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COLLEGE OF ENGINEERING

DETAILED LECTURE NOTES

Unit - 1

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Artificial Intelligence

Introduction :

- The term Artificial Intelligence was first coined decades ago in the year 1956 by John McCarthy at the Dartmouth Conference. He defines it as "The science and engineering of making intelligent machines" especially intelligent computer programs.
- AI is the intelligence of machines and the branch of computer science that aims to create it.

Artificial Intelligence

Reasoning

Performance

Performance

1

Behaviour

- The exciting new effort to make computers think ... machines with minds in the full and literal sense.
(Haugeland 1985)

- The study of mental faculties through the use of computational models
(Chomsky)

- The art of creating machines 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,

IA

Performance

and McPerrin, 1985)

- The automation of activities that we associate with human thinking, Activities such as decision making, Problem solving, learning (Bellman 1973).

- The study of the computations that make it possible to perceive, reason, and act. (Winston 1992).

people are better' (Riegger and Knight, 1991)

- A field of study that seeks to explain and emulate intelligent behaviour in terms of computational processes. (Schankoff, 1990)

- The Branch of Computer Science that is concerned with the Automation of Intelligent behaviour (Luger and Stubblefield, 1993).

Note: A system is Rational if it does the Right thing.

- Intelligence.
- Relate to tasks involving higher mental processes.
Examples: Creativity, solving problems, Pattern Recognition, classification, learning, induction, deduction, building Analogies, language processing, knowledge and many more.
- Intelligence is the Computational part of the Ability to achieve goals.

Artificial Intelligence can be structured under 3 evolutionary stages or 3 different types of Artificial Intelligence :-

1) Artificial Narrow Intelligence (ANI) also known as Weak AI involves applying AI only to specific tasks.
Example

Alexa / Face Verification in iPhones /
Autopilot feature at Tesla / Social Humanoid, Sophia,
built at Hanson Robotics / Finding the optimal
path through Google Maps.

2) Artificial General Intelligence (AGI) also known as Strong AI, involves machines that possess the Ability to perform any intellectual task that a human being can.

→ Machines do not possess human-like Abilities, we just have strong processing unit that performs higher level computations but they are not yet able to thinking and reasoning like a human.

→ Stephen Hawking warned us that "Strong AI would take off its own, and re-design itself at an ever-increasing

