

Unit 1

6 hrs.

Introduction to AI

- 1.1 Definition of Artificial Intelligence**
- 1.2 Brief history of Artificial Intelligence**
- 1.3 Importance and Application of Artificial Intelligence**
- 1.4 AI and related fields**
- 1.5 Definition of Knowledge, and Learning**
- 1.6 Intelligent Agents & it's types and performance measure**

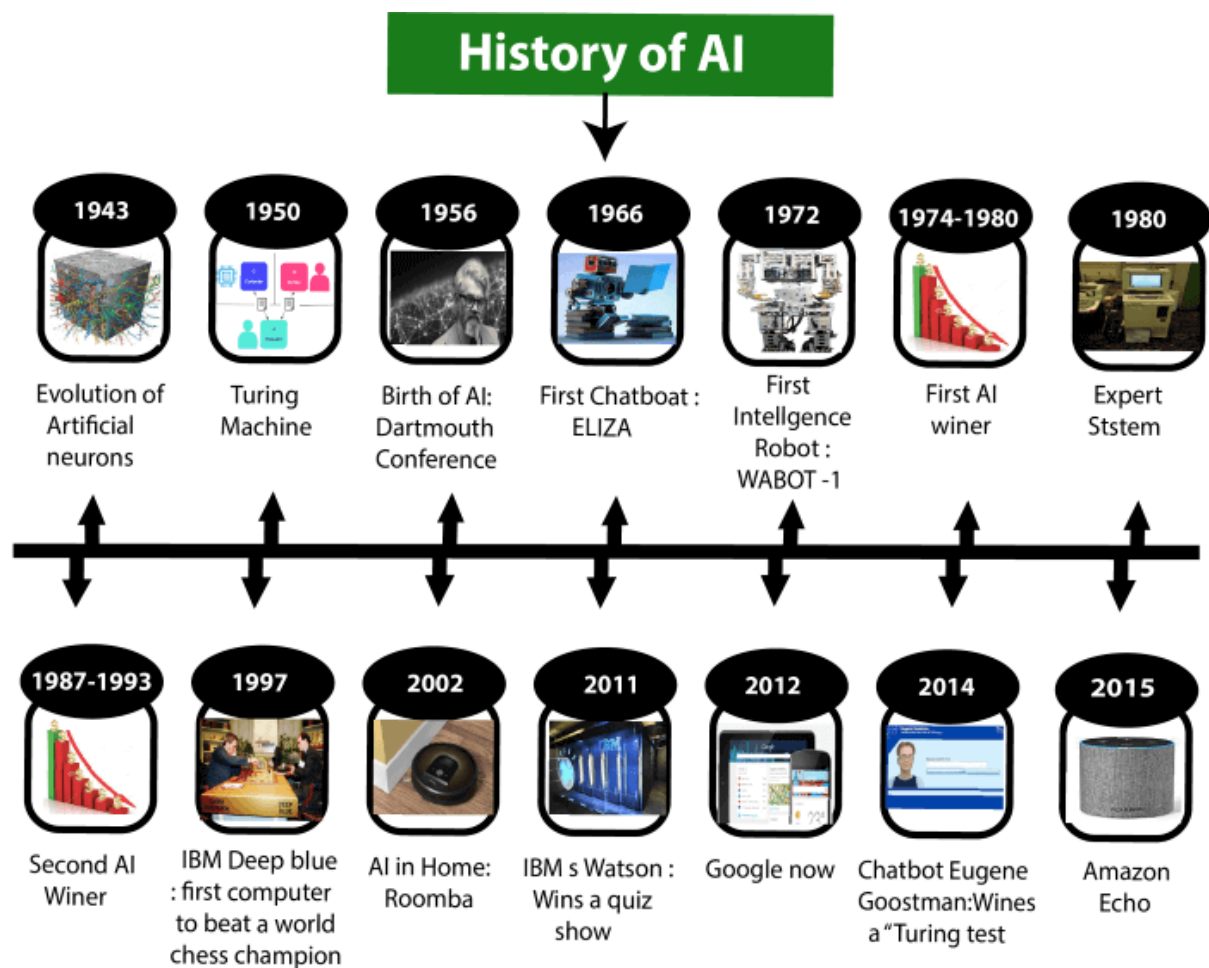
1.1 Definition of Artificial Intelligence

- **Intelligence:** Ability to learn, understand and think.
- **Artificial Intelligence:** Artificial intelligence is the ability to let machines learn, understand and think.
- It includes reasoning, knowledge, planning, learning, communication.
- Artificial intelligence (AI) is the intelligence exhibited by machines or software.
- Artificial Intelligence refers to intelligence displayed by machines that simulates human and animal intelligence.
- Artificial Intelligence sometimes called machine intelligence, is intelligence demonstrated by machines, in contrast to natural intelligence displayed by human and other animals.
- AI is an area of computer science that emphasize the creation of intelligent machine that work and react like human.
- AI textbooks define the field as "the study and design of intelligent agents" where an intelligent agent is a system that perceives its environment and takes actions that maximize its chances of success.
- **AI in practice:**
 - Self-Driving Cars.
 - Applications like Siri that understands and respond to human speech.
 - Google's AlphaGo AI has defeated many GO champions such as Ke Jie.
 - Implementing AI in chess (IBM Deep Blue vs. Garry Kasparov, 1996).
 - **6 games: K, D, draw, draw, draw, D**
 - Amazon ECHO product (home controlled chatbot device).

