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2 AI definition : Chen →

3 Artificial Intelligence (AI) is the study of
4 how to make computers do things which,
5 at the moment, people do better."

6
7 → AI has as one of its long-term goals the
8 development of machines that can do these
9 things as well as humans can, or possibly
10 even better.

11
12 → Another goal of AI is to understand this
13 kind of behaviour whether it occurs in
14 machines or in humans or other animals.
15 Thus AI has both engineering and scientific
16 goals.

17
18 → Artificial Intelligence is a branch of Computer
19 Science concerned with automation of
20 intelligent behavior.

21
22 → There are two basic Ideas in the definition:
23

1) ²⁴ Intelligence

2) ²⁵ Artificial device (Robot)

26
27 What is Intelligence?

28 → Intelligence, taken as a whole, consists of
29 the following skills:

30
31 1) The ability to reason

32 2) The ability to acquire and apply knowledge

33 3) The ability to manipulate and communicate
34 ideas.

35

Definitions may be well thought-out into four categories: A1 should contain following things:

- 1) Modeling exactly how humans actually think
 - 2) Modeling exactly how humans actually act
 - 3) Modeling how ideal agents should think
 - 4) Modeling how ideal agents should act

AJ System

→ ¹⁰ There are signs which seem to suggest that
¹¹ the newer off-shoots of AI together with
¹² their real world applications are
¹³ gradually overshadowing it.

→ 16 As AI migrates to the real world we do
17 not seem to be satisfied with just a
18 computer playing a chess game.
19

→ Instead we wish a robot would sit opposite to us an opponent, visualize the real board and make the right moves in this physical world. Such notions seem to push the definitions of AI to greater extent.

→ 27 One question is that "Can machines think?"
28 Some people believe that thinking
29 machines might have to be so complex
30 and have such complex experiences. (Interac-
31 ting with their environment and with
32 other machines.) that we ~~could~~ never
33 actually design or build them.
34 Turing test:

Smart car : using deep learning and Sensor fusion it is possible to make 3D map of everything that is going around the vehicle to make decisions than a human driver ever could.

Ex : feature extract match

→ Computer game (chess) ↗

→ Automated face detection and focusing

→ Smart Cars (

virtual personal Assistants (apple's Siri)

Virtual personal Assistant : that can perform

tasks or services for an individual

also called "Chat bot". used to refer to virtual assistants generally or specifically those accessed by online chat

AI : Artificial Intelligence is an area of Computer Science that emphasized the creation of intelligent machines that work and react like human.

It is Science and engineering of making intelligent machines, especially intelligent Computer programs.

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AI Problems :

1) ⁵ Mundane Tasks :

2) ⁶ Perception

- vision
- Speech

3) ¹² Natural language

- understanding
- generation
- Translation

4) ¹⁸ Commonsense reasoning

5) ²⁰ Robot Control

6) ²³ Formal Tasks :

7) ²⁵ Games

- Chess
- Backgammon
- Checkers - go

8) ³¹ Mathematics

- Geometry
- Logic
- Integral Calculus

1 - Proving properties of programs
2
3

4) 4 Expert Tasks :

5 → 6 Engineering

- 7
8 - Design
9 - fault finding
10 - Manufacturing planning
11

→ 12 Scientific analysis

→ 13 Medical diagnosis

→ 14 financial analysis.

15 fig : Some of the task domains of AI .

16 formal task :

17 Much of early work in the field focused on
18 formal tasks . Such as game playing
19 and theorem proving .

20 game playing and theorem proving share the
21 property that people who do them well
22 are considered to be displaying intelligence.
23 Despite this , it ^{appeared} initially that computers
24 could perform well at those tasks
25 simply by being fast at exploring a
26 large number of solution paths and then
27 selecting the best one .

28 Mundane task :

29 AI also focused on the sort of problem
30 solving that we do every day when

¹ we decide how to get to work in the
² morning often called common-sense reasoning
³

ex:

⁴) It includes reasoning about physical objects
⁵ and their relationships to each other.
for ex: an object can be in only one
place at a time.

