# *Chapter 1*

# Introduction to Artificial Intelligence
# (2025)

## *By*
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# COURSE GOALS

- Introduce the students to the field of AI
- Build the global idea of AI and its effect on the community
- Identify the types of AI agents
- Identify the various AI fields
- Work with some practical examples of AI
- Apply one of the AI fields as a project (self-learning)

# COURSE POLICIES

**<span style="color:green">Teaching methods:</span>**

- Lectures (2 hrs weekly)

- Sections (practical and theoretical) (1+2 hrs weekly)

- Course project and presentation (within lectures and sections

**<span style="color:red">Evaluation methods</span>**

- Quizzes, reports, tasks all the term and Midterm exam **<span style="color:red">(50 degrees)</span>**

- Oral and practical exam **<span style="color:red">(10 degrees)</span>**

- Final exam **<span style="color:red">(40 degrees)</span>**

# COURSE MATERIALS

- Russell & Norvig, AI: A Modern Approach

- http://lib.ysu.am/disciplines_bk/b7707dde83ee24b2b23999b4df5fd988.pdf

- Other material (videos, practical and theoretical will be given later)
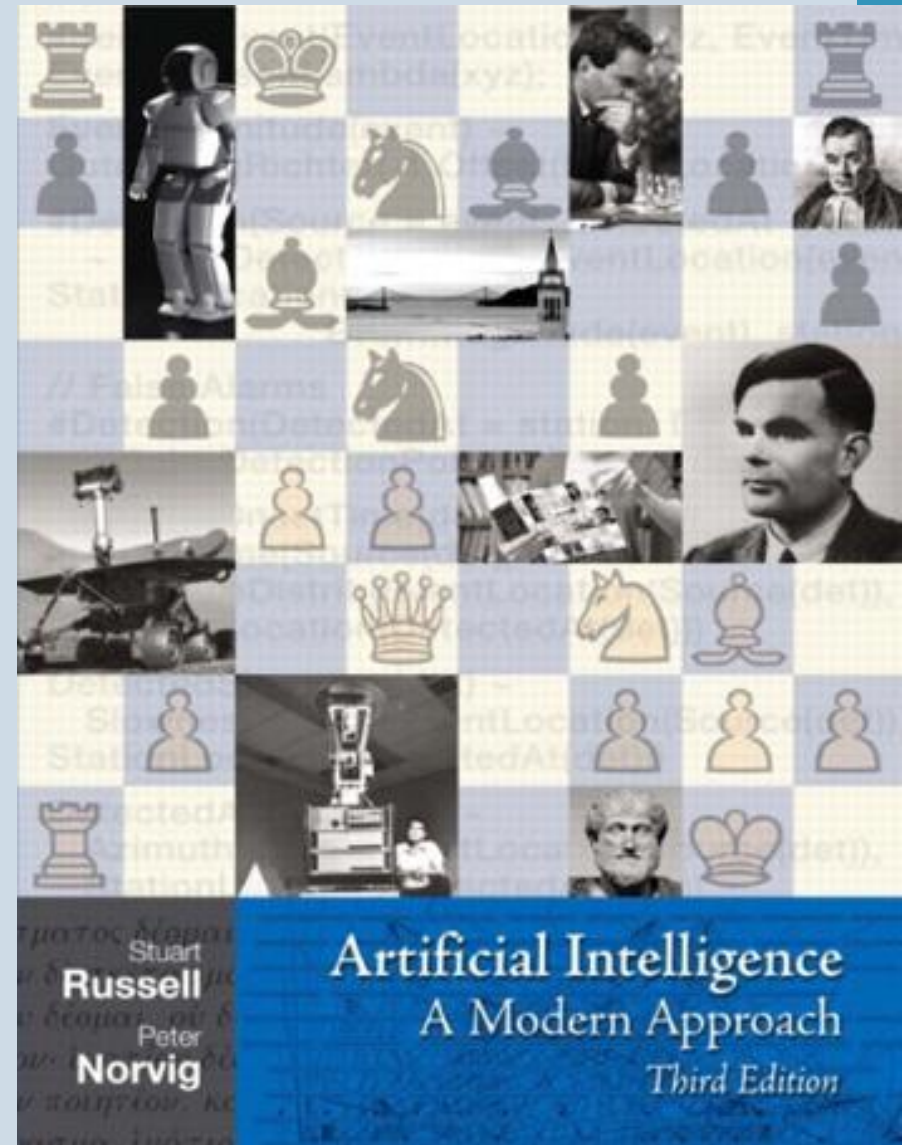
# WHAT IS INTELLIGENCE?