1.2 Brief history of Artificial Intelligence

John McCarthy, who coined the term in 1956, defines it as "it is the science and engineering of making intelligent machines, especially intelligent computer program." i.e. it is the branch of computer science dedicated to develop program that enable the computer system to reproduce the human activities to perform some task or try to imitate the activities.

A Brief History of Artificial Intelligence



Maturation of Artificial Intelligence (1943-1952)

- **Year 1943:** The first work which is now recognized as AI was done by Warren McCulloch and Walter Pitts in 1943. They proposed a model of **artificial neurons**.
- **Year 1949:** Donald Hebb demonstrated an updating rule for modifying the connection strength between neurons. His rule is now called **Hebbian learning**.

- **Year 1950:** The Alan Turing who was an English mathematician and pioneered Machine learning in 1950. Alan Turing publishes "**Computing Machinery and Intelligence**" in which he proposed a test. The test can check the machine's ability to exhibit intelligent behavior equivalent to human intelligence, called a **Turing test**.

The birth of Artificial Intelligence (1952-1956)

- **Year 1955:** An Allen Newell and Herbert A. Simon created the "first artificial intelligence program" which was named as "**Logic Theorist**". This program had proved 38 of 52 Mathematics theorems, and find new and more elegant proofs for some theorems.
- **Year 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.

At that time high-level computer languages such as FORTRAN, LISP, or COBOL were invented. And the enthusiasm for AI was very high at that time.

The golden years-Early enthusiasm (1956-1974)

- **Year 1966:** The researchers emphasized developing algorithms which can solve mathematical problems. Joseph Weizenbaum created the first chatbot in 1966, which was named as ELIZA.
- **Year 1972:** The first intelligent humanoid robot was built in Japan which was named as WABOT-1.

The first AI winter (1974-1980)

- The duration between years 1974 to 1980 was the first AI winter duration. AI winter refers to the time period where computer scientist dealt with a severe shortage of funding from government for AI researches.
- During AI winters, an interest of publicity on artificial intelligence was decreased.

A boom of AI (1980-1987)

- **Year 1980:** After AI winter duration, AI came back with "Expert System". Expert systems were programmed that emulate the decision-making ability of a human expert.
- In the Year 1980, the first national conference of the American Association of Artificial Intelligence **was held at Stanford University**.

The second AI winter (1987-1993)

- The duration between the years 1987 to 1993 was the second AI Winter duration.
- Again, Investors and government stopped in funding for AI research as due to high cost but not efficient result. The expert system such as XCON was very cost effective.

The emergence of intelligent agents (1993-2011)

- **Year 1997:** In the year 1997, IBM Deep Blue beats world chess champion, Gary Kasparov, and became the first computer to beat a world chess champion.
- **Year 2002:** for the first time, AI entered the home in the form of Roomba, a vacuum cleaner.
- **Year 2006:** AI came in the Business world till the year 2006. Companies like Facebook, Twitter, and Netflix also started using AI.

Deep learning, big data and artificial general intelligence (2011-present)

- **Year 2011:** In the year 2011, IBM's Watson won jeopardy, a quiz show, where it had to solve the complex questions as well as riddles. Watson had proved that it could understand natural language and can solve tricky questions quickly.
- **Year 2012:** Google has launched an Android app feature "Google now", which was able to provide information to the user as a prediction.
- **Year 2014:** In the year 2014, Chatbot "Eugene Goostman" won a competition in the infamous "Turing test."
- **Year 2018:** The "Project Debater" from IBM debated on complex topics with two master debaters and also performed extremely well.
- Google has demonstrated an AI program "Duplex" which was a virtual assistant and which had taken hairdresser appointment on call, and lady on other side didn't notice that she was talking with the machine.

Now, AI has developed to a remarkable level. The concept of Deep learning, big data, and data science are now trending like a boom. Nowadays companies like Google, Facebook, IBM, and Amazon are working with AI and creating amazing devices. The future of Artificial Intelligence is inspiring and will come with high intelligence.

1.3 Importance and Applications of AI

Artificial Intelligence is the machines which are designed and programmed in such a manner that they can think and act like a human.

Artificial Intelligence becomes the important part of our daily life. Our life is changed by AI because this technology is used in a wide area of day to day services.

These technologies reduce human effort. Now in many industries, people are using this technology to develop machine slaves to perform the different activity. Using the machine for the work speed up your process of doing work and give you an accurate result.

