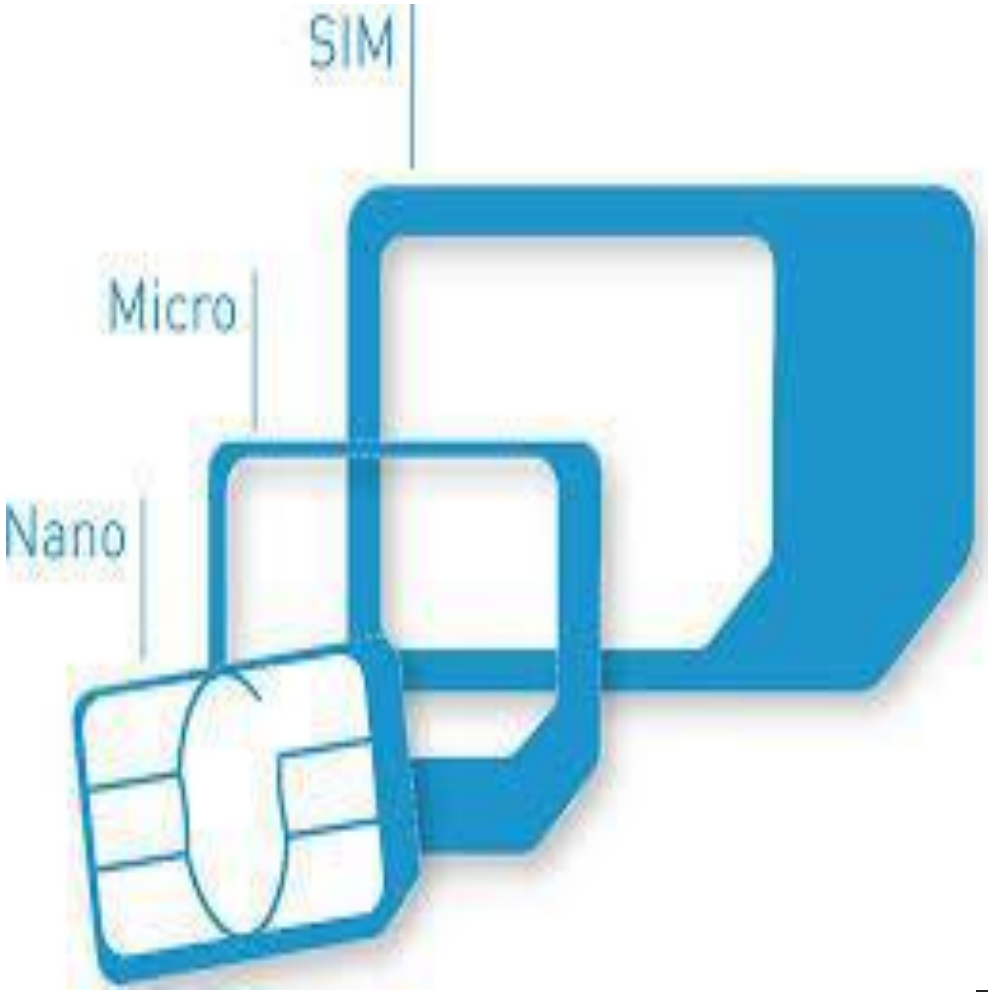
