Artificial Intelligence

Introduction to AI and its Applications

Lecture 01

Learning Objectives

- Expose the students to artificial intelligence philosophy
- introduce the students to the different branches of AI and their applications

Agenda

1. Introduction to Artificial Intelligence
2. Artificial Intelligence Branches and Applications
3. Topics in Artificial Intelligence

What is artificial intelligence?

What is artificial Intelligence?

- It is a branch of Computer Science aims at creating computers or machines as intelligent as human beings
- *"The science and engineering of making intelligent machines, especially intelligent computer programs"* [John McCarthy]
- A set of methods and techniques of making computer, a robot or a software think intelligently, in a manner similar to human

What is artificial intelligence?

What is Intelligence?

"I know that I am intelligent, because I know that I know nothing." [*Socrates*]

"The true sign of intelligence is not knowledge but imagination." [*Einstein*]

"The ability to learn or understand or to deal with new or trying situations" [*Webster*]

" The ability to learn, understand, and make judgments or have opinions that are based on reason" [Cambridge]

So, What is Intelligence?

- The ability to obtain, manipulate, and apply knowledge to solve problems.
- The ability learns quickly and from experience.
- The capacity to think clearly and act effectively in the environment.
- Being A Human??

How do we measure intelligence?

How do we measure intelligence?

- The standard and most widely accepted method is by **measuring** a person's '**intelligence quotient**' or IQ.
- IQ assess various types of abilities:
  - mathematical,
  - Spatial,
  - Verbal,
  - logic and memory.
- **A person can be highly intelligent and still score poorly on IQ tests**

How do we measure Artificial Intelligence?

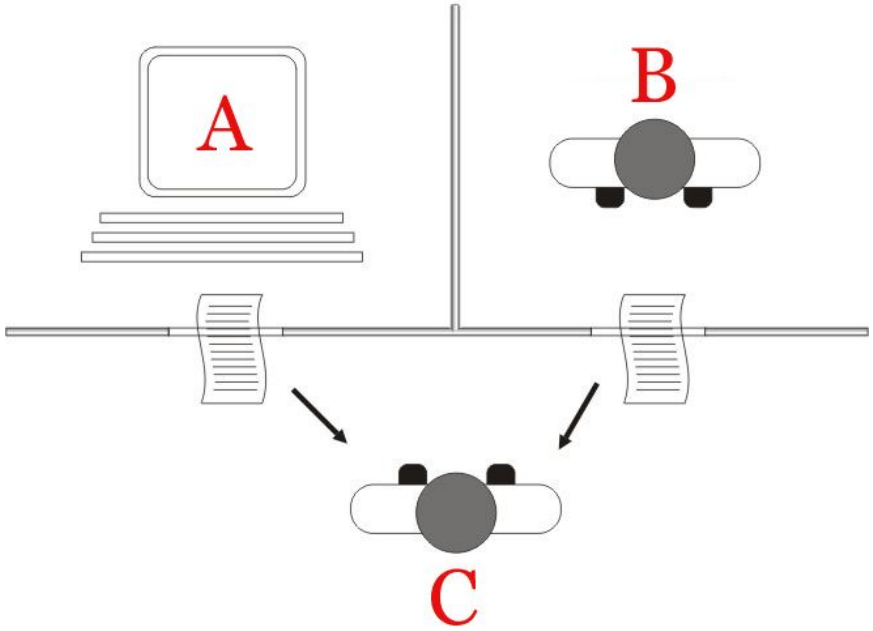
- Intelligence is not a single thing , we can not ask, a yes or no question Is this machine intelligent or not?
- There are two main schools of thought in artificial intelligence:
  - Computing Machinery and Intelligence [Turing Machines | Turing Test]
  - Nine Objections Group
- The Turing Machines put the human mind into the computer and promise that AI with human intelligence will be accomplished within the next 20 years.

Computing Machinery and Intelligence

Article by Alan Turing, Published in 1950, Can machines think?

Can the machine win a game, called the "Imitation Game".

Chatbot is one good example of imitation game



Nine Objections Group

- Religious, Mathematical, Neurology, etc
- AI would need to be truly non-deterministic.
- People have promised that AI was just "20 years off" since 1936
- We have no idea how human intelligence work.

In less than 20 years: https://youtu.be/Db3evy2Jnz4

Artificial Intelligence Branches & Applications

What are the branches of AI?

- Logical AI, Reasoning, Inference
- Search
- Pattern Recognition
- Learning
- Computational Intelligence
- Knowledge Representation

Logical AI, Reasoning and Inference

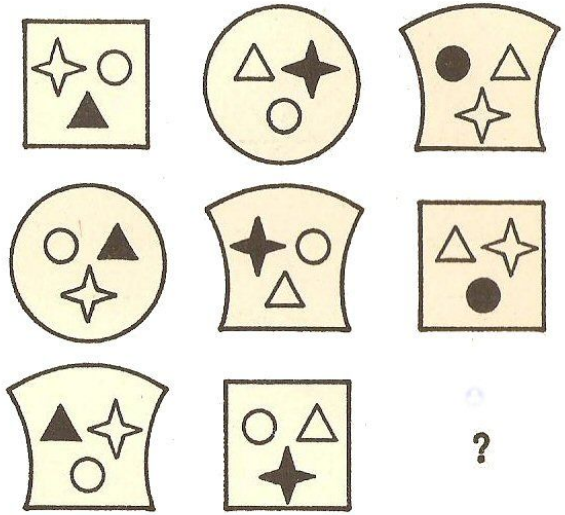
- Systems that generate conclusion (proposition) from knowledge (facts or premises) using logical techniques such as induction, deduction, abduction reasoning
- Example:
  - Every quiz has been easy => Therefore the final test will be easy [inductive]
  - All men are mortal, Socrates is a man => Therefore, Socrates is mortal [deductive]
  - Fever, Cough, Sore throat, Malaise => You have Flu [abductive]