⁶) as well as reasoning about actions and
⁷ their consequences.

for ex: if you let go of something, it will
fall to the floor and may break.

To investigate this sort of reasoning,
CGPS (General Problem Solver) was built
But in CGPS, only simple tasks were
selected.

Then AI developed techniques were made
on tasks such as: perception (vision and
speech), natural language understanding
and problem solving in specialized
domain such as medical diagnosis and
chemical analysis.

²⁴ vision: analysis of satellite images

²⁵ Perception: Animals with much less intelligence
²⁶ than people are capable of more sophisticated
²⁷ visual perception than current machines.

²⁸ speech:

²⁹ The problem of understanding spoken language
³⁰ is a perceptual problem. Called natural
³¹ language understanding.

1 Expert task :

2 Examples of Expert task include engineering
3 design, Scientific discovery, medical diagnosis
4 and financial planning .

5

6 Expert task requires less knowledge than do
7 more mundane skills. and that knowledge
8 is easier to represent. So there are now
9 thousands of programs called the expert
10 Systems. in day - to - day operation
11 throughout all areas of industry and
12 government :

13

14 1) What are our underlying assumptions about
15 intelligence ?

16 2) What kind of techniques will be useful for
17 solving AI Problems ?

18 3) At what level of detail, if at all are we
19 trying to model human intelligence ?

20 The Underlying Assumption :

21

22 The Physical Symbol System Hypothesis :

23

24 A physical Symbol System has the necessary
25 and sufficient means for general intelligent
26 action.

27

1) Acting Humanly : Turing Test

→ "Can machine think ?" → Can Machines behave
31 intelligently ?

32

33 operational test for intelligent behavior :
34 The Imitation game.

35

1 Turing Test :

2 Turing test was developed by Alan Turing
3 in 1950. Turing test is used to determine
4 whether or not computer (machine) can think
5 intelligently like human ?

→ 6 Imagine a game of three players having
7 two human and one computer : one human
8 as interrogator . The interrogator 's job is
9 to try and figure out which one is human
10 and which one is machine by asking the
11 question from both of them.

→ 12 The whole conversation would be limited to
13 text only channel.

→ 14 If interrogator would not be able to
15 distinguish the answers provided by both
16 human and computer (machine) then the
17 computer passes the test and machine is
18 considered as intelligent

21 Imitation game .

22 Human

23 Human interrogator

24 AI system .

2) Thinking Humanly: Cognitive modeling

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1 Cognitive Science Approach: This requires
2 "getting inside" of the human mind to see
3 how it works and then comparing our Computer
4 programs to this.

5 → Try to get "inside" our minds

6 ex: Conduct experiments with people to try to
7 "reverse-engineer" how we reason, learn, remember, predict.

8 problems:

9 Human Problem Solving and argue that one's
10 programs go about problem solving in a
11 similar way.

12 → Humans don't behave rationally.

13 ex: insurance

14 → The reverse engineering is very hard to do.

15 → The brain's hardware is very different to
16 a Computer program.

3) Thinking Rationally: Laws of Thought

17 → Represent facts about the world via logic.
18 Use logical inference as a basis for
19 reasoning about these facts.

20 → Can be a very useful approach to AI.

21 Ex: theorem-provers. Why man Philip happens?
22 have to know facts to give answer

23 Limitations:

24 → Does not account for an agent's uncertainty
25 about the world.

26 for ex: difficult to couple to vision or speech
27 Systems

Teacher's Sign _____

Example: all Computers use energy . Using energy always generates heat. Therefore, all computers generate heat.

This initiates the field of logic.

formal logic : developed in the late nineteenth century.

→ It provides a precise notation and rules for representing and reasoning with all kinds of things in the world.

4) Acting Rationally: Intelligent agent approach.
→ Acting so as to achieve one's goals, given one's beliefs.

→ Does not necessarily involve thinking.

In rationality, the rational agent knows all and will take the action that maximizes his utility.