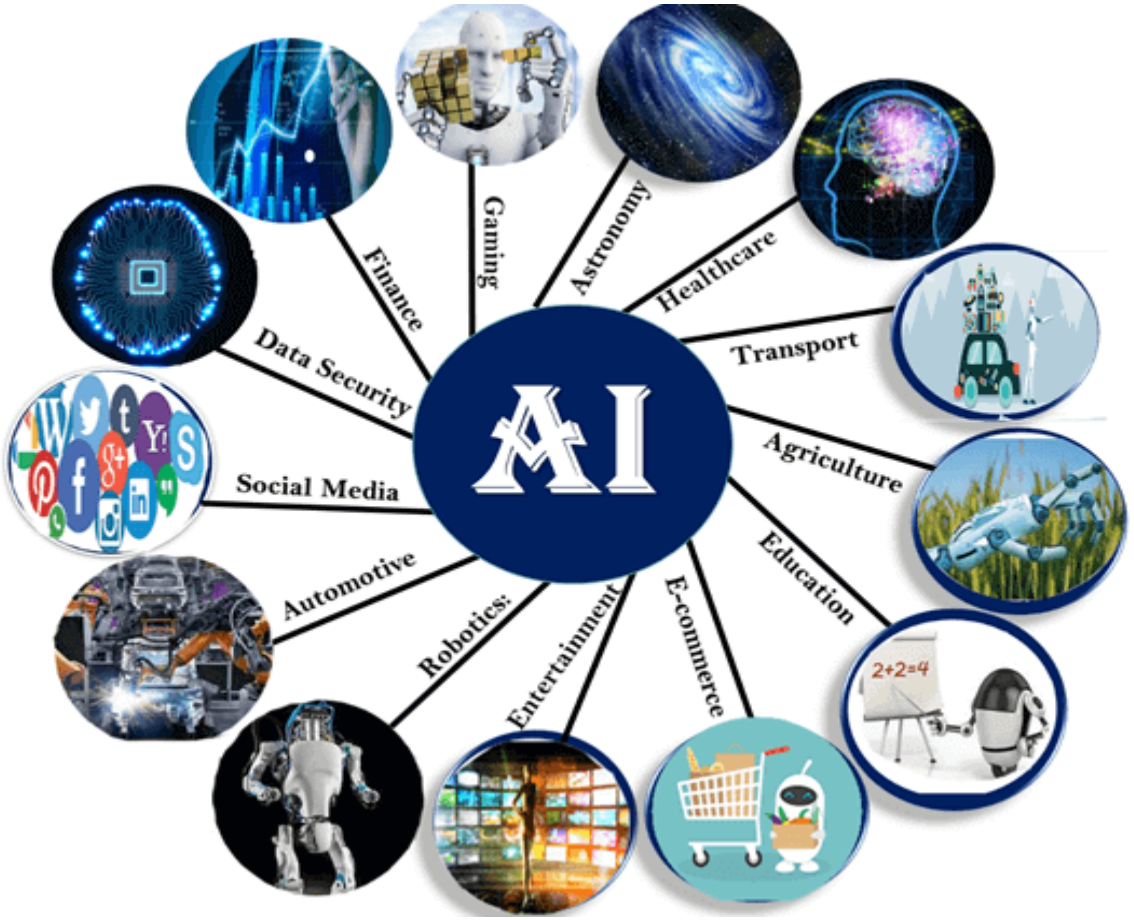