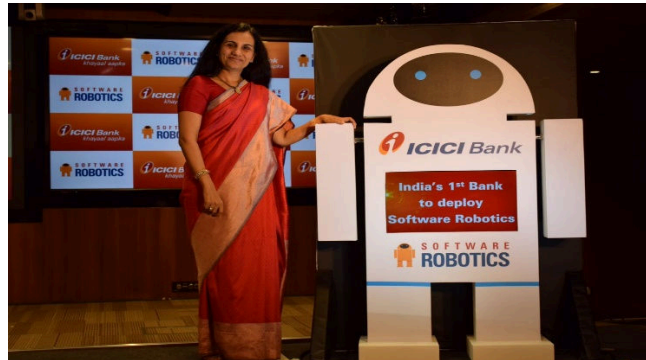
The introduction of AI brings the idea of error free world. This technology will slowly introduce in all the sector to reduce human effort and give accurate and faster result.

AI is important because it can help solve immensely difficult issues in various industries, such as entertainment, education, health, commerce, transport, and utilities. AI applications can be grouped into five categories:

- **Reasoning:** The ability to solve problems through logical deduction. e.g. financial asset management, legal assessment, financial application processing, autonomous weapons systems, games
- **Knowledge:** The ability to present knowledge about the world. e.g. financial market trading, purchase prediction, fraud prevention, drug creation, medical diagnosis, media recommendation
- **Planning:** The ability to set and achieve goals. e.g. inventory management, demand forecasting, predictive maintenance, physical and digital network optimization, navigation, scheduling, logistics
- **Communication:** The ability to understand spoken and written language. e.g. real-time translation of spoken and written languages, real-time transcription, intelligent assistants, voice control
- **Perception:** The ability to infer things about the world via sounds, images, and other sensory inputs. e.g. medical diagnosis, autonomous vehicles, surveillance

AI Used in Bank and Financial System

Banks are using AI technology to handle numerous activities in the bank. They handle work like financial operations, Money investing in stocks, Managing different properties and much more. Using AI to handle this activity beat a human in trading challenges. Using AI in the bank helps the bank to handle their customer and give them a quick solution.



Use of AI in Medical Science

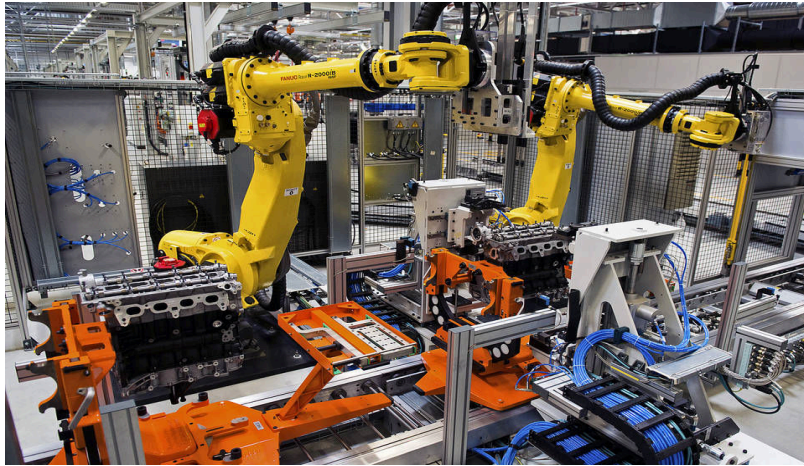
AI technology changes the face of medical science. There is a number of applications in which AI are used and give incredible value. In medical science AI is used to create virtual personal health care assistant. They are used for research and analytics. Even Healthcare bots are also introduced to give customer support. Bots are used for scheduling an appointment in hospitals. And the most important thing they give 24/7 assistance.



Heavy Industries

Today in most of the big manufacturing company AI are mostly used in the production unit. They are used as a robot who give a different shape to an object, who displace object from one place to another, they are used as a convey belt and much more.

If they are used in management system also. They are used to keep the records of the employee. They are used to extract correct data for decision making of the company. Using AI in the big industry help them to complete their task in time and helps business to get proper leads generation.



Role of AI in Air Transport

One of the most systematic transport is air transport. And without AI air transport can't survive. A machine which is used in the plans for performing different functions is run on the basis of AI. All most all the activity which performed to control air transportation is based on AI technologies. There are different softwares designed on the AI platform to give better flight to passengers and feel free from the danger.



AI role in Gaming Zone

Computer and TV games got more development and updates in their fields. There was a time when "Super Mario" was considered as the best game. But nowadays there are different gaming bots are introduced and you don't have to wait for other to play with yours. Bots are developed who will play with you.

You can buy machines that can play master level chess for a few hundred dollars. There is some AI in them, but they play well against people mainly through brute force computation-- looking at hundreds of thousands of positions. To beat a world champion by brute force and known reliable heuristics requires being able to look at 200 million positions per second.