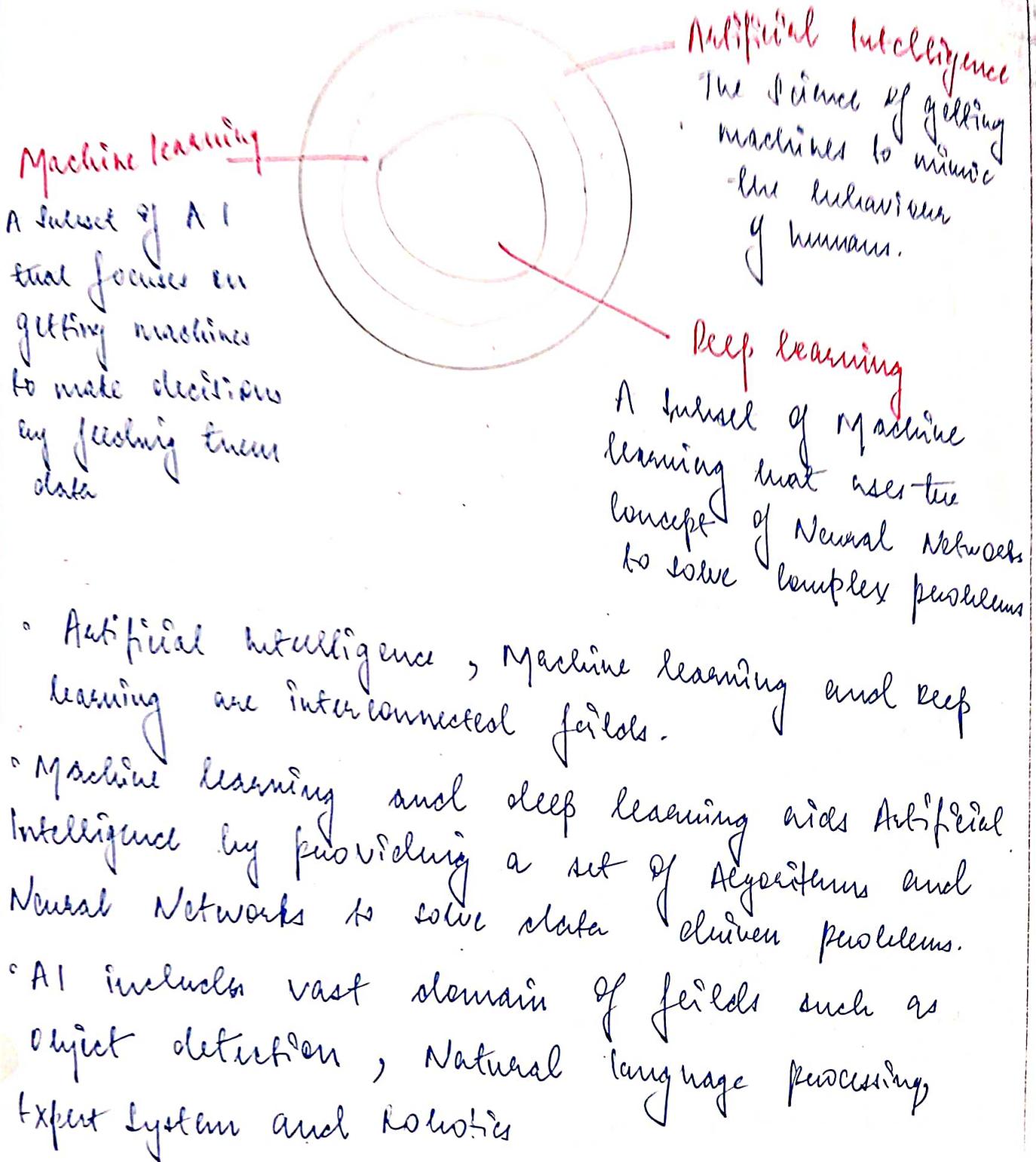


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1950 : Alan Turing proposed the Turing Test. The test basically determines whether or not a computer can intelligently think like a human being. The Turing test was a serious proposal in the philosophy of Artificial Intelligence.

→ Alan Turing published a landmark paper in which he speculated about the possibility of creating machines that think.

1951 : Name AI A few set of computer scientist developed the programs for checkers and for chess. However, these programs were later rewritten and redone in a better way.

1956 : The Birth of AI : It was marked as the most important year for Artificial Intelligence. John McCarthy first coined the term "Artificial Intelligence" in 1956 at the Dartmouth conference.

1959 : First AI Laboratory-

MIT AI Lab was first set up in 1959. The research in AI began.

1960 : General Motors Robot

It Robot was introduced to General Motors Assembly line.



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rate. Humans, who are limited by slow biological evolution, couldn't compete, and would be superseded.

- 3) Artificial Super Intelligence (ASI) is a term referring to the time when the capability of computers will surpass humans.
 - o It is presently seen as hypothetical situation as depicted in movies and science fiction books where machines will take over the world. However tech masterminds like Elon Musk believe that Artificial Super Intelligence will take over the world by year 2040.

History of Artificial Intelligence

- The concept of AI goes back to Classical Ages under Greek Mythology - Talos.

Talos was a giant animated bronze warrior programmed to guard the Island of Letha created by Hephaestus.



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1961: First AI bot

The 1st AI that bot called ELIZA was introduced in 1961.

1997: IBM Deep Blue

IBM's Deep Blue beats World Champion Garry Kasparov in the game of chess.

2005: DARPA Grand Challenge

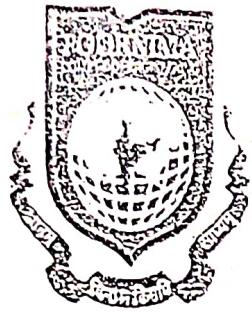
Stanford Racing team Autonomous Robotic car, Stanley wins the 2005 DARPA Grand Challenge.

2011: IBM Watson

IBM's Question Answering system, Watson, defeated the 2 greatest Jeopardy! Champions, Brad Rutter and Ken Jennings.

Domains of AI

- 1) Machine learning
- 2) Deep learning.
- 3) Robotics
- 4) Expert systems
- 5) Fuzzy logic
- 6) Natural language processing.



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Introduction to AI and Intelligent Agent.

Different Approach of AI

human-like vs Rational

Thought

vs

Behaviour

Thought vs	Human-like	Rational
Behaviour	Systems that think like humans Cognitive science	Systems that think Rationally
	Systems that act like humans	Systems that act Rationally