- Make the right action
- Take the right decision
- Infer from current data (knowledge)
- Analyze data to predict or summarize
- The ability to acquire and apply knowledge and skills.
- The ability to solve complex problems or make decisions with outcomes benefiting the environment
- Having or showing the ability to easily learn or understand things or to deal with new or difficult situations
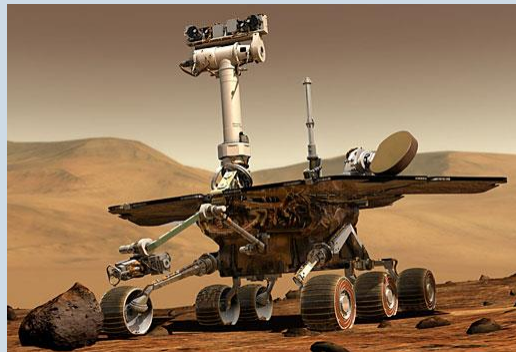
# WHAT IS ARTIFICIAL INTELLIGENCE?

- To make the machine (computer, robot, mobile,….) behave like <u>human</u>

- Intelligent human  of course

- <u>Which means:</u>

- Make the right action

- Take the right decision

- Infer from current data (knowledge) ,…..etc

- Later on, we will discover that not only human is Intelligent, other God's creatures have a sort of Intelligence we will make use of (birds, ants,…).

# AI IN MOVIES
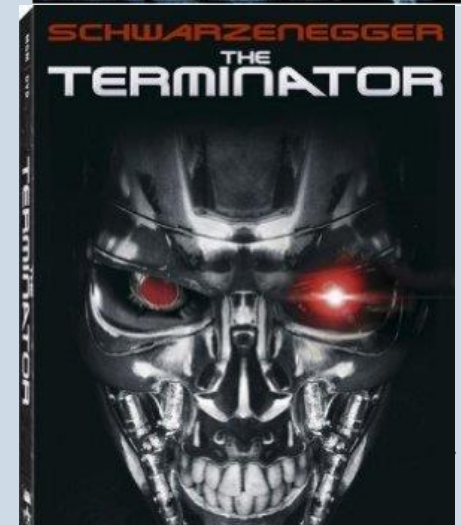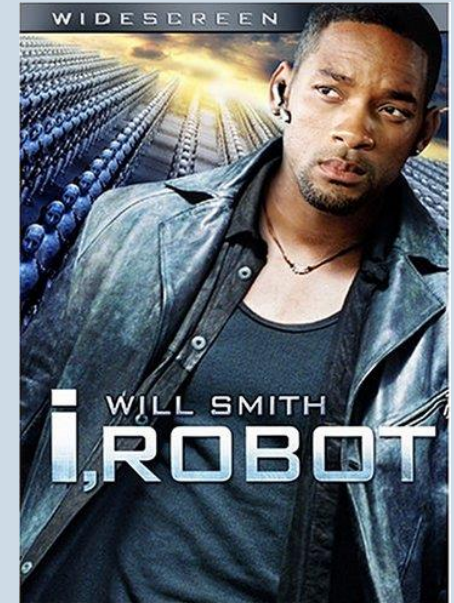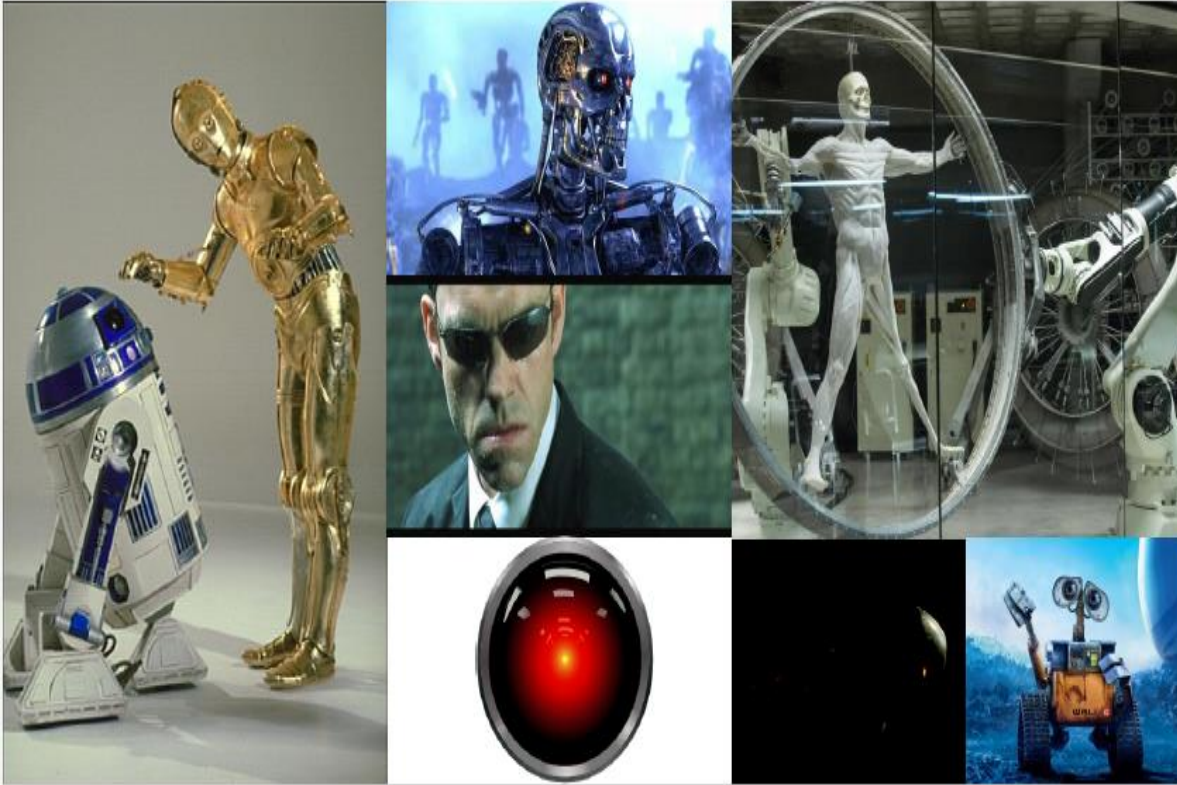
# AI IN REAL WORLD