Deep Blue versus Garry Kasparov was a pair of six-game chess matches between world chess champion Garry Kasparov and an IBM supercomputer called Deep Blue.



Conclusion

AI technology becomes the part of everyone's life. From small to big work everyone is using AI to generate leads and remove the work pressure. These technologies are so advanced that you don't have to write code for every activity. They understand the motion of work automatically.

1.4 AI and related fields

1. Healthcare

AI and ML technology has been particularly useful in the healthcare industry because it generates massive amounts of data to train with and enables algorithms to spot patterns faster than human analysts.

- Medecision developed an algorithm that detects 8 variables in diabetes patients to determine if hospitalization is required.
- An app called BiliScreen utilizes a smartphone camera, ML tools, and computer vision algorithms to detect increased levels of bilirubin in the sclera (white portion) of a person's eye, which is used to screen people for pancreatic cancer. This cancer has no telltale symptoms; hence it has one of the worst prognoses of all cancers.
- NuMedii, a biopharma company, has developed a platform called Artificial Intelligence for Drug Discovery (AIDD), which uses big data and AI to detect the link between diseases and drugs at the systems level.
- GNS Healthcare uses ML algorithms to match patients with the most effective treatments for them.

2. Entertainment

A familiar application of AI in everyday life is seen with services like Netflix or Amazon, wherein ML algorithms analyze the user's activity and compare it with that of other users to determine which shows or products to recommend. The algorithms are becoming intelligent with time—to the extent of understanding that a user may want to buy a product as a gift and not for himself/herself, or that different family members have different watching preferences.

3. Finance

- Financial services companies use AI-based natural language processing tools to analyze brand sentiment from social media platforms and provide actionable advice.
- Investment companies like Aidya and Nomura Securities use AI algorithms to conduct trading autonomously and robo-traders to conduct high-frequency trading for greater profits, respectively.
- Fintech firms like Kensho and Forward Lane use AI-powered B2C robo-advisors to augment rebalancing decisions and portfolio management performed by human analysts. Wealthfront uses AI algorithms to track account activity and help financial advisors customize their advice.
- Chatbots, powered by natural language processing, can serve banking customers quickly and efficiently by answering common queries and providing information promptly.
- Fraud detection is an important application of AI in financial services. For example, Mastercard uses Decision Intelligence technology to analyze various data points to detect fraudulent transactions, improve real-time approval accuracy, and reduce false declines.

4. Data security

Cyber-attacks are becoming a growing reality with the move to a digital world. There are also concerns about AI programs themselves turning against systems.

- Automatic exploit generation (AEG) is a bot that can determine whether a software bug, which may cause security issues, is exploitable. If a vulnerability is found, the bot automatically secures it. AEG systems help develop automated signature generation algorithms that can predict the likelihood of cyberattacks.
- PatternEx and MIT's Computer Science and Artificial Intelligence Laboratory (CSAIL) have developed an AI platform called AI2 which claims to predict cyber-attacks better than existing systems. The platform uses Active Contextual Modeling, a continuous feedback loop between a human analyst and the AI system, to provide an attack detection rate that is better than ML-only solutions by a factor of 10.

- Deep Instinct, an institutional intelligence company, says that malware code varies between 2% - 10% in every iteration and that its AI model is able to handle the variations and accurately predict which files are malware.

5. Manufacturing

- Landing.ai claims to have created machine-vision tools to **find microscopic defects** in objects like circuit boards using an ML algorithm trained using tiny volumes of sample images. In the future, self-driving robots may be created which can move finished goods around without endangering anyone or anything around.
- Robots in factories are often stationary but are still in danger of crashing into objects around it. A new concept called collaborative robots or “cobots, enabled by AI, can take instructions from humans, including instructions that the robot has not been previously exposed to, and work productively with them.
- AI algorithms can influence the **manufacturing supply chain** by detecting the patterns of demand for products across geographies, socioeconomic segments, and time, and **predicting market demand**. This, in turn, will affect inventory, raw material sourcing, financing decisions, human staffing, energy consumption, and maintenance of equipment.
- AI tools help in **predicting malfunctions and breakdown of equipment** and taking or recommending preemptive actions as well as tracking operating conditions and performance of factory tooling.

6. Automotive industry

- Tesla introduced **TeslaBot**, an intelligent virtual assistant integrated with Tesla models S and X, allows users to interact with their car from their phone or desktop.
- Uber AI Labs is working on developing **self-driven cars** with the help of the best engineers and scientists. Uber has already tested a batch of self-driving cars in 2016.
- Nvidia has partnered with Volkswagen to develop “**intelligent co-pilot systems**” in cars that will enable safety warnings, gesture control, and voice and facial recognition.
- Ericsson predicts that 5G technology will improve vehicle-to-vehicle communication wherein sensors will be implanted in airport runways, railways, and roads.

1.5 Definition of Knowledge and Learning

What is Knowledge?

