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Artificial Intelligence is the study of how to make computers do things which, at the moment, people do better.

AI Problems:- AI focused on the sort of problem solving that we do every day when we decide how to get to work in the morning. It includes reasoning about physical objects and their relationships to each other, as well as reasoning about actions & their consequences.

As AI research progressed and techniques for handling larger amounts of world knowledge were developed - some progress was made on the task just described & new tasks could reasonably be attempted.

AI Technique:-

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Definition of AI:

By Waterman (1986)

"the part of computer science concerned with developing intelligent computer programs."

By Rich (1983)

"Artificial intelligence (AI) is the study of how to make computers do things at which, at the moment, people are 'better'."

By Russell (2004)

"An intelligent system is one whose expected utility is the highest that can be achieved by any system with the same computational limitation."

By Marvin Minsky

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"The science of making machines do things that would require intelligence, or if done by men".

or

'mechanization, or duplication, of the human thought process.'

By Charniak and McDermott (1985)

"Artificial Intelligence is the study of mental faculties through the use of computational models".

By Schildt (1987)

"An intelligent program is one that exhibits behavior similar to that of a human when confronted with similar problems. It is not necessary that the program actually solve, or attempt to solve, the problem in the same way that a human would."

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AI is the intelligence of machine & branch of computer science that aims to create it.

" AI is the branch of Computer Science concerned with the study and creation of computer systems that exhibit some form of intelligence ; system that learn new concepts and tasks, system that can reason & draw useful conclusions about the world around us , system that can understand a natural language or perceive and comprehend a visual scene , and system that perform other types of tasks that require human types of intelligence."

An understanding of AI requires an understanding of related terms such as intelligence, knowledge, reasoning, thought, cognition, learning and a no. of computer related terms .

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Intelligence as the ability to acquire, understand & apply knowledge, or the ability to exercise thought and reason. It embodies all of the knowledge & feats, both conscious & unconscious which we have acquired through study & experience: highly refined sight and sound perception; thought; imagination; the ability to converse, read, write, drive a car, memorize & recall facts, express & feel emotions & much more.

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What is AI Technique?

AI research is that intelligence requires knowledge. To Knowledge require some less desirable properties, including

- It is voluminous
- It is hard to characterize accurately.
- It is constantly changing.
- It differs from data by being organized in a way that correspond to the ways it will be used.

So, AI technique is a method that exploits knowledge that should be represented in such a way that-

- The knowledge captures generalization
In other words, it is not necessary to represent separately each individual situation. Instead, situations that share important properties are grouped together. If knowledge does not have

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this property, inordinate amounts of memory and updating will be required, so we usually call something without this property "data" rather than knowledge.

- It can be understood by people who must provide it. In AI domains, most of the knowledge a program has must ultimately be provided by people in terms they understand.
- It can easily modified to correct errors and reflect changes in the world and in our world view.
- It can be used in a great many situations even if it is not totally accurate or complete.
- It can be used to help overcome its own sheer bulk by helping narrow the range of possibilities their must usually be considered.

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Long term Goal :-

- Produce machines which exhibit intelligent behaviour

ex. The Monty Hall Problem

Imagine you're on a TV game show called "Let's make a deal", hosted by Monty Hall. You're shown three doors and monty says: "Behind one is the big cash prize, behind the others is nothing, please choose a door." and he open a door, behind which there is nothing. monty does this every week. This leaves only two doors (but) the one you chose and another one. Finally Monty ask "Ok, do you want to change ur mind & choose the other door?"

Another reason we might want to construct intelligent m/c is to enable us to do things we couldn't do before.

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- Understand human intelligence in society.

Introduction to AI:- AI is a broad topic, consisting of different fields, from mlc ~~vision~~ vision to expert systems. The elements that the fields of AI have in common is the creation of mlc that can "think".