# What is artificial intelligence?

- There is no clear consensus on the definition of AI
- **John McCarthy** coined the phrase AI in 1956

*Q. What is artificial intelligence?*

A. It is the science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of using computers to understand human or *other* intelligence, but AI does not have to confine itself to methods that are biologically observable.

| | |
|---|---|
| "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" (Charniak and McDermott, 1985) |
| "[The automation of] activities that we associate with human thinking, activities such as decision-making, problem solving, learning ..." (Bellman, 1978) | "The study of the computations that make it possible to perceive, reason, and act" (Winston, 1992) |
| "The art of creating machines that perform functions that require intelligence when performed by people" (Kurzweil, 1990) | "A field of study that seeks to explain and emulate intelligent behavior in terms of computational processes" (Schalkoff, 1990) |
| "The study of how to make computers do things at which, at the moment, people are better" (Rich and Knight, 1991) | "The branch of computer science that is concerned with the automation of intelligent behavior" (Luger and Stubblefield, 1993) |

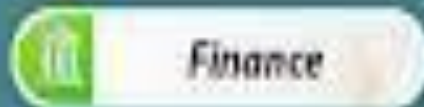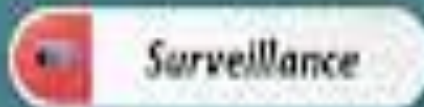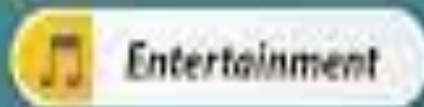# Possible applications for Artificial Intelligence