Knowledge is the information about a domain that can be used to solve problems in that domain. To solve many problems requires much knowledge, and this knowledge must be represented in the computer. As part of designing a program to solve problems, we must define how the knowledge will be represented. A **representation scheme** is the form of the knowledge that is used in an agent. A **representation** of some piece of knowledge is the internal representation of the knowledge. A representation scheme specifies the form of the knowledge. A **knowledge base** is the representation of all of the knowledge that is stored by an agent.

A good representation scheme is a compromise among many competing objectives. A representation should be

- rich enough to express the knowledge needed to solve the problem.
- as close to the problem as possible; it should be compact, natural, and maintainable. It should be easy to see the relationship between the representation and the domain being represented, so that it is easy to determine whether the knowledge represented is correct. A small change in the problem should result in a small change in the representation of the problem.
- able to be acquired from people, data and past experiences.

What is learning?

- According to **Herbert Simon**, learning denotes changes in a system that enable a system to do the same task more efficiently the next time.
- **Arthur Samuel stated that**, "Machine learning is the subfield of computer science, that gives computers the ability to learn without being explicitly programmed".
- In 1997, **Mitchell** proposed that, "A computer program is said to learn from experience '**E**' with respect to some class of tasks '**T**' and performance measure '**P**', if its performance at tasks in '**T**', as measured by '**P**', improves with experience **E**".
- The main purpose of machine learning is to study and design the algorithms that can be used to produce the predicates from the given dataset.
- Besides these, the machine learning includes the agent's percepts for acting as well as to improve their future performance.

The following tasks must be learned by an agent.

- To predict or decide the result state for an action.
- To know the values for each state (understand which state has high or low value).
- To keep record of relevant percepts.

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Why do we require machine learning?

- Machine learning plays an important role in improving and understanding the efficiency of human learning.
- Machine learning is used to discover a new thing not known to many human beings.

Various forms of learnings are explained below:

1. Rote learning

- Rote learning is possible on the basis of memorization.
- This technique mainly focuses on memorization by avoiding the inner complexities. So, it becomes possible for the learner to recall the stored knowledge.

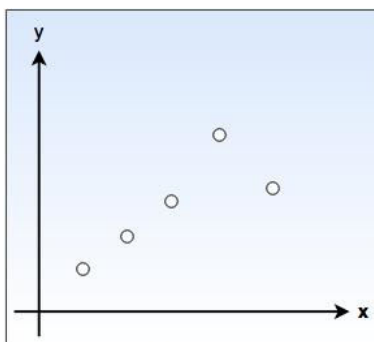
For example: When a learner learns a poem or song by reciting or repeating it, without knowing the actual meaning of the poem or song.

2. Induction learning (Learning by example).

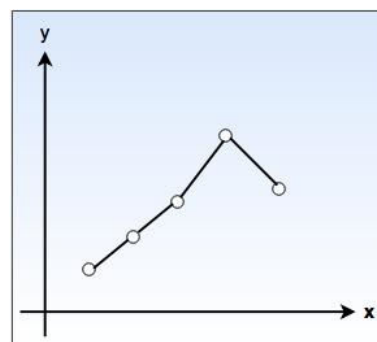
- Induction learning is carried out on the basis of supervised learning.
- In this learning process, a general rule is induced by the system from a set of observed instances.
- However, class definitions can be constructed with the help of a classification method.

For Example:

Consider that ' f ' is the target function and example is a pair $(x, f(x))$, where ' x ' is input and $f(x)$ is the output function applied to ' x '.



Fig(a)



Fig(b)

3. Learning by taking advice

- This type is the easiest and simple way of learning.
- In this type of learning, a programmer writes a program to give some instructions to perform a task to the computer. Once it is learned (i.e. programmed), the system will be able to do new things.
- Also, there can be several sources for taking advice such as humans(experts), internet etc.
- However, this type of learning has a more necessity of inference than rote learning.
- As the stored knowledge in knowledge base gets transformed into an operational form, the reliability of the knowledge source is always taken into consideration.

Explanation based learning

- Explanation-based learning (EBL) deals with an idea of single-example learning.
- This type of learning usually requires a substantial number of training instances but there are two difficulties in this:
 - i. it is difficult to have such a number of training instances
 - ii. Sometimes, it may help us to learn certain things effectively, especially when we have enough knowledge.

Hence, it is clear that instance-based learning is more data-intensive, data-driven while EBL is more knowledge-intensive, knowledge-driven.

- Initially, an EBL system accepts a training example.
- On the basis of the given goal concept, an operationality criteria and domain theory, it "generalizes" the training example to describe the goal concept and to satisfy the operationality criteria (which are usually a set of rules that describe relationships between objects and actions in a domain).
- Thus, several applications are possible for the knowledge acquisition and engineering aspects.

Learning in Problem Solving

- Humans have a tendency to learn by solving various real-world problems.
- The forms or representation, or the exact entity, problem solving principle is based on reinforcement learning.
- Therefore, repeating certain action results in desirable outcome while the action is avoided if it results into undesirable outcomes.