In Order to classify machines as "thinking", it is necessary to define "intelligence". To what degree does "intelligence" consist of, for example, solving complex problems, or making generalization & relationships? And what about perception & comprehension? Research into the areas of learning of language, and of sensory perception have aided scientists in building intelligent machines.

The best way to gauge the intelligence of a mlc is British computer scientist Alan Turing's test. He stated that a "Computer would deserves to be called intelligent if it could deceive a human into believing that it was human".

What is AI?

- Building intelligent entities.
- Getting computers to do tasks that which require human intelligence.
- Intelligence :-
- Simple things turn out to be the hardest to automate.
- Recognizing a face
- Navigating a busy street.
- Understanding what someone says.

All tasks require reasoning or knowledge.

What does AI?

- : Many disciplines contribute to goal of creating modeling intelligent entities.
- Computer science
- Psychology (human reasoning)
- Philosophy (nature of belief, rationality, etc)

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- linguistics (Structure and meaning of language)
- Human Biology (how brain works)

Typical AI Problems

- Intelligent entities (or "agents") need to be able to do both "mundane" and "expert" tasks.
- Mundane tasks - consider going shopping:
 - Planning route and sequence of shops to visit
 - Recognising (through natural language)
 - Navigating round obstacles on the street, and manipulating objects for purchase.
- Expert tasks are things like:
 - medical diagnosis
 - equipment repair

Often "mundane" tasks are the hardest.

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following AI Topics

- AI programming, using Prolog.
- Knowledge Representation
 - How do we represent knowledge about the world in a formal manner that can be manipulated in a sound & efficient manner?
- Search:
 - How do we represent can an AI system go through all possibilities in a systematic manner when looking for solutions to complex problems.
- Natural Language:
 - How can a system communicate in a natural language such as english
- Machine learning and neural networks:
 - How can a system learn from experience or from past case data

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→ Agents:

- ↗ How can we develop and use practical "intelligent agents?"
- Knowledge Engineering?
- How do we elicit human expertise required to build intelligent applications.

AI Problem;— There are no. of problems in which algo can be developed use your own techniques, set of rules to solve the problem.

- e.g. 1) Playing chess
2) solving quadratic eqⁿ
3) solving puzzles.

Key elements of Problem solving

- 1) State: It is nothing but the configuration of all objects.

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1) State Space :- There are constraints in a state space, it may be the total area, or total space.

2) Operators :- The available actions performed is called operators. e.g. in solving quadratic eq"

$$ax^2 + bx + c = 0$$

in this eq" '+' & '=' are operators.

4) Initial State :- Initial state is the position from which the problem starts from the initial state & reach the goal state. for e.g. in playing chess keep the power on the chess board in their position.

5) Goal State:- for every problem there must be a goal state, always starts from initial state & reach the goal state. There may be 1 goal or many goals. In playing games there is single goal, in

Travelling salesman problem there may be more than one goal.

b) Metrics :- Metrics measures the performance for the given solution. Once the soln is reached then we get the metrics.

AI Technique:-

AI Technique is voluminous, it is constantly changing, it differs from data & it is hard to characterize accurately.

Definition:- AI technique is a method that exploits knowledge that should be represented in such a way that

- Knowledge captures generalization
- It should be understood by the people
- It can be easily modified to correct errors
- It can be used in many situations
- It can be used to solve the existing problem.

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E.g. Tic-tac-toe - it is a two player game & it has 9 squares. The winner is the 1st person who capture the diagonals or horizontal or vertical position. Each player uses his/her own technique or methodology or tactics to solve or try to win the goal.

- Problem characteristics :- The problem has several characteristic:-
- It is decomposable :- Check whether the given problem is decomposable or not. If decomposable then divide the problem into independent, smaller, parts easier sub-problems.
- Can the solv' steps be ignored?
If you feel some steps are not necessary, then you can ignore the steps.
- Complexity :- All the problems involve both space & time complexity.

• time complexity:- means how much time is needed to solve a particular problem occupies. ^{Time} Space complexity also as must be as minimum as possible.

