Introduction to AI

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Books

•**Text Books**

1. Elaine Rich and Kevin Knight: Artificial Intelligence- Tata McGraw Hill.

•**Reference Books**

1. Nils J. Nilsson: Principles of Artificial Intelligence- Narosa Publishing house.
2. Artificial Intelligence : A Modern Approach, Stuart Rusell, Peter Norvig, Pearson Education, 2nd Edition
3. Artificial Intelligence, Winston, Patrick, Henry, Pearson Education
4. Artificial Intelligence and Expert System, Gopal Krishna , Janakiraman

Syllabus

- Introduction to AI,
- Problem Solving, State space search,
- Blind search:
  - Depth first search,
  - Breadth first search,
- Informed search:
  - Heuristic function,
  - Hill climbing search,
  - Best first search,
  - A* & AO* Search,
  - Constraint satisfaction.
- Game tree
- Evaluation function,
- Mini-Max search,
- Alpha-beta pruning,

What is AI ?

- Artificial Intelligence is the science and engineering of making intelligent machines.
- Artificial Intelligence is the study of how to make computers do things which, at the moment, people do better.
- Artificial Intelligence is the branch of computer science that is concerned with the automation of intelligent behaviour.
- Artificial Intelligence is the study and design of intelligent agents, where an intelligent agent is a system that perceives its environment and takes actions that maximize its chance of success.

What is AI ?

- Artificial Intelligence is concerned with the design of intelligence in an artificial device.
- The term was coined by McCarthy in 1956.
- There are two ideas in the definition.
  - Intelligence
  - Artificial
- The term artificial is easy to understand. But it's very difficult to define intelligence.

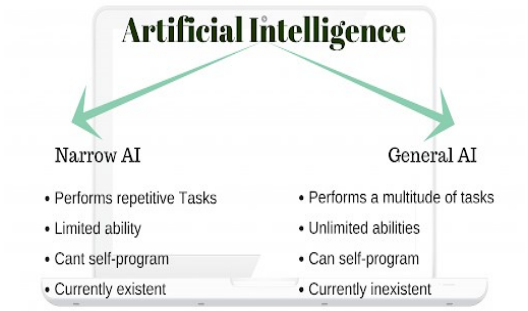
What is Intelligence?

- Intelligence is what we use when we don't know what to do.
- Intelligence relates to tasks involving higher mental processes.

Examples: Creativity, Solving problems, Pattern recognition, Classification, Learning, Induction, Deduction, Building analogies, Optimization, Language processing, Knowledge and many more.

Approaches to AI

- Hard or Strong AI
- Soft or Weak AI
- Applied AI
- Cognitive AI



Goals of AI

The definition of AI gives four possible goals to pursue:

1. Systems that think like humans
2. Systems that think rationally
3. Systems that act like humans
4. Systems that act rationally

AI Goal

Engineering based AI Goal

- Develop concepts, theory and practice of building intelligent machines
- Emphasis is on system building

Science based AI Goal

- Develop concepts, mechanisms and vocabulary to understand biological intelligent behavior.
- Emphasis is on understanding intelligent behavior.

Applications area of AI

- Perception
  - –Machine vision
  - –Speech understanding
  - –Touch (*tactile or haptic) sensation*
- Robotics
- Natural Language Processing
  - –Natural Language Understanding
  - –Speech Understanding
  - –Language Generation
  - –Machine Translation
- Planning
- Expert Systems
- Machine Learning
- Theorem Proving
- Symbolic Mathematics
- Game Playing

The History of AI

i. Gestation of AI (1943-1956)
ii. Early enthusiasm, great expectations (1952-1969)
iii. A dose of reality (1966-1974)
iv. Knowledge-based systems (1969-1979)
v. AI becomes an industry (1980-1988)
vi. Evolving systems (1986-present)
vii. Recent events (1987-present)

Gestation of AI

- First work
  - –McCulloch and Pitts (1943): build a Boolean circuit model of brain
- First neural network computer
  - –Minsky and Edmonds (1951) build "SNARC" neural network computer
- First chess programs
  - –Shannon (1950) and Turing (1953)
- Official birthplace of AI
  - –The 1956 Dartmouth workshop organized by John McCarthy

Early enthusiasm, great expectations

- Newell and Simon's early work
  - –Logic Theorist(1956)
  - –General Problem Solver
- Samuel's checkers program(1952-1956)
- The MIT connection
  - –McCarthy's LISP (1958)
  - –Minsky's microworlds (1963