Search

- Examine a large number of possibilities, searching for the best move, option, decision, etc
- Examples:
  - Uninformed Search (blind or brute-force)
  - Informed Search (Heuristic)
  - Local Search
- Applications:
  - Games
  - Cybersecurity
  - Networks on Chip Design

Pattern Recognition

- Methods and algorithms to discover patterns, compare, find similarity, measure distance between objects.
- Applications
  - Computer Vision
  - Data Mining
  - Economy (Stock Exchange Forecast)
  - Traffic Analysis and Control (Civil Administration)
  - Cybersecurity Biometrics



Learning (machine learning)

- Computer systems than can learn and solve problems without being explicitly programmed.
- A Subfield of soft computing (sometimes)
- Main Types
  - Supervised Learning
  - Unsupervised Learning
  - Reinforcement Learning
- Applications
  - Engineering
  - Economics
  - Healthcare

Computational Intelligence

- nature-inspired computational methodologies and approaches to address complex real-world problems.
- Examples:
  - Evolutionary Computation (Artificial Immune System, Swarm Intelligence, Genetic Algorithm)
  - Neural Network
  - Fuzzy Logic
- Application:
  - Engineering
  - Economics
  - Healthcare

Knowledge Representation

- Methods and Techniques focus on modeling, encoding, and representing real-world knowledge, problem-solving knowledge in a form that computer system can use. (computer-friendly format)
- Examples:
  - Frame-Language
  - Ontology Engineering
  - Graph Modeling (Knowledge Graph)
- Applications
  - Expert Systems.
  - Recommendation Systems.

Topics in AI

1. Introduction to AI and its Applications
2. Search Techniques for Artificial Intelligence (heuristic search, back tracking, maxmin, and pathfinding)
3. Measuring Similarity and Distance
4. Computational Intelligence (genetic algorithm, swarm intelligence, artificial immune system, etc)
5. Machine Learning (data preparation, supervised and unsupervised learning techniques)
6. Natural Network & Deep Learning (introduction and basic concepts)
7. Recommendation and Expert Systems (knowledge representation, collaborative, content-based, hybrid system)

Course Agenda

Dates		Tuesday	Wednesday	Friday
Week 01	May, 01-05, 2016	Introduction to AI and its Applications		
Week 02	May, 08-12, 2016	Search Techniques for Artificial Intelligence		
Week 03	May, 15-19, 2016			
Week 04	May, 22-26, 2016	Measuring Similarity and Distance		
Week 05	May, 29-02, 2016	Computational Intelligence		
Week 06	June, 05-09, 2016			
Week 07	June, 12-16, 2016	Machine Learning		
Week 08	June, 19-23, 2016			
Week 09	June, 26-30, 2016	Natural Network & Deep Learning		
Week 10	July, 03-07, 2016			
Week 11	July, 10-14, 2016	Recommendation Systems		
Week 12	July, 17-21, 2016	Projects & Papers		
Week 13	July, 24-28, 2016	Projects & Papers		Final Quiz

Topics will Not Covered

- Intelligent Agents
- Case-based Reasoning
- Logical AI and Reasoning
- Knowledge Representation
- Others

Next Time

- Introduction to Search Algorithms
- Uninformed Search Algorithm

Reading List

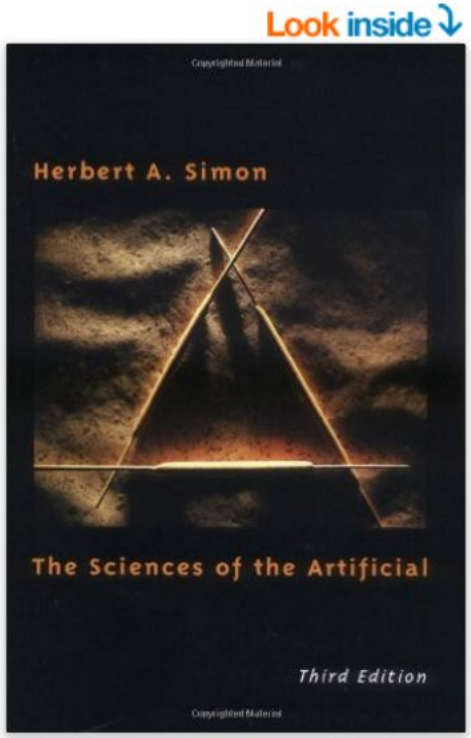
Papers | Articles

- Is it an Agent, or just a Program?: A Taxonomy for Autonomous Agents, 1996
- Computing Machinery and Intelligence, 1950

Books:

- Ch01, Artificial Intelligence: A Modern Approach (3rd Edition), by Stuart Russell and Peter Norvig

Reading List (additional)



The Sciences of the Artificial Paperback – Sep 26 1996

by Herbert A. Simon (Author)

3 customer reviews

See all 8 formats and editions

Kindle Edition	Hardcover	Paperback
CDN$ 47.99	CDN$ 94.51 Prime	CDN$ 60.66 Prime
Read with Our Free App	4 Used from CDN$ 216.95 5 New from CDN$ 94.51	11 Used from CDN$ 17.83 21 New from CDN$ 40.25

Continuing his exploration of the organization of complexity and the science of design

Learning Outcome

- Send an email as a group
  - List at least three things you did not know before about the lecture topic
  - List at least one practical application or usage where you think you can use what have learned.
  - List one thing you did not like