Notes

- What are artificial intelligence techniques?

Artificial Intelligence techniques refer to a set of methods and algorithms used to develop intelligent systems that can perform tasks requiring human-like intelligence. These techniques encompass various approaches like machine learning, NLP, computer vision, and deep learning

1. **Artificial Intelligence** (AI) refers to the simulation of human intelligence in machines that are programmed to think and act like humans.
2. It involves the development of algorithms and computer programs that can perform tasks that typically require human intelligence such as visual perception, speech recognition, decision-making, and language translation.
3. AI has the potential to revolutionize many industries and has a wide range of applications, from virtual personal assistants to self-driving cars.
4. Before leading to the meaning of artificial intelligence let understand what is the meaning of Intelligence-
5. Intelligence: The ability to learn and solve problems.
6. Intelligence, as we know, is the ability to acquire and apply knowledge.
7. Knowledge is the information acquired through experience.
8. Experience is the knowledge gained through exposure(training)

Artificial Intelligence
Top 4 Uses

1. Artificial Intelligence has made an unprecedented impact in the medical industry and hence changed the face of the medical industry.
2. Various machine learning algorithms and models have efficiently predicted various important use cases, such as determining whether a

particular patient has malignant or benign cancer or tumor based on symptoms, health records, and history.

3. It is also being used in future predictions where patients are well informed about their deteriorating health and what they should do to return to a normal and healthy life.
4. Artificial intelligence has created a virtual care private assistant specifically built for people's needs. It is widely used to monitor, research different types of cases, and analyze past cases and their outcomes.
5. It also seeks to improve their model's and assistants' efficiency by predicting what could be improved and making themselves smarter.
6. The use of healthcare bots is another efficient move taken by the medical industry to work their way up in medicine, which is known to provide 24/7 assistance and take up the less important work of managing appointments.

. In the Field of Air Transport

1. One of the major systematic transport in the world is air transport, and there has become an urgent need to optimize their mode of operation.
2. Here came the involvement of Artificial Intelligence, where the machine is involved in planning the routes along with the flight landing and take-off charts.
3. Artificial intelligence has been used in many aircraft, navigation maps, taxing routes, and a quick examination of the entire cockpit panel to ensure the correct operation of each component. Hence, it gives very promising results and is being adopted very frequently. The ultimate aim of artificial intelligence in air transport is to give easier and more comfortable travel to human beings.

. In the field of banking and financial institutions

1. Artificial Intelligence plays a vital role in managing financial transactions and handling many other activities in the bank.
2. The day-to-day operations of banks, such as transactions and financial operations, stock market money and their management, etc., are being handled more easily and efficiently by these machine learning models.
3. Use cases such as anti-money laundering where suspicious financial transactions are being monitored and reported to regulators are a classic example of artificial intelligence in the banking and financial industry.

4. Other use cases include credit systems analysis which is popular among credit card companies.
5. Suspicious credit card transactions are tracked geographically and acted upon and resolved based on various parameters

- **In the field of gaming and entertainment**

1. From virtual reality games to today's modern games, this is one industry where artificial intelligence has made the biggest leap forward. Bots are always there for you to play with, so you don't need another person to play.
2. The level of personalized detail and graphics is also possible due to the advent of Artificial Intelligence and is taking this industry to a different level.

Fields of AI

- Machine learning is an artificial data intelligence characteristic that allows a computer to automatically acquire learning from the difficulties or instances it has met rather than having to be expressly programmed to accomplish the task or function.
- Machine learning emphasizes the development of algorithms that can analyze data and generate predictions. Its primary application is in the healthcare field, where it is utilized for disease diagnosis and medical scan interpretation.
- Machine learning has a subcategory called pattern recognition. It is defined as the computer algorithms' automatic recognition of the blueprint from raw data.
- A pattern can be a recurring collection of actions of people in any network that can indicate some social activity, a persistent series of data over time that is used to predict a sequence of events and trends, specific characteristics of image features to identify objects, recurring combination of words and sentences for language assistance, and many other things.