1.3 What is an AI Technique?

AI problems span a very broad spectrum. There are some techniques that are appropriate for the solution of a variety of these problems.

Before learning individual techniques, let's see the properties it will possess:

One of the result came out of AI research is that intelligence requires knowledge

- 1
2 Knowledge possesses some less desirable
3 properties, including:
4 human data
→ 5 It is voluminous.
→ 6 It is hard to characterize accurately.
→ 7 It is constantly changing.
→ 8 It differs from data by being organized
9 in a way that corresponds to the ways it
10 will be used.
11
→ 12 AI Technique is a method that exploits
13 knowledge that should be represented in
14 such a way that:
15
1) → 16 The knowledge captures generalizations. that means
17 it is not necessary to represent separately
18 each individual situation.
19
20 Instead of that, situations that share important
21 properties are grouped together. So we can
22 call something "data" rather than "knowledge"
23 without this property.
24 S teacher, S student
2) 25 Data must be understood by people who
26 must provide it. The bulk of data can
27 be required automatically. for ex- reading
28 from variety of instruments in many
29 AI domains.
30 3 person → earth is round.
31 1 person → earth is square } earth is round
32 3) 33 It can easily be modified to correct errors
34 and to reflect changes in the world.
35

4) 1 It can be used in many situations even if
 2 it's not totally accurate.
 3

→ 4 Although AI techniques must be designed
 5 keeping with these constraints imposed by
 6 AI problems; There is some degree of
 7 independence between problems
 8 and problem solving techniques.
 9

→ 10 It is possible to solve AI problems without
 11 using AI techniques (not suggested generally)
 12 and it is also possible to apply AI
 13 techniques to solution of non AI problems.
 14

15 There are three important AI techniques:
 16

1) 17 Search: Travelling Salesman problem:

18 a) provides a way of solving problems for
 19 which no direct approach is available
 20

21 b) It also provides a framework into
 22 which any direct techniques that are
 23 available can be embedded
 24

2) 25 Use of knowledge:

26 a) provides a way of solving complex problems
 27 by exploiting the structure of the objects
 28 that are involved.
 29

3) 30 Abstraction:

31 a) provides a way of separating important
 32 features and variations from many un-
 33 important ones that would otherwise over-
 34 whelm any process.

1 The level of the model:

- 3 Before we do something, it is good idea to
4 decide exactly what we are trying to do.
- 6 So we must ask ourselves, "What is our goal
7 in trying to produce programs that do intelligent
8 things that people can also do?"
- 10 There have been AI Projects motivated by
11 each of these goals.
- 13 Efforts to build programs that perform tasks
14 the way people do can be divided into
15 two classes.

Dont 1) 17 Programs in first class attempt to solve
fix 18 problems that don't really fit our
definition of AI task.
R 20

→ 21 They are the problems that Computer could
22 solve easily. Easy Solution would use
23 mechanisms that may not be available
24 to people.

→ 26 A classical example of this of program is
27 the "elementary perceivers and memorizers"
EPAM. Which memorized associated pairs of
device 29 nonsense Syllables.
used for Counting vowels and consonants "vowels"

→ 31 Memorizing pairs of nonsense syllables is
32 easy for Computer. To retrieve a response
33 syllable, the Computer just scans for the
34 stimulus syllable and responds with the one
35 stored next to it.

1 But the same task is hard for people.

2

3 The second class of program that attempt

4 to model human performance are those

5 that do things that fall more clearly within

6 our definitions of AI tasks.

7

8 There are several reasons one might want

9 to model human performance at these tasks

10

a) To test psychological theories of human

11 performance. One program is also written

12 to model human "mental" behavior of a

13 "mental" person. In this model, psychologists

14 can communicate with a program via

15 terminal and program can diagnose the

16 behavior of mental person.

17

b) To enable computers to understand human

18 reasoning. For example, computer to be

19 able to read a newspaper story and then

20 answer a question, such as "Why did the

21 terrorists kill the hostages?" Its program

22 must be able to simulate the reasoning

23 processes of people.