List of AI Tools Frameworks

- Artificial Intelligence has facilitated the processing of a large amount of data and its use in the industry The number of tools and frameworks available to data scientists and developers has increased with the growth of AI, ML and DL.
- List of AI Tools Frameworks
    1. Scikit Learn
    2. TensorFlow
    3. Theano
    4. Caffe
    5. MxNet
    6. Keras
    7. PyTorch
    8. Google ML Kit and etc…

Applications of AI

- Artificial Intelligence has various applications in today's society.
- It is becoming essential for today's time because it can solve complex problems with an efficient way in multiple industries, such as Healthcare, entertainment, finance, education, etc.
- AI is making our daily life more comfortable and fast.



Agents and Environments:

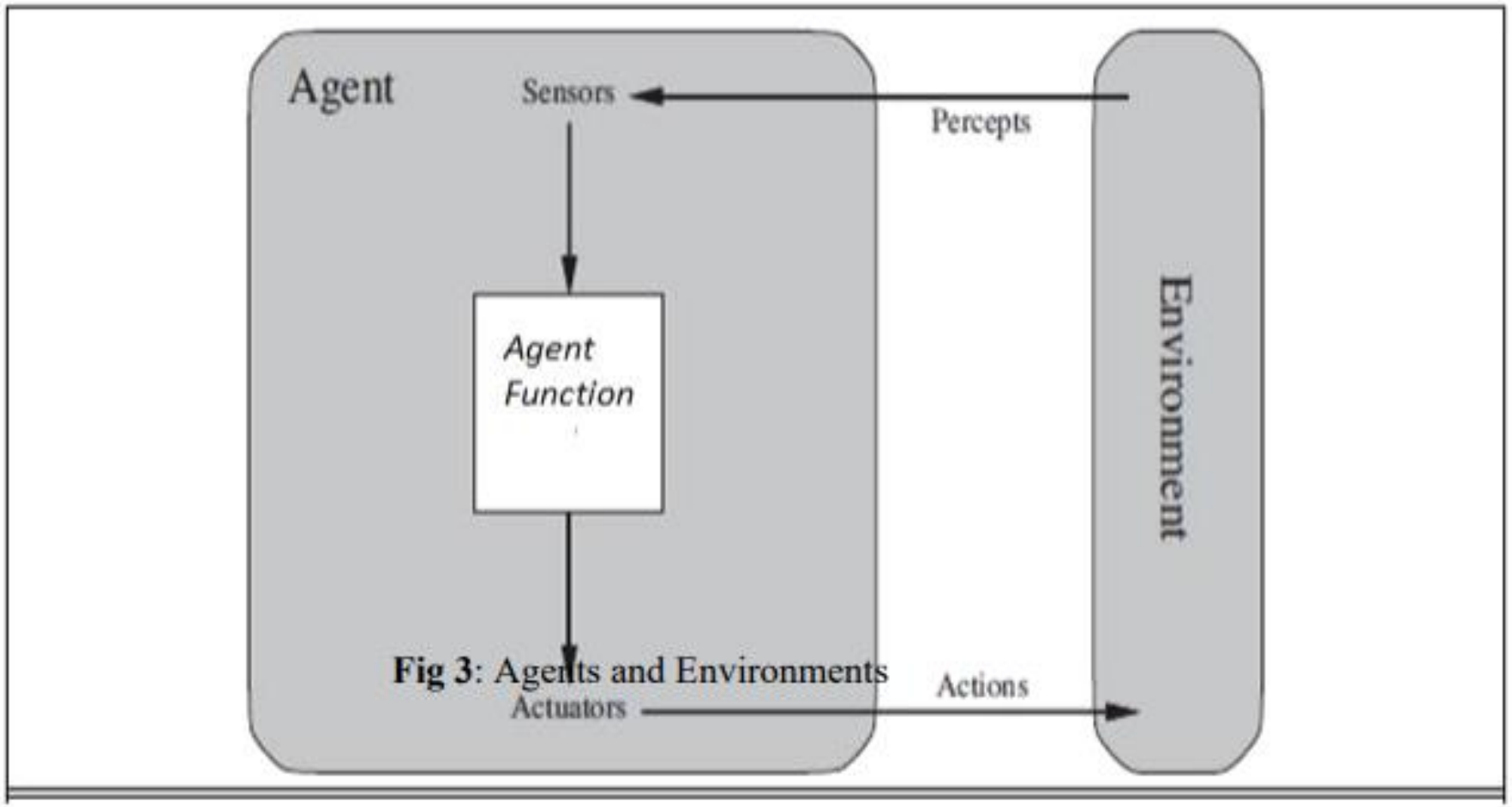


Fig 3: Agents and Environments

Agents and Environments:

An Agent is anything that can be viewed as perceiving its environment through sensors and acting upon that environment through actuators.

- A human agent has eyes, ears, and other organs for sensors and hands, legs, mouth, and other body parts for actuators.
- A robotic agent might have cameras and infrared range finders for sensors and various motors for actuators.
- A software agent receives keystrokes, file contents, and network packets as sensory inputs and acts on the environment by displaying on the screen, writing files, and sending network packets.