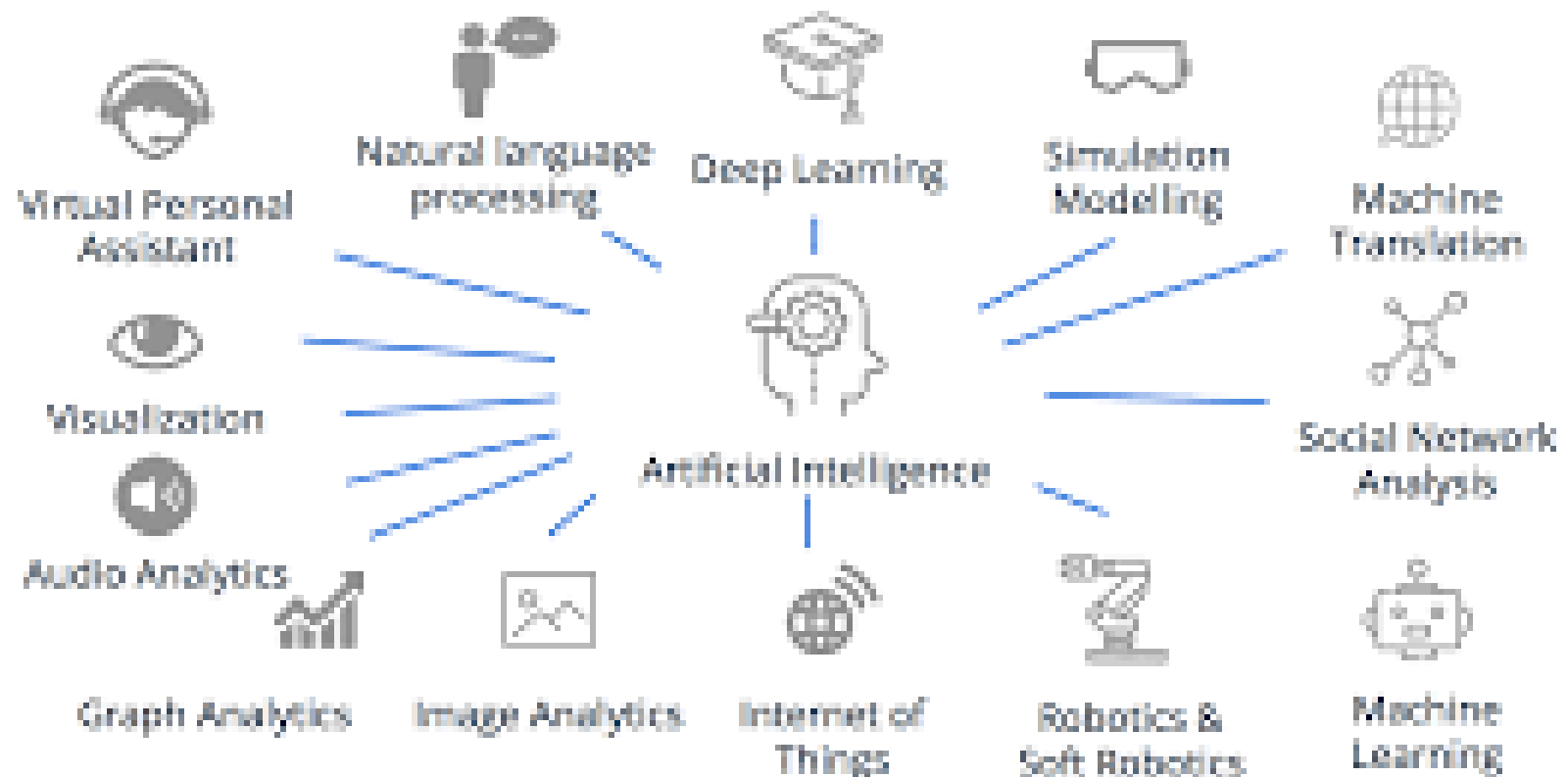
# WHEN AI BEGUN?

➤ Artificial intelligence is one of the newest sciences which emerged after the world war II.

➤ AI represents a big and open field.

➤ The name artificial intelligence was adopted for the first time in 1956.

➤ Artificial intelligence can be viewed as a universal field: ho to automate intellectual tasks?

# What AIains must know

- AI has roots in a **number of scientific disciplines**

  1. computer science and engineering (hardware and software)
  2. philosophy (rules of reasoning)
  3. mathematics (logic, algorithms, optimization)
  4. cognitive science and psychology (modeling high level human/animal thinking)
  5. neural science (model low level human/animal brain activity)
  6. linguistics

# History of AI

- **The birth of AI (1943 – 1956)**
  - McCulloch and Pitts (1943): simplified mathematical model of neurons (resting/firing states) can realize all propositional logic primitives (can compute all Turing computable functions)
  - Alan Turing: Turing machine and Turing test (1950)
  - Claude Shannon: information theory; possibility of chess playing computers
  - Boole, Aristotle, Euclid (logics, syllogisms)

- A machine can be described as a thinking machine if it passes the Turing Test.
- A human communicates with a computer via a teletype (i.e. keyboard).
- If the human **can't tell he is talking to a computer or another human**, it passes.