- As the outcomes have to be evaluated, this type of learning also involves the definition of a utility function. This function shows how much is a particular outcome worth?
- There are several research issues which include the identification of the learning rate, time and algorithm complexity, convergence, representation (frame and qualification problems), handling of uncertainty (ramification problem), adaptivity and "unlearning" etc.
- In reinforcement learning, the system (and thus the developer) know the desirable outcomes but does not know which actions result into desirable outcomes.
- In such a problem or domain, the effects of performing the actions are usually compounded with side-effects. Thus, it becomes impossible to specify the actions to be performed in accordance to the given parameters.
- Q-Learning is the most widely used reinforcement learning algorithm.
- The main part of an algorithm is a simple value iteration update. For each state 'S', from the state set S, and for each action, a, from the action set 'A', it is possible to calculate an update to its expected reduction reward value, with the following expression:

1.6 Intelligent Agents & its type and performance measures

An AI system can be defined as the study of the rational agent and its environment. The agents sense the environment through sensors and act on their environment through actuators. An AI agent can have mental properties such as knowledge, belief, intention, etc. An agent can be anything that perceive its environment through sensors and act upon that environment through actuators. An Agent runs in the cycle of perceiving, thinking, and acting.

An agent can be:

Human-Agent: A human agent has eyes, ears, and other organs which work for sensors and hand, legs, vocal tract work for actuators.

Robotic Agent: A robotic agent can have cameras, infrared range finder, NLP for sensors and various motors for actuators.

Software Agent: Software agent can have keystrokes, file contents as sensory input and act on those inputs and display output on the screen.

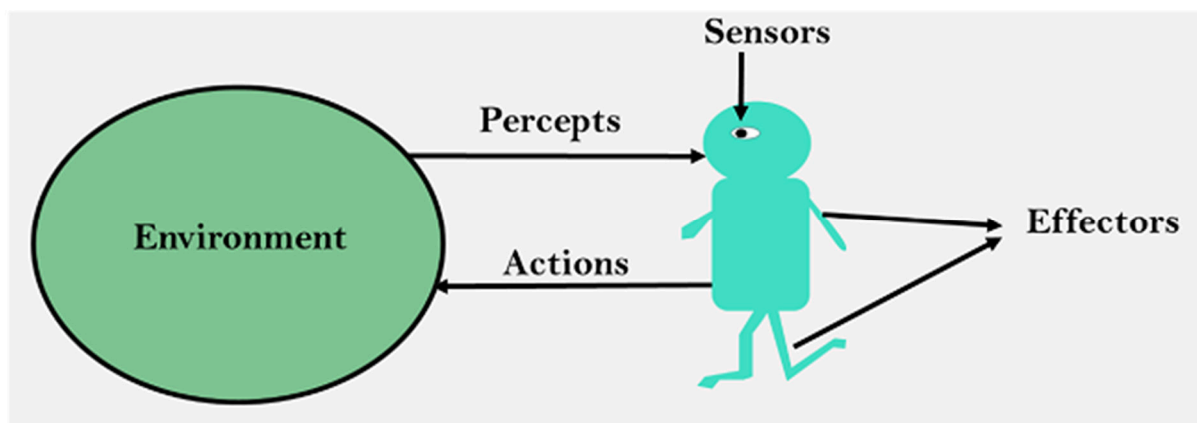
Hence the world around us is full of agents such as thermostat, cellphone, camera, and even we are also agents.

Before moving forward, we should first know about sensors, effectors, and actuators.

Sensor: Sensor is a device which detects the change in the environment and sends the information to other electronic devices. An agent observes its environment through sensors.

Actuators: Actuators are the component of machines that converts energy into motion. The actuators are only responsible for moving and controlling a system. An actuator can be an electric motor, gears, rails, etc.

Effectors: Effectors are the devices which affect the environment. Effectors can be legs, wheels, arms, fingers, wings, fins, and display screen.



Intelligent Agents:

An intelligent agent is an autonomous entity which act upon an environment using sensors and actuators for achieving goals. An intelligent agent may learn from the environment to achieve their goals. A thermostat is an example of an intelligent agent.

Following are the main four rules for an AI agent:

Rule 1: An AI agent must have the ability to perceive the environment.

Rule 2: The observation must be used to make decisions.

Rule 3: Decision should result in an action.

Rule 4: The action taken by an AI agent must be a rational action.

Rational Agent:

A rational agent is an agent which has clear preference, models uncertainty, and acts in a way to maximize its performance measure with all possible actions.

A rational agent is said to perform the right things. AI is about creating rational agents to use for game theory and decision theory for various real-world scenarios.

For an AI agent, the rational action is most important because in AI reinforcement learning algorithm, for each best possible action, agent gets the positive reward and for each wrong action, an agent gets a negative reward.

Note: Rational agents in AI are very similar to intelligent agents.