Agents and Environments:

- **Percept:**

We use the term percept to refer to the agent's perceptual inputs at any given instant.

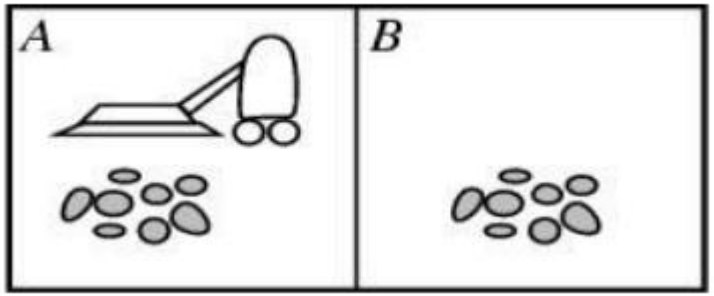
- **Percept Sequence:**

An agent's percept sequence is the complete history of everything the agent has ever perceived.

- **Agent function:**

Mathematically speaking, we say that an agent's behaviour is described by the agent function that maps any given percept sequence to an action.

Example of Agents and Environments:



To illustrate these ideas, we will use a very simple example-the vacuum-cleaner world shown in Fig. This world has just two locations: squares A and B. The vacuum agent perceives which square it is in and whether there is dirt in the square.

It can choose to move left, move right, suck up the dirt, or do nothing.

One very simple agent function is the following: if the current square is dirty, then suck, otherwise move to the other square.

A partial tabulation of this agent function is shown in table.

Percept Sequence	Action
[A, Clean]	Right
[A, Dirty]	Suck
[B, Clean]	Left
[B, Dirty]	Suck
[A, Clean], [A, Clean]	Right
[A, Clean], [A, Dirty]	Suck

The Nature of Environments:

- Task environments: We must think about task environments, which are essentially the "problems" to which rational agents are the "solutions."
- Specifying the task environment

The rationality of the simple vacuum-cleaner agent, needs specification of

- The performance[P] measures
- The environment[E]
- The agent's[A] actuators and
- Sensors[S]

- PEAS:

All these are grouped together under the heading of the task environment. We call this the PEAS (Performance, Environment, Actuators, and Sensors) description. In designing an agent, the first step must always be to specify the task environment as fully as possible.

