What is Artificial Intelligence: Notes on Chapter 1

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What is Artificial Intelligence

- Artificial Intelligence (AI) is the study of how to make computers do things (tasks) which, at the moment, people do better.
- AI is the theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision making and translation between languages. (**Google**)
- AI is the science and engineering of making intelligent machines, especially intelligent computer programs. Intelligence is the computational part of the ability to achieve goals in the World. (**John McCarthy**)

AI Problems

What are the tasks (problems) that are targets of work in AI ?

- Mundane Tasks
  - ▶ Perception: Vision and Speech
  - ▶ Natural language: Understanding, Generation and Translation
  - ▶ Commonsense Reasoning
  - ▶ Robot Control
- Formal Tasks
  - ▶ Games: Chess, Backgammon, Checkers-Go
  - ▶ Mathematics: Geometry, Logic, Integral Calculus, Proving properties of programs
- Expert Tasks
  - ▶ Engineering: Design, Fault finding, Manufacture planning
  - ▶ Scientific Analysis
  - ▶ Medical Diagnosis
  - ▶ Financial Analysis

Fundamental Questions in AI

Before embarking on a study of specific **AI problems** and **solution techniques**, it is important to discuss the following four questions.

- What are our underlying assumptions about intelligence ?
- What kind of techniques are useful for solving AI problems ?
- At what level of detail are we trying to model human intelligence ?
- How do we know when we have succeeded in building an intelligent program ?

The underlying assumption

At the heart of research in Artificial Intelligence lies the PHYSICAL SYMBOL SYSTEM HYPOTHESIS.

Definition (Physical Symbol System)

A PHYSICAL SYMBOL SYSTEM *consists of a set of entities, called* SYMBOLS, *which are physical patterns that can occur as components of another type of entity called an* EXPRESSION *or* SYMBOL STRUCTURE. *Besides, these symbol structures, the system also contains a collection of processes that operate on expressions to produce other expressions: processes of creation, modification, reproduction and destruction. A physical symbol system is a machine that produces through time an evolving collection of expressions.*

The underlying assumption

The Physical Symbol System Hypothesis: A physical symbol system has the necessary and sufficient means for general intelligent action.

Computers can be programmed to simulate any physical symbol system.

What is an AI Technique ?

Three important (characteristics of) AI techniques:

- **Search—** Provides a way of solving problems where no direct approach is available.
- **Use of Knowledge—** Provides a way of solving complex problems by exploiting the structures of the objects that are involved.
- **Abstraction—** Provides a way of separating important features and variations from unimportant ones.

Level of the Model

- What is our goal in trying to produce programs that do the intelligent things that people do?
- Two perspectives:
  - To produce programs that do the tasks in whatever ways appears easiest ?
  - To produce programs that do the tasks the same way people do ?

Criteria for Success

- How do we know if we have developed a system that is intelligent ?
- In 1950, Alan Turing proposed the method to determine whether a machine (computer, program) can think, known as TURING TEST.
  - To conduct the test, we need two persons and the machine to be evaluated.
  - One person (interrogator), sits in a room separate from the machine and the other person.
  - The interrogator can ask questions of either the person or the machine, by typing them and receiving typed responses.
  - The interrogator knows them only as A and B and aims to determine which is the person and which is machine.
  - The goal of the machine is to fool the interrogator in believing that it is the person.
  - If the machine succeeds then we will conclude that it is intelligent.