Rationality:

The rationality of an agent is measured by its performance measure. Rationality can be judged on the basis of following points:

- Performance measure which defines the success criterion.
- Agent prior knowledge of its environment.
- Best possible actions that an agent can perform.
- The sequence of percepts.

Note: Rationality differs from Omniscience because an Omniscient agent knows the actual outcome of its action and act accordingly, which is not possible in reality.

Structure of an AI Agent

The task of AI is to design an agent program which implements the agent function. The structure of an intelligent agent is a combination of architecture and agent program. It can be viewed as:

1. Agent = Architecture + Agent program

Following are the main three terms involved in the structure of an AI agent:

Architecture: Architecture is machinery that an AI agent executes on.

Agent Function: Agent function is used to map a percept to an action.

1. $f: P^* \rightarrow A$

Agent program: Agent program is an implementation of agent function. An agent program executes on the physical architecture to produce function f .

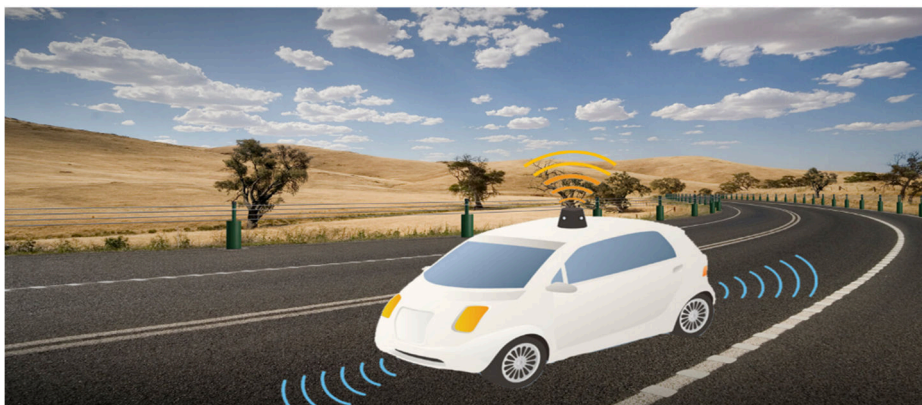
PEAS Representation

PEAS is a type of model on which an AI agent works upon. When we define an AI agent or rational agent, then we can group its properties under PEAS representation model. It is made up of four words:

- **P:** Performance measure
- **E:** Environment
- **A:** Actuators
- **S:** Sensors

Here performance measure is the objective for the success of an agent's behavior.

PEAS for self-driving cars/ Automated Taxi Driver Agent:



Let's suppose a self-driving car or Automated Taxi Driver Agent.

Then PEAS representation will be:

Performance: Safety, Time, Legal drive, Comfort, Getting the correct destination, Less Cost

Environment: Roads, Traffic Other Vehicles, Road Signs, Pedestrian, Different types of Passenger

Actuators: Steering, Accelerator, Brake, Signal, Horn

Sensors: Camera, GPS, Speedometer, Odometer, Accelerometer, Sonar, IR sensor.

Example of Agents with their PEAS representation

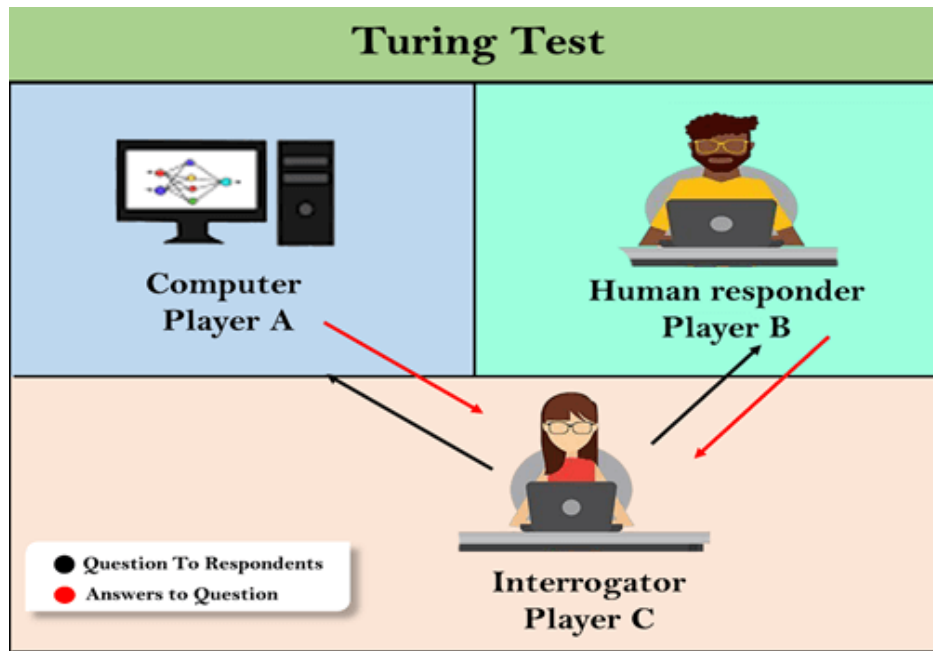
Agent	Performance measure	Environment	Actuators	Sensors
1. Medical Diagnose	<ul style="list-style-type: none"> ○ Healthy patient ○ Minimized cost 	<ul style="list-style-type: none"> ○ Patient ○ Hospital ○ Staff 	<ul style="list-style-type: none"> ○ Tests ○ Treatments 	Keyboard (Entry of symptoms)
2. Vacuum Cleaner	<ul style="list-style-type: none"> ○ Cleanness ○ Efficiency ○ Battery life ○ Security 	<ul style="list-style-type: none"> ○ Room ○ Table ○ Wood floor ○ Carpet ○ Various obstacles 	<ul style="list-style-type: none"> ○ Wheels ○ Brushes ○ Vacuum Extractor 	<ul style="list-style-type: none"> ○ Camera ○ Dirt detection sensor ○ Cliff sensor ○ Bump Sensor ○ Infrared Wall Sensor
3. Part - picking Robot	<ul style="list-style-type: none"> ○ Percentage of parts in correct bins. 	<ul style="list-style-type: none"> ○ Conveyor belt with parts, ○ Bins 	<ul style="list-style-type: none"> ○ Jointed Arms ○ Hand 	<ul style="list-style-type: none"> ○ Camera ○ Joint angle sensors.