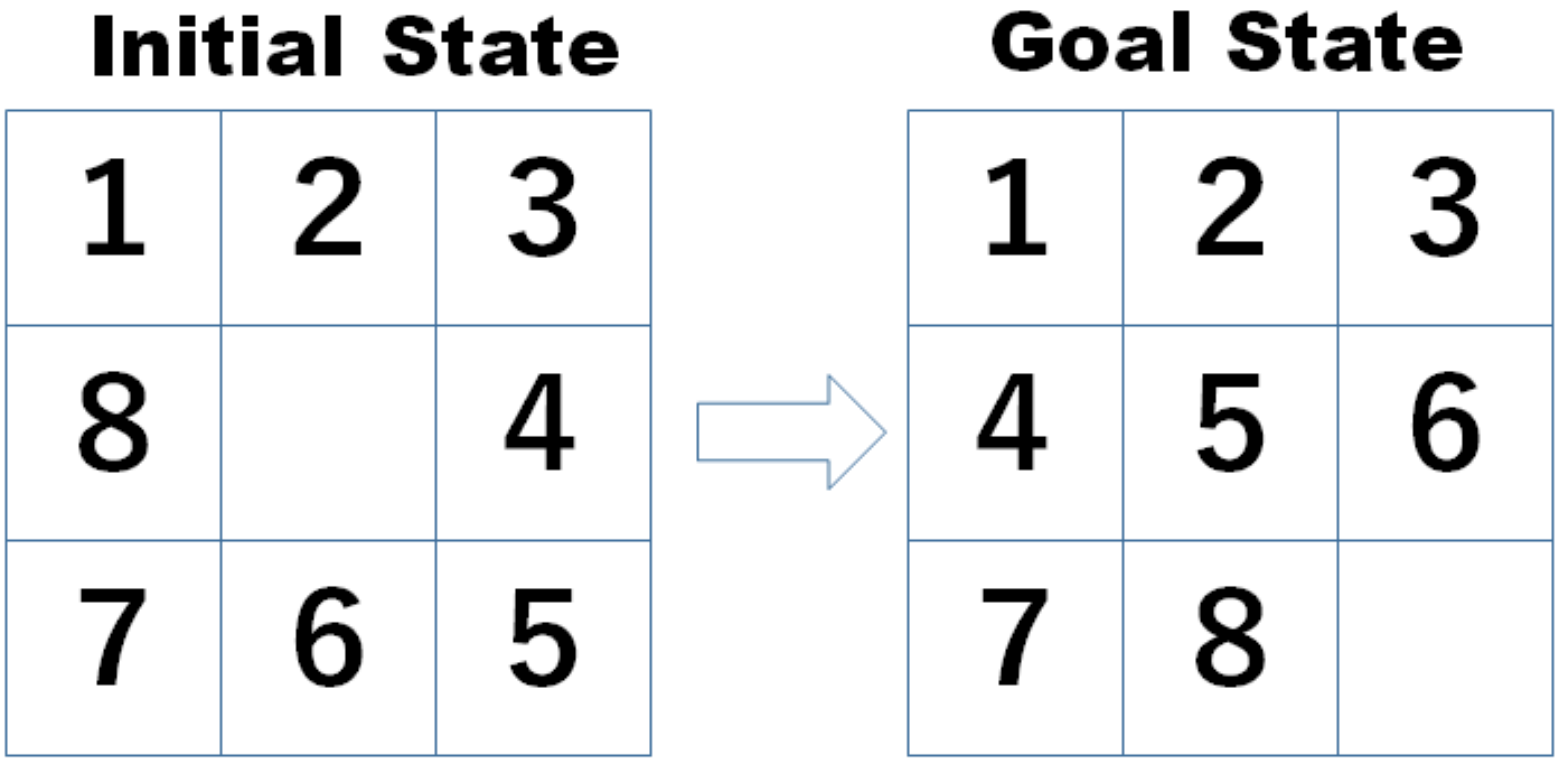
Agent Type	Performance Measure	Environments	Actuators	Sensors
Taxi driver	Safe: fast, legal, comfortable trip, maximize profits	Roads, other traffic, pedestrians, customers	Steering, accelerator, brake, Signal, horn, display	Cameras, sonar, Speedometer, GPS, Odometer, engine sensors, keyboards, accelerometer