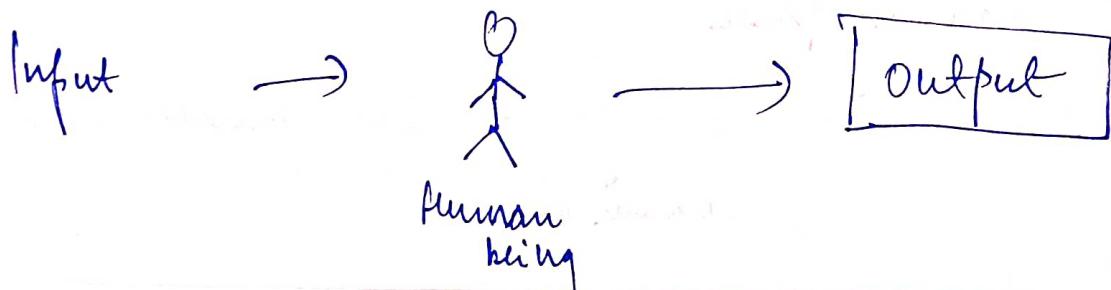
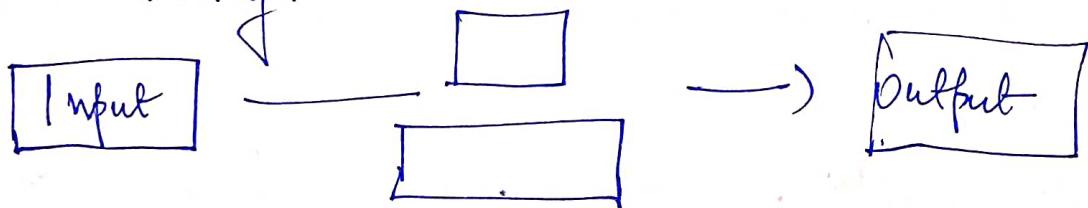
1) Cognitive Science : Think Human like

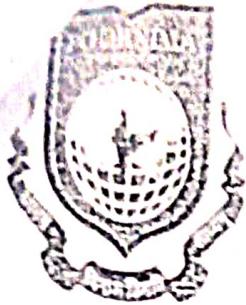
- An exciting new effort to make computers think ; i.e. the machine with minds , in the full and literal sense .
- Focus is ^{not} just on behaviour and I/O , but looks at reasoning process
- Computational model as to how results were obtained.

• Goal is not just to produce human-like behaviour, but to produce a sequence of steps of the reasoning process, similar to the steps followed by a human in solving the same task.

2 ways to understand how human mind works? -

- 1) **Introspection:** It is the examination or observation of one's own mental and Emotional process
 - 2) **Psychological Experiment:** A scientific procedure undertaken to make a discovery, test a hypothesis or demonstrate a known fact
- Once we have a sufficient precise theory of the mind, it becomes possible to express the theory as a computer program.
 - If the programs input / output and timing behaviour matches with corresponding human behaviour then we can call it as cognitive modelling.





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2) Turing Test: Art Human like

- The Art of creating machines that perform functions requiring **Intelligence** when performed by people ; that
- It is the study of , how to make computer do things which at true moment people do better.
- Focus is on action and not intelligent behaviour centered around representation of the world.
- A Behaviourist Approach, is not concerned with how to get results but to the similarity to what human results are.

Qualities of Acting Humanly

- 1) Natural language Processing.
- 2) Knowledge Base
- 3) Automated Reasoning .
- 4) Machine Learning
- 5) Computer Vision
- 6) Robotics .

Example : Turing Test

- 3 Rooms contain → A Person , A Computer and an Interrogator.
- The Interrogator can communicate with the other 2 by teletype (to avoid the machine imitate the Appearance or Voice of the person)
- The Interrogator tries to determine which is the person and which is the machine.
- The Machine tries to fool the Interrogator to believe that it is the Human , and the person also tries to convince the Interrogator that it is the Human.
- If the Machine succeeds in fooling the Interrogator, then conclude that the machine is Intelligent.
→ goal is to develop systems that are human-like

3) Lanes of Thought : Think Rationally

- The study of mental faculties through the use of computational models ; that it is the study of the computations that make it possible to perceive , reason and Act.
- Focus is on inherent mechanisms that are provably correct and guarantee an optimal solution.



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- Develop systems of representation to allow inferences to be like
"Socrates is a man. All men are mortal.
Therefore Socrates is mortal."
- Goal is to formalize the Reasoning process as a system of logical rules and procedure for inference.
- The issue is not all the problems can be solved just by reasoning and inferences
- There are 2 main ways to exist to implement this Approach
 - This Approach needs 100% knowledge.
 - Too many computations required

v) Rational Agent : Act Rationally

- This to explain and emulate Intelligent Behaviour in terms of Computational processes, that is concerned with the Automation of intelligence.

Focus is on systems that act sufficiently if not

Optimally in all situations.

- It is possible to have imperfect reasoning if the job gets done.
- Goal is to develop systems that are rational and efficient.
- Acting Rationally (Rational Agent Approach)
- **Rational** : Behaving Rightly and Capable of Reasoning.
- **Agent** : Have more attributes than just a program.
 - ↳ Rational Agent = Acts to achieve Best Outcome, if uncertainty - the best expected output is achieved
 - Behave Rightly , Optimal Solution