Lecture 1. INTRODUCTION

The objectives of this lecture are:

- To define Artificial Intelligence (AI).
- To describe the topics to be covered during this term.
- To go over some organizational details.
WHAT IS AI?

- AI is a relatively new field
- It started at the end of the 1940s
- Its name was coined by John McCarthy in 1956
- There are many definitions of Artificial Intelligence. Two of them are:
  - “AI as an attempt to understand intelligent entities and to build them” (Russell and Norvig, 1995)
  - “AI is the design and study of computer programs that behave intelligently” (Dean, Allen, and Aloi-monos, 1995)

- What is an “intelligent entity” or what does it mean to “behave intelligently”?
  - “Intelligence is the degree of accomplishment exhibited by a system when performing a task” (Allen. AAAI97 invited lecture)
## OTHER DEFINITIONS OF AI
(Adapted from Russell and Norvig’s book)

<table>
<thead>
<tr>
<th>Systems that think like humans</th>
<th>Systems that think rationally</th>
</tr>
</thead>
<tbody>
<tr>
<td>“The exciting new effort to make computers think ... machines with minds, in the full and literal sense” (Haugeland, 1985)</td>
<td>“The study of mental faculties through the use of computational models” (Charniak and McDermott, 1985)</td>
</tr>
<tr>
<td>“[The automation of] activities that we associate with human thinking, activities such as decision-making, problem solving, learning ...” (Bellman, 1978)</td>
<td>“The study of the computations that make it possible to perceive, reason, and act” (Winston, 1992)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Systems that act like humans</th>
<th>Systems that act rationally</th>
</tr>
</thead>
<tbody>
<tr>
<td>“The art of creating machines that perform functions that require intelligence when performed by people” (Kurzweil, 1990)</td>
<td>“A field of study that seeks to explain and emulate intelligent behavior in terms of computational processes” (Schalkoff, 1990)</td>
</tr>
<tr>
<td>“The study of how to make computers do things at which, at the moment, people are better” (Rich and Knight, 1991)</td>
<td>“The branch of computer science that is concerned with the automation of intelligent behavior” (Luger and Stubblefield, 1993)</td>
</tr>
<tr>
<td>“AI is the design and study of computer programs that behave intelligently” (Dean, Allen, and Aloimonos, 1995)</td>
<td></td>
</tr>
</tbody>
</table>
THE TURING TEST
For the “acting humanly” approach

- It was proposed by Alan Turing (1950).
- This test is an operational definition of intelligence:
  It defines intelligent behavior as the ability to achieve human-level performance in all cognitive tasks, sufficient to consistently fool human interrogators.

- Test:
  A computer is interrogated by a human through a tty terminal and passes the test if the interrogator cannot tell if there is a computer or a human at the other end.

- To pass the Turing test a machine will need to:
  1. represent knowledge
  2. reason automatically
  3. learn
  4. process natural language

- For the TOTAL Turing test (which includes also a video signal so that the interrogator can test the subject’s perceptual abilities) the machine will also need to:
  5 “see” (computer vision)
  6 “move” (robotics)

There has NOT been a big effort to try to pass the Turing test.
WHAT IS AI? (Cont.)

• AI is at the intersection of
  
  – philosophy,
  – mathematics,
  – psychology,
  – computer engineering,
  – linguistics,
  – cognitive science, and
  – computer science.

• It differs from philosophy and psychology
  (which are also concerned with intelligence)
  in which AI strives to BUILD intelligent entities as well as to understand them.

• It differs from other subareas of computer science and engineering, in its emphasis on perception, reason, and action.
WHAT IS AI? (Cont.)

• AI can be seen as an ensemble of ideas about
  – representing knowledge
  – using knowledge to solve problems

• with two goals:
  – Engineering Goal:
    To solve real-world problems using AI
  – Scientific Goal:
    To explain various sorts of intelligence.
TOPICS TO BE COVERED IN THIS COURSE

• Core AI:
  – Knowledge Representation Techniques:
    Semantic Nets, Rules, Propositional Logic, 1st Order Logic,
    Probability, . . .
  – Problem Solving Strategies:
    Blind Search, Heuristic Search, Optimal Search, Tree and
    Adversarial Search (Game Playing), Constraint Satisfaction,
    Logical Inference, Planning, Probabilistic Reasoning, . . .

• AI Applications:
  – Machine Learning,
  – Machine Vision, and
  – Natural Language Processing.
SUCCESSFUL STORIES IN AI:

- **Computer Chess:**
  e.g. Deep Blue, developed at IBM.

- **Robot Explorers:**
  e.g. Space exploration on Mars. Robot designed at the Jet Propulsion Laboratory.

- **Autonomous vehicles:**
  e.g. car developed at Carnegie Mellon Univ.

- **Expert Systems for Medical Diagnosis:**
  e.g. MYCIN (diagnoses blood infections. It performs as well as human experts and considerably better than junior doctors) developed at Stanford Univ.

- **Expert Systems for Financial Applications.**

- **Language Translation Systems.**

- **Air Traffic Control Systems**

- **Automated Personal Assistants**

- **Robots for Hazardous Conditions**