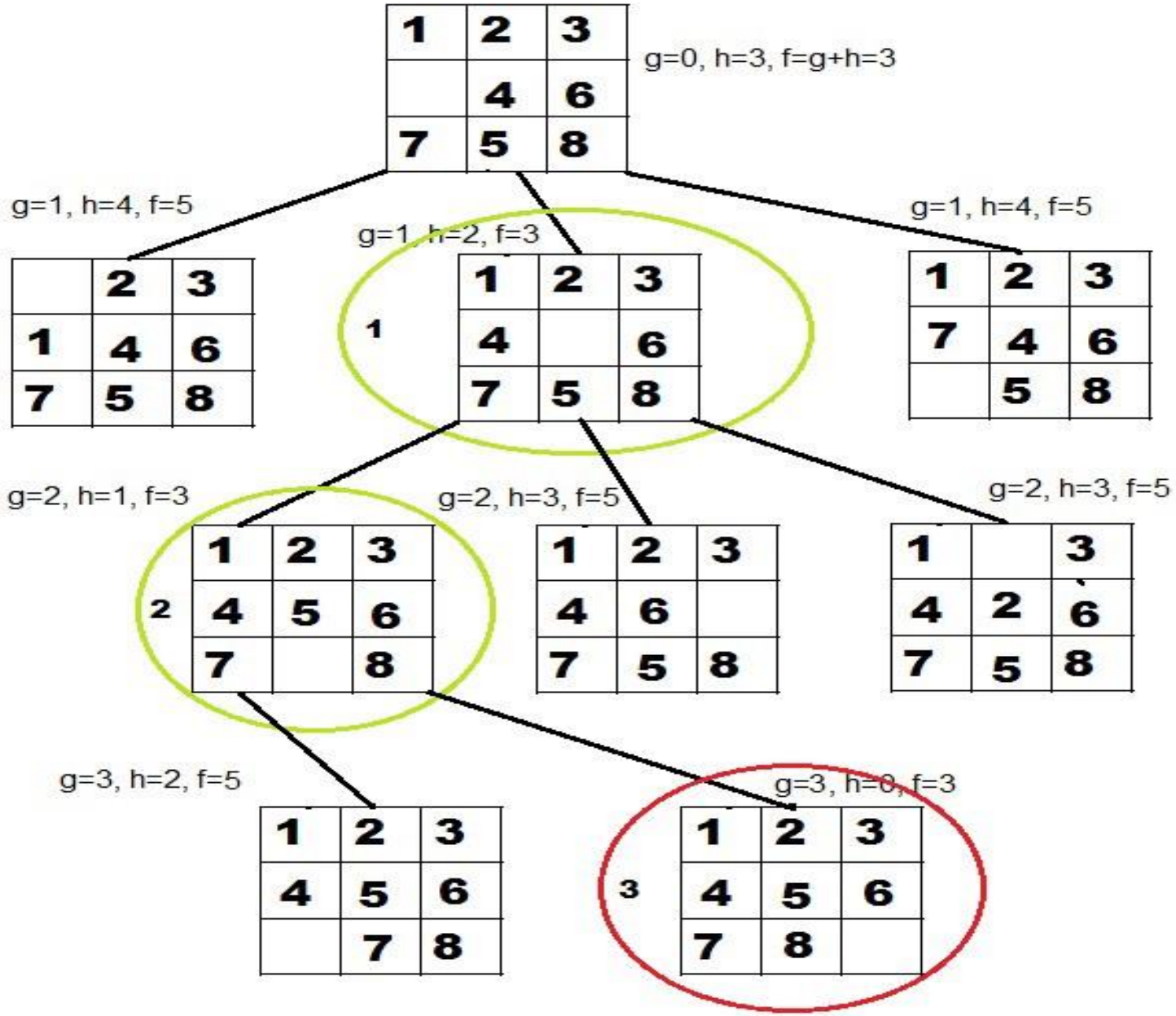
Fig 6: PEAS description of the task environment for an automated taxi

Agent Type	Performance Measure	Environment	Acurators	Sensors
Medical Diagnostic	Healthy patient , minimize costs, lawsuits	Patient, hospital, staff	Display questions, tests, diagnosis, treatments, referrals	Keyboard entry of symptoms, findings, patients' answers

- Examples of simple problems that can be Implementation of toy Problems
  - Eight Puzzle problem
  - Vacuum cleaner

