

ARTIFICIAL INTELLIGENCE CS 471

Lecture 1

Artificial intelligence is the branch of computer science

This definition implies that AI is a part of computer science,

- must be based on sound theoretical and applied principles of computer science

Principles of Computer Science

- This definition implies AI is a part of computer science,
 - must be based on sound theoretical and applied principles of computer science

Principles include:

- the data structures used in knowledge representation,
- the algorithms needed to apply that knowledge and
- the languages and programming techniques used in their implementation

AI dealings

- Development of algorithms and techniques to simulate or even recreate the capabilities of human mind
- Computer perception, reasoning and action

Dealing with uncertainty is a central challenge for AI

Computer perception

- Computer perception is **the capability of a computer system to interpret data in a manner that is similar to the way humans use their senses to relate to the world around them.**

The basic method that the computers take in and respond to their environment is through the attached hardware

Computer reasoning

Reasoning system is a software system that generates conclusions from available knowledge using logical techniques such as deduction and induction.

Reasoning systems play an important role in the implementation of artificial intelligence and knowledge-based systems.

Overview of AI

- Uncertainty management capabilities are required to combine evidence about a new situation with knowledge about similar situations, to draw inferences, and predict the effects of actions
- Numerical computing has traditionally focused on problems where measurement imprecision is the sole source of reasoning uncertainty
- AI researchers aim to develop software systems for applications such as automated learning, perception, natural language, and speech understanding.

Overview of AI

Such systems must deal with many sources of uncertainty such:

- alternative explanations;
- missing information;
- incorrect object;
- ambiguous references;
- prediction of future events;
- deliberate deception.

AI application areas

These days machines are performing many smarter activities using cognitive intelligence in contrast to natural intelligence (NI) displayed by humans and other animals.

AI is being used in many sectors and it has opened the doors of implementation of AI in many other emerging sectors.

AI application areas

- Virtual Assistant or Chatbots
- Agriculture and Farming
- Autonomous Flying
- Retail, Shopping and Fashion
- Security and Surveillance
- Sports Analytics and Activities
- Manufacturing and Production
- Live Stock and Inventory Management
- Autonomous cars
- Healthcare and Medical Imaging Analysis
- Warehousing and Logistic Supply Chain

AI in Virtual Assistant or Chatbots

- Alexa, Siri and Google Assistance are the major examples of virtual assistance
- Automated bots answering the questions of customers are the example of AI-based chatbots working with the best performance

Chatbots are used to automate the customer support and assistance system more expedient and trouble-free.

Chatbots can transform business with multiple benefits and keeping the client-customer relationship more intact.

AI in Agriculture

- Autonomous tractors and **AI based drones** monitoring are used to enhance the productivity and crop yield of farmlands.
- Robots and automated machines are also used in these fields to monitor crop health conditions and harvesting.
- **AI can help agriculture** to boost crop productivity with better plant **health** and weather monitoring systems while making the entire process trouble-free.
- Data is also gathered to further train such models work in agricultural or farming related fields.

AI in Automotive

- **Autonomous Vehicles or Self-driving Cars** are the other examples of AI
- When AI is fully integrated into such a system, it makes the machine work automatically while understanding the nearby surroundings and real-world scenario.

AI-based face recognition and biometric system

helping to keep track the human beings and provide a safe zone to live.

AI application areas

Automated assembly lines in automotive sectors are making cars with higher production

AI in health care

Empowers machines to do diagnosis

Analysis of prediction of the various types of diseases

Monitoring patient's progress

Helping scientists to explore new drug discoveries

Game playing

Early research in AI was done in game playing such as chess, checkers, draft, 15 puzzle

Why choose games?

- Games have an intelligent appeal and properties that make them subjects of research
- Games are played with well defined rules and this makes it easy to generate search space
- Researcher is freed from many ambiguities and complexities inherent in less structured problems.

Game playing

- Games use board configurations which can be easily represented on a computer
- Games can generate extremely large search spaces
- They allow the use of heuristics which are a major area of AI research

A heuristic is a useful but potentially fallible problem solving strategy

For example checking to make sure an unresponsive appliance is plugged on before assuming it is broken or to castle in order to try and protect your king from being captured in a chess game

Expert Systems

One major insight gained from early work in problem solving was the importance of domain specific knowledge for example:

- A doctor is effective in diagnosing illness because he/she knows a lot about medicine
- A geologist is effective at discovering mineral deposits because he/she is able to apply lots of theoretical and empirical knowledge about geology to the problem at hand

Expert Systems

Expert knowledge is a combination of:

- Theoretical understanding of the problem
- A collection of heuristic problem solving rules that experience has shown to be effective in the domain

Expert systems are constructed by:

- Obtaining knowledge from a human expert
- Coding it in a form that a computer may apply to similar problems.

Introduction to AI

Definitions and Concerns

AI is a branch of computer science that deals with the automation of intelligent behavior

What is Intelligence?

Capability to think, to learn from experience, to adapt and solve problems and in particular:

- The ability to solve novel problems
- Ability to act rationally
- Ability to act like humans

What is involved in intelligence?

1. Ability to interact with the real world:

- To perceive, understand and act
- Speech recognition and understanding synthesis
- Image understanding
- Ability to take actions

2. Reasoning and planning

- Solving new problems
- Planning and making decisions

Reasoning and planning

- Ability to deal with unexpected problems or uncertainties

3. Learning and adaption

- Continuous learning and adapting to new situations/environments
- Human internal models are always being updated for example

A baby learning to categorize and recognize animals

Three types of intelligence

American psychologist Robert Sternberg proposed the triarchic theory to describe the distinct types of intelligence in an individual:

- **analytical intelligence,**
- **creative intelligence,**
- **and practical intelligence.**

Concerns of AI

Is Artificial Intelligence Dangerous? Should we be scared of artificial intelligence (AI)?

- Legendary physicist Stephen Hawking and Tesla and SpaceX leader and innovator Elen Musk suggest AI could potentially be very dangerous.
- Musk at one point was comparing AI to the dangers of the dictator of North Korea.
- Microsoft co-founder Bill Gates also believes there's reason to be cautious, but that the good can outweigh the bad if managed properly.

Recent developments have made super-intelligent machines possible much sooner than initially thought, the time is now to determine what dangers artificial intelligence poses.

Analytical intelligence in AI

Computers will support analytics to a very high degree through:

- data mining,
- deep thinking,
- and advanced control of experiments.

AI concerns

AI applications that play a critical role in ensuring safety that Musk, Hawking, and others were concerned about when they proclaimed their hesitation about the technology.

For example, if AI is responsible for ensuring the operation of our power grid and our worst fears are realized, and the system goes rogue or gets hacked by an enemy, it could result in massive harm

AI programmed to do something dangerous, as is the case with autonomous weapons programmed to kill, is one way AI can pose risks. It might even be plausible to expect that the nuclear arms race will be replaced with a global autonomous weapons race.

AI Concerns

Social manipulation

Investigations are still underway to determine the fault of Cambridge Analytica and others associated with the firm who used the data from 50 million Facebook users to try to sway the outcome of the 2016 U.S. presidential election and the U.K.'s Brexit referendum, but if the accusations are correct, it illustrates AI's power for social manipulation.