- **. Deep learning**
- It is the process of learning in which the machine processes and analyzes the input data using a variety of approaches until it identifies a single desirable output. It's also referred to as machine self-learning.
- To convert the raw sequence of input data to output, the machine uses a variety of random programs and algorithms. The output y is raised finally from the unknown input function f(x) by employing various algorithms like neuroevolution and other ways like gradient descent on a neural topology, assuming that x and y are associated.
- In this case, the task of neural networks is to determine the correct f function.
- **Deep learning will witness all possible human characteristics and behavioral databases and will perform supervised learning. This process includes:**
- Detection of different kinds of human emotions and signs.
- Identify the human and animals by the images like by particular signs, marks, or features.
- Voice recognition of different speakers and memorize them.
- Conversion of video and voice into text data.
- Identification of right or wrong gestures, classify spam things, and fraud cases (like fraud claims).
- **Neural Networks**
- Artificial intelligence's brain is made up of neural networks. They are computer systems that mimic the neural connections seen in the human brain. The perceptron refers to the brain's artificial equivalent neurons.
- Artificial neural networks in machines are created by stacking several perceptron together. The neural networks gather information by processing various training instances before producing a desired output.
- This data analysis procedure will also provide answers to many related questions that were previously unsolved thanks to the application of various learning models.

- Deep learning, in conjunction with neural networks, may reveal several layers of hidden data, including the output layer of complicated issues, and is useful in domains such as speech recognition, natural language processing, and computer vision, among others.
- The first types of neural networks had only one input and output, as well as only one hidden layer or a single perceptron layer.
- Between the input and output layers, deep neural networks have more than one hidden layer. To discover the hidden layers of the data unit, a deep learning method is necessary.
- **. Cognitive Computing**
- The goal of this artificial intelligence component is to initiate and expedite human-machine interaction for complex job completion and problem solving.
- While working with humans on a variety of jobs, robots learn and understand human behavior and sentiments in a variety of situations, and then duplicate the human thought process in a computer model.
- The machine learns to understand human language and picture reflections as a result of this practice. As a result, cognitive thinking combined with artificial intelligence can create a product with human-like actions and data handling capabilities.
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- **Natural Language Processing**
- Computers can interpret, recognize, locate, and process human language and speech using this aspect of artificial intelligence.

- The intent of introducing this component is to make the connection between machines and human language as seamless as possible, so that computers can respond logically to human speech or queries.
- The concentration of natural language processing on both the vocal and written sections of human languages means that algorithms can be used in both active and passive modes.
- Natural Language Generation (NLG) will analyze and decode sentences and words spoken by people (verbal communication), whereas Natural Language Understanding (NLU) will focus on written vocabulary to translate language into text or pixels that machines can understand.
- Natural language processing is best demonstrated by computer applications that use Graphical User Interfaces (GUI).
- The natural language processing system includes many types of translators that transform one language to another. This is also demonstrated by Google's voice assistant and voice search engine.

Best first search (BFS)

This algorithm always chooses the path which appears best at that moment. It is the combination of depth-first search and breadth-first search algorithms. It lets us to take the benefit of both algorithms. It uses the heuristic function and search. With the help of the best-first search, at each step, we can choose the most promising node.

- **Best first search algorithm:**
- **Step 1:** Place the starting node into the OPEN list.
- **Step 2:** If the OPEN list is empty, Stop and return failure.
- **Step 3:** Remove the node n from the OPEN list, which has the lowest value of h(n), and places it in the CLOSED list.
- **Step 4:** Expand the node n, and generate the successors of node n.
- **Step 5:** Check each successor of node n, and find whether any node is a goal node or not. If any successor node is the goal node, then return success and stop the search, else continue to next step.

- **Step 6:** For each successor node, the algorithm checks for evaluation function f(n) and then check if the node has been in either OPEN or CLOSED list. If the node has not been in both lists, then add it to the OPEN list.
- **Step 7:** Return to Step 2.

A* Search Algorithm

- A* search is the most commonly known form of best-first search. It uses the heuristic function h(n) and cost to reach the node n from the start state g(n). It has combined features of UCS and greedy best-first search, by which it solve the problem efficiently.
- It finds the shortest path through the search space using the heuristic function. This search algorithm expands fewer search tree and gives optimal results faster.
- **Algorithm of A* search:**
- **Step 1:** Place the starting node in the OPEN list.
- **Step 2:** Check if the OPEN list is empty or not. If the list is empty, then return failure and stops.
- **Step 3:** Select the node from the OPEN list which has the smallest value of the evaluation function (g+h). If node n is the goal node, then return success and stop, otherwise.
- **Step 4:** Expand node n and generate all of its successors, and put n into the closed list. For each successor n', check whether n' is already in the OPEN or CLOSED list. If not, then compute the evaluation function for n' and place it into the Open list.
- **Step 5:** Else, if node n' is already in OPEN and CLOSED, then it should be attached to the back pointer which reflects the lowest g(n') value.
- **Step 6:** Return to Step 2.