## Turing Test Process

Human Communication

↓

Computer Response

↓

Human Identifies Entity?

No →

Yes ↓

Not Pass

Pass
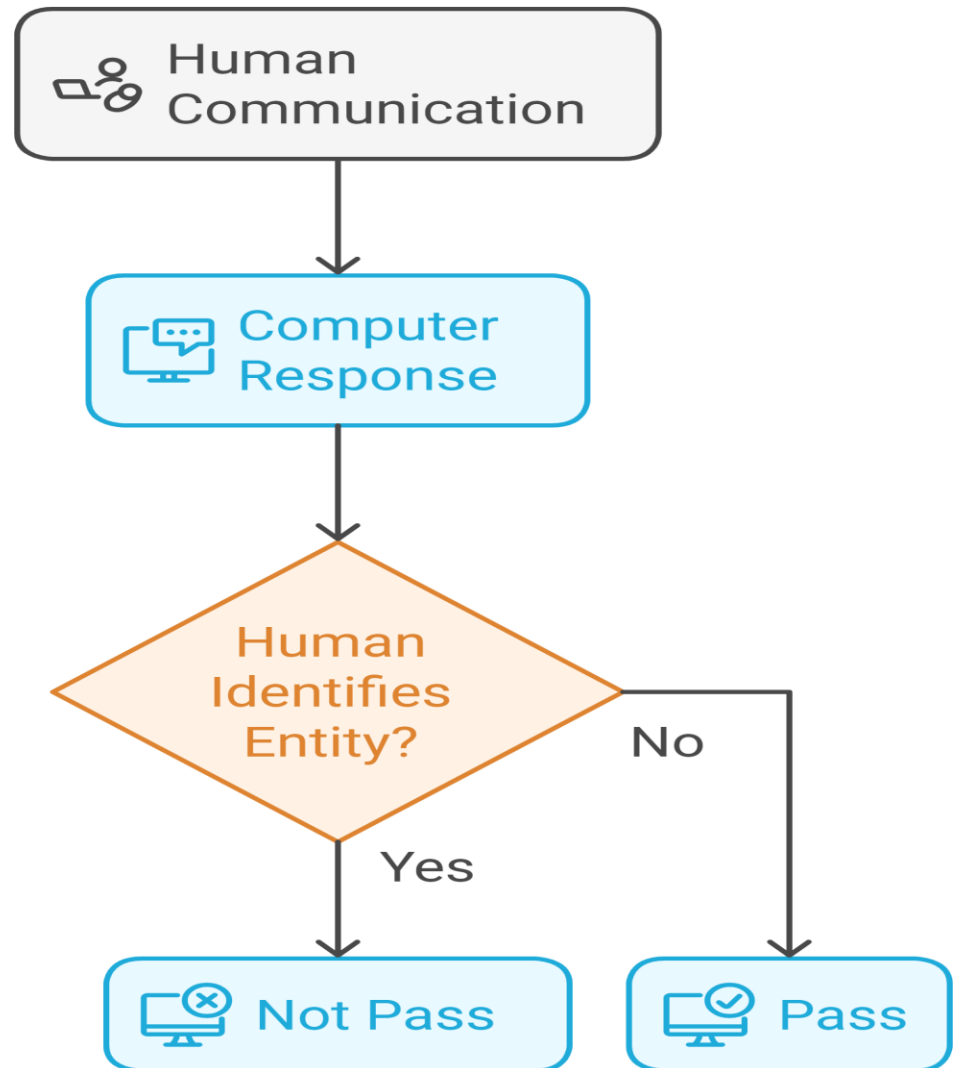
# THE TURING TEST

- **For a machine to do so, it needs to be able to:**

➢**Natural language processing**: To communicate successfully.

➢**Knowledge representation**: To store what it knows or hears.

➢**Automated reasoning**: to answer questions and draw conclusions using stored information.

**Recently they added**

➢**Machine learning**: To adapt to new circumstances and to detect and extrapolate patterns.

➢**Computer vision**: To perceive objects.