• space complexity: means how much space in terms of memory; the particular problem occupies. Space complexity also as min. as possible.

• Is the problems universally predictable?

In some games we can predict the outcomes e.g. playing chess. In playing chess the outcome is predictable & is AI Puzzles.

Other problems like playing bridge, cricket - the outcome is not predictable. it is uncertain.

• Is good solnⁿ to the problem obvious without comparison to all other possible solutn. for every problem you may get the ans in either in 1 step or many steps.

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A particular problem can be solve in many ways. Compare the diff ways & select the best way.

- Is large amount of knowledge required?

Some games or problems involve very less knowledge, eg. Consider the game of chess, it needs high knowledge skill, lots of strategy & tactics we must use to play the game. Consider the game of tic tac toe, it needs very less knowledge skill.

- Can the computer that is simply given the problem return the solution? or the problem required interaction b/w computer & person.
- In playing chess human interaction is needed, Two persons can play computer game or a single person can play with the computer.

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The method or steps to solve given problem :-

- Define the Problem :-

Define the problem precisely, the definition must include the initial steps or situation as well as the final soln.

- Analyze :-

Analyzing the problem is very imp. It involves various technique to solve a particular problem.

- Isolate & rules :-

Describe the set of rules to solve a particular problem & isolate the knowledge i.e. necessary to solve the prob.

- Choose the best :-

Select the best rule the given rules & apply them for a particular problem.

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Some definition of AI organized into four categories:

① System that think like human

"The exciting new effort to make computers think ... machines with mind in the full & literal sense."

"The automation of activities that associate with human thinking, activities such as decision making, problem solving, learning ..." (Bellman, 1978)

② System that act like humans

"The art of creating m/c's that perform functions that require intelligence when performed by people." (Kurzweil 1990)

"The study of how to make computers do things at which, at the moment, people are better." (Rich & Knight 1991)

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System that think rationally

"The study of mental faculties through the use of computational models." (Harniak & Mc Dermott, 1980)

"The study of the computations that make it possible to receive, reason & act." (Winston, 1992)

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System that act rationally.

"Computational intelligence is the study of the design of intelligent agents." (Poole et al 1998).

"AI is concerned with 'intelligent' behavior in artifacts." (Nilsson, 1998).

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Acting humanly : The Turing Test Approach

Turing test was designed to provide a satisfactory operational definition of intelligence.

The computer would need to possess the following capabilities

- * natural language processing
- * knowledge representation to store what it knows or hears .
- * automated reasoning to use the stored information to answer questions & to draw new conclusion.
- * mlc learning to adapt to new circumstances and to detect and extrapolate patterns,
- * Computer vision to perceive objects .
- * robotics to manipulate objects & move about

Thinking humanly :

we need to get inside the actual working of human minds.

There are two ways

- ① through introspection :- trying to catch our own thoughts as they go by.
- ② through psychological experiments.

Thinking rationally

for exp.

"Socrates is a man; all men are mortal.
therefore Socrates is mortal.

These laws of thought were of supposed to govern the operation of mind; therefore study initiated the field, called logic.

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Acting rationally: The rational agent-approach

"An agent is just something that acts. A rational agent is one that acts so as to achieve the best outcome or when there is uncertainty the best ~~outcome~~ expected outcome.

Production System:- The production system offers a general framework for implementation search, because of its simplicity modifiability & flexibility

A Production System consists of the following

- ① A set of rules, each consisting of a left side that determines the applicability of the rule & a right side that describes the operation to be performed if the rule is applied.

- ① One or more knowledge database that contains whatever information is appropriate for the particular task. Some parts of the database may be permanent, while other parts of it may pertain only to the solution of the current problem. The information in these database may be structured in any appropriate manner/way.
- ② A control strategy that specifies the order in which the rules will be compared to the database & a way of resolving the conflicts that arise when several rules match at once.
- ③ A rule applier.

Control Strategy:-