A dose of reality

- Things were not so easy…
  - –AI discovers computational complexity(1966-1974)
  - –Only syntactic manipulation and little knowledge
  - –A lot of AI problems are intractable
  - –Basic structures had fundamental limitations

Knowledge-based systems(1969-79)

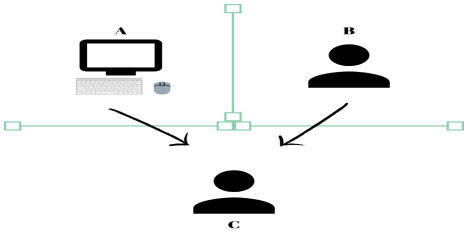
- Expert systems
  - –Use knowledge to suit larger reasoning steps
  - –Inferring molecular structures: DENDRAL (1969)
  - –Medical diagnosis: MYCIN(1974)
  - –Geological system: PROSPECTOR
- Knowledge representation schemes
  - –Production System (Newell)
  - –Frame theory (Minsky)
  - –Conceptual Dependency (Schank)
  - –PROLOG (Colmerauer

Evolving systems(1990)

- Machine learning
  - –An attempt to solve the knowledge acquisition bottleneck
  - –Reinvention of the back propagation learning algorithm
- Expert system design is very time-consuming
  - –Can machine learning fix that problem?
- Intelligent tutoring
- Case based reasoning
- Multi agent planning
- Scheduling
- Natural language
- Virtual reality, games
- Genetic algorithms
  - –Evolutionary programming

The Turing Test

- Turing proposed operational test for intelligent behaviour in 1950



Turing test

- To conduct Turing test, we need two people and the machine to be evaluated. One person plays the role of the interrogator, who is in a separate room from the computer and the other person.
- •The interrogator can ask questions of either the person or the computer by typing questions and receiving typed responses. however, the integrator knows only as A and B and aims to determine which is the person and which is the machine.
- •The goal of the machine is to fool the interrogator into believing that it is the person. If the machine succeeds at this, then we will conclude that the machine can think. The machine is allowed to do whatever it can to fool the interrogator.

The AI Problem

- Much of the early work in the field focused on **formal tasks, such as game playing and theorem proving.**
- Another early foray into AI focused on the sort of problem solving that we do every day called as **mundane tasks, such as commonsense reasoning.**
- The problem area where AI is now flourishing most as a practical discipline are primarily the domains that require only specialized expertise without the assistance of commonsense knowledge, called as **expert systems**

Formal Tasks

- Games
  - –Chess
  - –Backgammon
  - –Checkers-Go
- Mathematics
  - –Geometry
  - –Logic
  - –Internal calculus
  - –Proving properties of programs

Mundane Tasks

- Perception
  - –Vision
  - –Speech
- Natural language
  - –Understanding
  - –Generation
  - –Translation
- Commonsense reasoning
- Robot control

Expert Tasks

- Engineering
  - –Design
  - –Fault finding
  - –Manufacturing planning
- Scientific analysis
- Medical diagnosis
- Financial analysis

Just think !!!

- What are our basic assumption about intelligence?
- What kind of techniques will be useful to solve AI problems?
- Up to which level we want to build intelligent model?
- How will we know, we have succeeded?

AI Technique

- It is voluminous .
- Hard to characterize.
- Constantly changing.

Knowledge Representation in AI Technique

- The knowledge capture generalizations.
- It can be understood by the people who must provide it.
- It can easily be modified or correct errors and to reflect changes in the world and in our world view.
- It can be used in great many situation even if it is not accurate

Examples

- Tic –Tac –Toe
- Eight tile Puzzle
- Question answering

Final word

- Lots of knowledge is required to build a simple AI

Limits of AI Today

Today's AI systems have been able to achieve limited success in some of these tasks.

- In Computer vision, the systems are capable of face recognition
- In Robotics, we have been able to make vehicles that are mostly autonomous.
- In Natural language processing, we have systems that are capable of simple machine translation.
- Today's Expert systems can carry out medical diagnosis in a narrow domain
- Speech understanding systems are capable of recognizing several thousand words continuous speech
- Planning and scheduling systems had been employed in scheduling experiments with the Hubble Telescope.
- The Learning systems are capable of doing text categorization into about a 1000 topics
- In Games, AI systems can play at the Grand Master level in chess (world champion), checkers, etc.

What can AI systems NOT do yet?

- Understand natural language robustly (e.g., read and understand articles in a newspaper)
- Surf the web
- Interpret an arbitrary visual scene
- Learn a natural language
- Construct plans in dynamic real-time domains
- Exhibit true autonomy and intelligence