➢**Robotics** to manipulate objects and move.

# Machine capabilities

## Natural Language Processing

Enables communication with users effectively.

## Automated Reasoning

Answers questions and draws conclusions from data.

## Knowledge Representation

Stores information and knowledge for future use.

# History of AI

- **Early enthusiasm (1952 – 1969)**
  - 1956 Dartmouth conference
    John McCarthy (Lisp);
    Marvin Minsky (first neural network machine);
    Alan Newell and Herbert Simon (GPS);
  - Emphasis on intelligent general problem solving
    GSP (means-ends analysis);
    Lisp (AI programming language);
    Resolution by John Robinson (basis for automatic theorem proving);
    heuristic search (A*, AO*, game tree search)

- **Emphasis on knowledge (1966 – 1974)**
  - domain specific knowledge is the key to overcome existing difficulties
  - knowledge representation (KR) paradigms
  - declarative vs. procedural representation

# History of AI

- **<u>Knowledge-based systems (1969 – 1999)</u>**
  - DENDRAL: the first knowledge intensive system (determining 3D structures of complex chemical compounds)
  - MYCIN: first rule-based expert system (containing 450 rules for diagnosing blood infectious diseases)
  EMYCIN: an ES shell
  - PROSPECTOR: first knowledge-based system that made significant profit (geological ES for mineral deposits)

- **<u>AI became an industry (1980 – 1989)</u>**

  - AI started to become industrially and commercially beneficial
  - wide applications in various domains
  - commercially available tool

- **<u>Current trends (1990 – present)</u>**
  - Japan: "First Generation" project (10 year plan to build intelligence machines running in Prolog)
  - USA: Microelectronics and Computer Technology Corporation (MCC) was formed in response
  - Britain: Funding for AI was reinstated
  - more realistic goals
  - more practical (application oriented)
  - distributed AI and intelligent software agents
  - resurgence of natural computation - neural networks and emergence of genetic algorithms – many applications
  - dominance of machine learning (big apps)

# WEAK AND STRONG AI

**What type of AI is being considered?**

**Weak AI**

Machines simulate intelligence without consciousness.
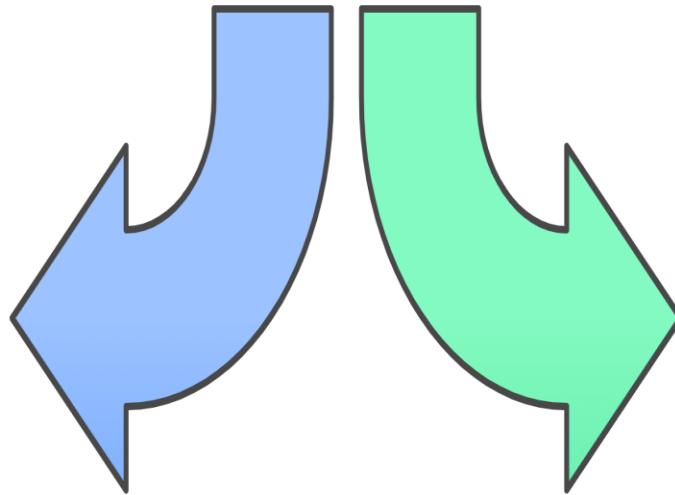
**Strong AI**

Machines possess real consciousness and intelligence.

❑ ***Examples of AI applications*: Natural Language Understanding**

➢ Natural language understanding (spell checkers, grammar checkers)

➢ AI translators – spoken to and prints what one wants in foreign languages : Alta Vista's translation of web pages.

➢ Advanced systems can answer questions based on the information in the text and produce useful summaries.

➢ PROVERB (Littman 1999) crossword puzzles

➢ ChatGPT

## ❑*Examples of AI applications*: Expert systems

➢In geology

**prospector** expert system carries evaluation of mineral potential of geological site or region

➢Diagnostic Systems

**Pathfinder**, a medical diagnosis system (suggests tests and makes diagnosis) developed by Heckerman and other Microsoft research

Microsoft Office Assistant in Office provides customized help by decision-theoretic reasoning by an individual user.

**MYCIN** system for diagnosing bacterial infections of the blood and suggesting  treatments

# PRACTICE

Identifying AI In Applications

# Employee Attendance Using Fingerprint

# Employee Attendance Using Face recognition

# REPORT 1
# (TO BE DELIVERED NEXT LECTURE)

# REPORT

- Identify a possible AI application that you can apply in our faculty to enhance its tasks.