24

c) To enable people to understand computer

25 reasoning. In many circumstances, people

26 are reluctant to rely on the output of a

27 computer unless they can understand how the

28 machine arrived at its result. If computer's

29 reasoning process is similar to that of

30 people, then producing an acceptable

31 explanation is much easier.

d) ^{most}² To use the knowledge ^{that} we can get from people. Since people are the best-known performers of ^{invasive}³ most of tasks with which we are dealing. ^{expected}⁴ it makes sense to look to knowledge to ^{useful}⁵ proceed properly.

→ ⁷ We must consider that "human brains" ⁸ are highly parallel devices and most ⁹ current computing systems are serial. A ¹⁰ Highly successful parallel technique can not ¹¹ computationally work on serial computer.

→ ¹³ Now due to parallel models and general ¹⁴ promise of parallel computing, there is now ¹⁵ substantial interest in design of parallel ¹⁶ machine to support "AI programs".

¹⁸ following are the AI problems technique:

- 1) ²⁰ Chess (Hill climbing)
- 2) ²¹ Water Jug (Best first Search, Branch and Bound)
- 3) ²² 8-puzzle (A*, Dfs)
- 4) ²³ Travelling Salesman (Heuristic Search)
- 5) ²⁴ Missionaries and Cannibals (Best fs with Backtrack)
- 6) ²⁵ Tower of Hanoi (Bfs)
- 7) ²⁶ Monkey and Bananas (Bfs, Best first search)
- 8) ²⁷ Cryptarithmetic (Dfs)
- 9) ²⁸ Bridge (Dfs)

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¹ Application of AI :

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³ **1** **Training** : AI is used in Strategic games
⁴ Such as chess, poker, tic-tac-toe.

⁵

⁶ **2** **Natural language processing** : It is possible
⁷ to interact with the computer that
⁸ understands natural language spoken by human

⁹

¹⁰ **3** **Expert Systems** : Some application which
¹¹ integrate machine, software and special
¹² information to import reasoning and they
¹³ provide explanation and advice to the user.

¹⁴

¹⁵ **4** **Vision Systems** : It understand, interpret and
¹⁶ comprehend visual input on the computer.

¹⁷

¹⁸ **5** **Handwriting recognition** :

¹⁹ It reads text written on paper by pen
²⁰ or on screen by a stylus.

²¹

²² **6** **Intelligent Robots** :

²³ able to perform task given by a human.

²⁴

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³⁵

* Criteria for Success :-

- One most important question in any scientific or engineering research project is, "How will we know if we have succeeded?"
- In AI also, the same issue is there, "How will we know if we have constructed a machine that is intelligent or not?" "Can we do anything to measure our progress?"
- Sometimes it is possible to get an accurate measure of the achievement of a program. → Compare with previous record of player for ex., a program can get a chess rating in the same way as a human player. The rating is dependent on previous rating of players whom the program defeated. Already programs have got chess ratings of many human players. So program can give current rating of human

by Observing & Considering Previous Settings & Current play of that particular Player, by a Comparison.

→ Compare with time taken by Program to solve problem & time taken by skilled person.

→ In other Technical domains, it's possible Compare time it takes for a program to complete a task to the time required by a person to do the same thing.

for ex. There are many programs in companies use configured to satisfy customer's needs. These programs typically require minutes to perform tasks that previously required hours by a skilled person. They usually save or make money.

→ For many routine tasks, it may be harder to measure a program's performance for ex., if we ask to describe a newspaper story, then the best test is usually just whether the program responded in some way like person is not.

→ The Conclusion of the question that "Whether machine has intelligence or can think is not clear to answer precisely. But it is possible to construct Computer Program That meets Some Performance Standard for Particular task.

- We focus on design representation mechanism & algorithm that can be used by programs to solve problems. We don't spend much time to discuss programming process to convert this design into working programs.
- ↳ Language that is often used for AI programming is PROLOG.