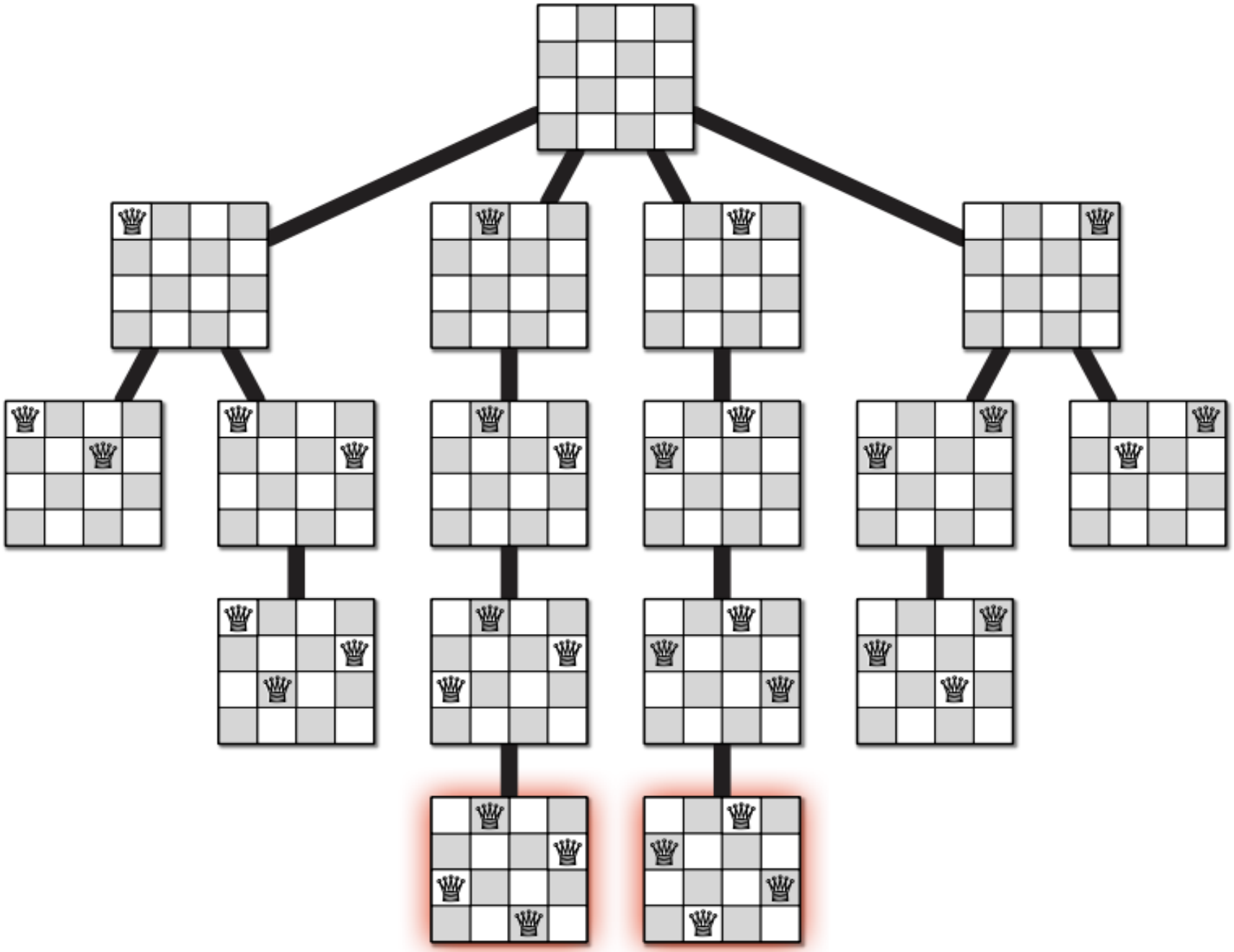
Eight number Puzzle problem




g=0, h=3, f=g+h=3
g=1, h=4, f=5
g=1, h=2, f=3
g=1, h=4, f=5
1
g=2, h=1, f=3
g=2, h=3, f=5
g=2, h=3, f=5
2
g=3, h=2, f=5
g=3, h=0, f=3
3

Four Queens Puzzle

- The 4-queens problem consists of a 4x4 chessboard with 4 queens.
- The goal is to place the 4 queens on the chessboard such that no two queens can attack each other.
- Each queen attacks anything in the same row, in the same column, or in the same diagonal.

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