- The report should contain:

- 1- title of the idea

- 2- description of the idea

- 3- the problem it solves

- 4- possible applicability

- 5- cost of devices to be used (if any)

# ❑ *Main issues in AI*

➢ **Representation**

➢ **Search:** many tasks can be viewed as searching a very large problem space for solution space

➢ **Inference:** related to search, inferring other facts from some given facts. e.g., knowing all "elephants  have trunks" and "Jo is an elephant," can we answer does Jo have a trunk?

➢ **Learning:** inductive inference, neural networks, artificial life, genetic algorithms, evolutionary strategies

➢ **Planning:** starting with general facts about  the world, facts about the effects of basic actions, facts about a particular situation, and a statement of a goal, generate a strategy

# CHAPTER 1

# AGENTS

# AGENTS

- An agent is anything that can be viewed as perceiving its environment through sensors and acting upon that environment through actuators
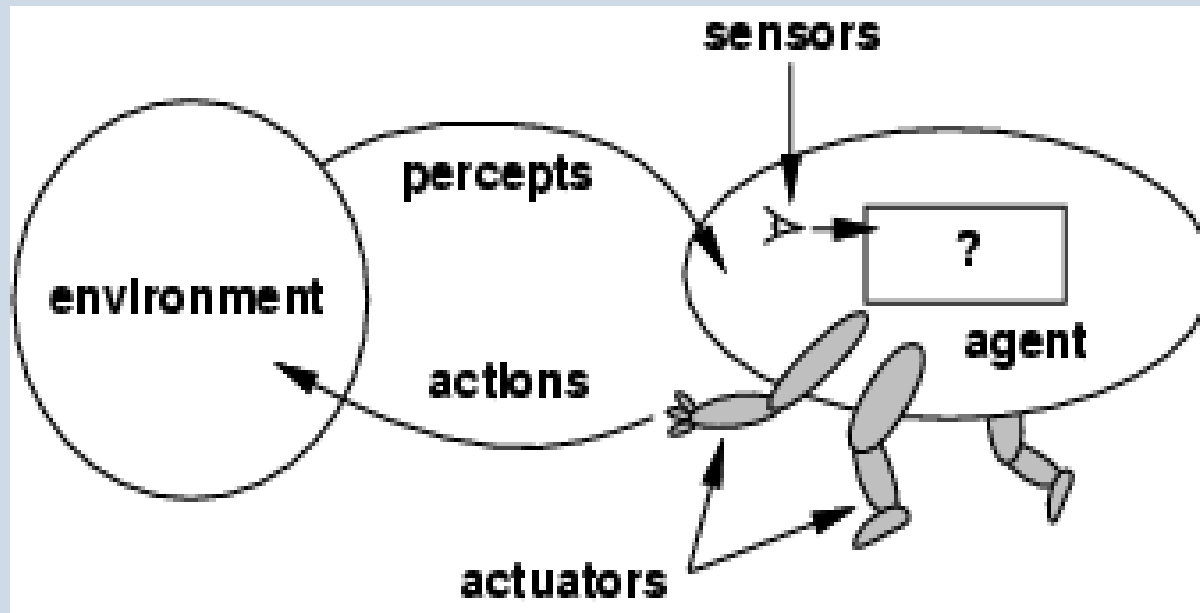
# GROUP PROJECT

1- Make a team (4-5 students) which should be submitted next week

2- Choose one of the following applications to be your project

3- Weekly, each team will gradually formulate the problem, the idea, the solution, make presentation and make simulation or real prototype for the project

# POSSIBLE IDEAS FOR PROJECTS

- 1- Smart City

- 2- Smart Faculty Campus

- 3- Smart Home

- 4- Robot

- 5- Controlling Cars

- 6- Computer Vision Application

- 7- Smart Agriculture

# PROJECTS

- 8- Voice Recognition Application
- 9- Speech Recognition Application
- 10- Recommender System
- 11- Text To Speech
- 12- Autonomous Cars
- 13- Natural Language Processing Application
- 14- Intruder Detection

# PROJECTS

- 15- Medical Diagnosis Application
- 16- Virtual and augmented reality Application
- 17- Automated Traffic Control
- 18- Image annotation