Propositional logic in Artificial intelligence

1. Propositional logic (PL) is the simplest form of logic where all the statements are made by propositions. A proposition is a declarative

statement which is either true or false. It is a technique of knowledge representation in logical and mathematical form

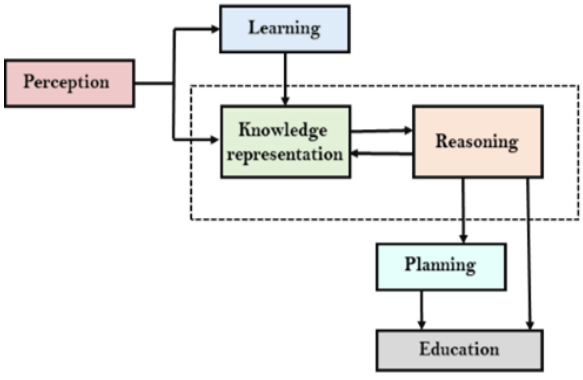
Example

- a) It is Sunday.
- b) The Sun rises from West (False proposition)
- c) 3+3= 7(False proposition)

d) 5 is a prime number

AI KNOWLEGDE CYCLE

- An Artificial intelligence system has the following components for displaying intelligent behavior:
- Perception
- Learning
- Knowledge Representation and Reasoning
- Planning
- Execution



1. The above diagram is showing how an AI system can interact with the real world and what components help it to show intelligence.
2. AI system has Perception component by which it retrieves information from its environment. It can be visual, audio or another form of sensory input.

3. The learning component is responsible for learning from data captured by Perception comportment. In the complete cycle, the main components are knowledge representation and Reasoning.
4. These two components are involved in showing the intelligence in machine-like humans. These two components are independent with each other but also coupled together.
5. The planning and execution depend on analysis of Knowledge representation and reasoning.

What is knowledge representation

1. Humans are best at understanding, reasoning, and interpreting knowledge. Human knows things, which is knowledge and as per their knowledge they perform various actions in the real world. **But how machines do all these things comes under knowledge representation and reasoning**. Hence we can describe Knowledge representation as following:
2. Knowledge representation and reasoning (KR, KRR) is the part of Artificial intelligence which concerned with AI agents thinking and how thinking contributes to intelligent behavior of agents.
3. It is responsible for representing information about the real world so that a computer can understand and can utilize this knowledge to solve the complex real world problems such as diagnosis a medical condition or communicating with humans in natural language.
4. It is also a way which describes how we can represent knowledge in artificial intelligence. Knowledge representation is not just storing data into some database, but it also enables an intelligent machine to learn from that knowledge and experiences so that it can behave intelligently like a human.

TYPES OF KNOWLEDGE CYCLE

1. Declarative Knowledge:
Declarative knowledge is to know about something.
It includes concepts, facts, and objects.
It is also called descriptive knowledge and expressed in declarative sentences.
It is simpler than procedural language.
2. Procedural Knowledge

It is also known as imperative knowledge.
Procedural knowledge is a type of knowledge which is responsible for knowing how to do something.
It can be directly applied to any task.
It includes rules, strategies, procedures, agendas, etc.
Procedural knowledge depends on the task on which it can be applied.
3.Meta-knowledge:
Knowledge about the other types of knowledge is called Meta-knowledge.
4. Heuristic knowledge:
Heuristic knowledge is representing knowledge of some experts in a filed or subject.
Heuristic knowledge is rules of thumb based on previous experiences, awareness of approaches, and which are good to work but not guaranteed.
5. Structural knowledge:
Structural knowledge is basic knowledge to problem-solving.
It describes relationships between various concepts such as kind of, part of, and grouping of something.
It describes the relationship that exists between concepts or objects.

Hill climbing algorithm

1. It is a technique for optimizing the mathematical problems. Hill Climbing is widely used when a good heuristic is available.
2. It is a local search algorithm that continuously moves in the direction of increasing elevation/value to find the mountain's peak or the best solution to the problem.
3. It terminates when it reaches a peak value where no neighbor has a higher value. Traveling-salesman Problem is one of the widely discussed examples of the Hill climbing algorithm, in which we need to minimize the distance traveled by the salesman.
4. It is also called greedy local search as it only looks to its good immediate neighbor state and not beyond that. The steps of a simple hill-climbing algorithm are listed below:

1. **Step 1:** Evaluate the initial state. If it is the goal state, then return success and Stop.
2. **Step 2:** Loop Until a solution is found or there is no new operator left to apply.
3. **Step 3:** Select and apply an operator to the current state.
4. **Step 4:** Check new state:
5. If it is a goal state, then return to success and quit.
6. Else if it is better than the current state, then assign a new state as a current state.
7. Else if not better than the current state, then return to step2.
8. **Step 5:** Exit.