THE END

Turing Test in AI

In 1950, Alan Turing introduced a test to check whether a machine can think like a human or not, this test is known as the Turing Test. In this test, Turing proposed that the computer can be said to be an intelligent if it can mimic (*imitating or copying something*) human response under specific conditions.

Turing Test was introduced by Turing in his 1950 paper, "Computing Machinery and Intelligence," which considered the question, "Can Machine think?"



The Turing test is based on a party game "Imitation game," with some modifications. This game involves three players in which one player is Computer, another player is human responder, and the third player is a human Interrogator, who is isolated from other two players and his jobs are to find that which player is machine among two of them.

Consider, Player A is a computer, Player B is human, and Player C is an interrogator. Interrogator is aware that one of them is machine, but he needs to identify this on the basis of questions and their responses.

The conversation between all players is via keyboard and screen so the result would not depend on the machine's ability to convert words as speech.

The test result does not depend on each correct answer, but only how closely its responses like a human answer. The computer is permitted to do everything possible to force a wrong identification by the interrogator.

The questions and answers can be like:

Interrogator: Are you a computer?

Player A (Computer): No

Interrogator: Multiply two large numbers such as $(256896489 * 456725896)$

Player A: Long pause and give the wrong answer.

In this game, if an interrogator would not be able to identify which is a machine and which is human, then the computer passes the test successfully, and the machine is said to be intelligent and can think like a human.

"In 1991, the New York businessman Hugh Loebner announces the prize competition, offering a \$100,000 prize for the first computer to pass the Turing test. However, no AI program to till date, come close to passing an undiluted Turing test".

Chatbots to attempt the Turing test:

ELIZA: ELIZA was a Natural language processing computer program created by Joseph Weizenbaum. It was created to demonstrate the ability of communication between machine and humans. It was one of the first chatterbots, which has attempted the Turing Test.

Parry: Parry was a chatterbot created by Kenneth Colby in 1972. Parry was designed to simulate a person with **Paranoid schizophrenia**(most common chronic mental disorder). Parry was described as "ELIZA with attitude." Parry was tested using a variation of the Turing Test in the early 1970s.

Eugene Goostman: Eugene Goostman was a chatbot developed in Saint Petersburg in 2001. This bot has competed in the various number of Turing Test. In June 2012, at an event, Goostman won the competition promoted as largest-ever Turing test content, in which it has convinced 29% of judges that it was a human. Goostman resembled as a 13-year old virtual boy.

The Chinese Room Argument:

There were many philosophers who really disagreed with the complete concept of Artificial Intelligence. The most famous argument in this list was "**Chinese Room**."

In the year **1980**, **John Searle** presented "**Chinese Room**" thought experiment, in his paper "**Mind, Brains, and Program**," which was against the validity of Turing's Test. According to his argument, "**Programming a computer may make it to understand a language, but it will not produce a real understanding of language or consciousness in a computer.**"

He argued that Machine such as ELIZA and Parry could easily pass the Turing test by manipulating keywords and symbol, but they had no real understanding of language. So it cannot be described as "thinking" capability of a machine such as a human.

Features required for a machine to pass the Turing test:

- **Natural language processing:** NLP is required to communicate with Interrogator in general human language like English.
- **Knowledge representation:** To store and retrieve information during the test.
- **Automated reasoning:** To use the previously stored information for answering the questions.
- **Machine learning:** To adapt new changes and can detect generalized patterns.
- **Vision (For total Turing test):** To recognize the interrogator actions and other objects during a test.
- **Motor Control (For total Turing test):** To act upon objects if requested.