Chapter 1: Introduction to AI

L3 - Computer science

University of Mohamed Khider Biskra

2023/2024

Some usefull references

- Michael, Negnevitsky. "Artificial intelligence, a guide to intelligent systems." (2005).
- Ertel, Wolfgang. Introduction to artificial intelligence. Springer, 2018.
- Nugues, Pierre M. An introduction to prolog. Springer Berlin Heidelberg, 2006.
- Tom, Taulli. "Artificial Intelligence Basics: A Non-Technical Introduction." Monrovia, CA, USA: Appres (2019).

1 Chapitre I - Introduction

Objective

- The objective of the course is to overview different concepts related to the field of artificial intelligence. Different types of AI-based algorithms will be then studied, which allow to acquire necessary knowledge in the field.

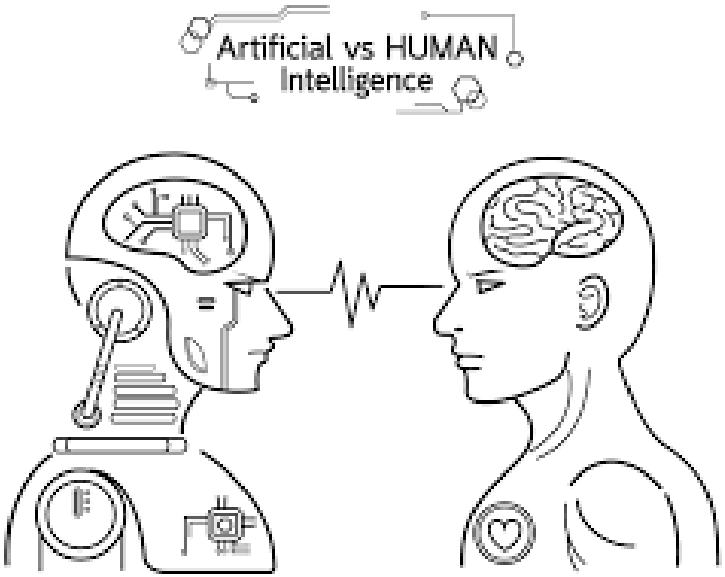
Content of the course

Table of contents:

Content of the course

- **Chapter 3: Expert systems.**
- **Chapter 4: Rule-based expert system.**
- **Chapter 5: Prolog**

- Simulation of human intelligence in machines that are designed to perform tasks that typically require human intelligence, such as recognizing speech, making decisions, and solving problems.
- AI has a growing role in today's world in various fields, such as healthcare, finance, education, and more.
- AI is changing the way we live, work, and interact with technology.



Classical Vs AI-Based algorithms

- **Classical programs:** work each time the same way.
- **AI-Based programs:** work differently according to the situation (**adaptaion**).

Classical Vs AI-Based algorithms

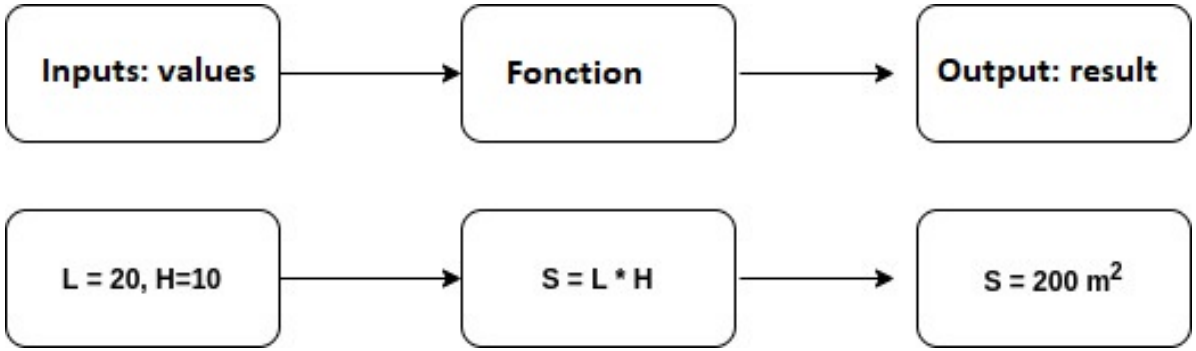


Figure 1: Programmation classique

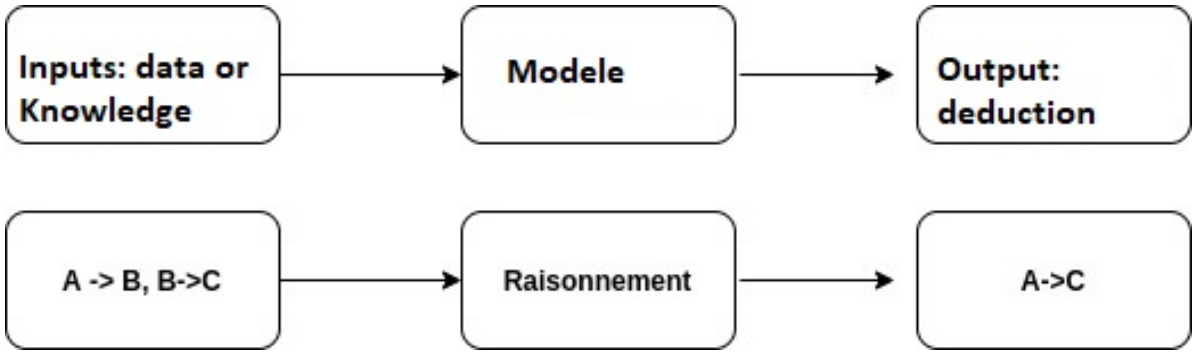
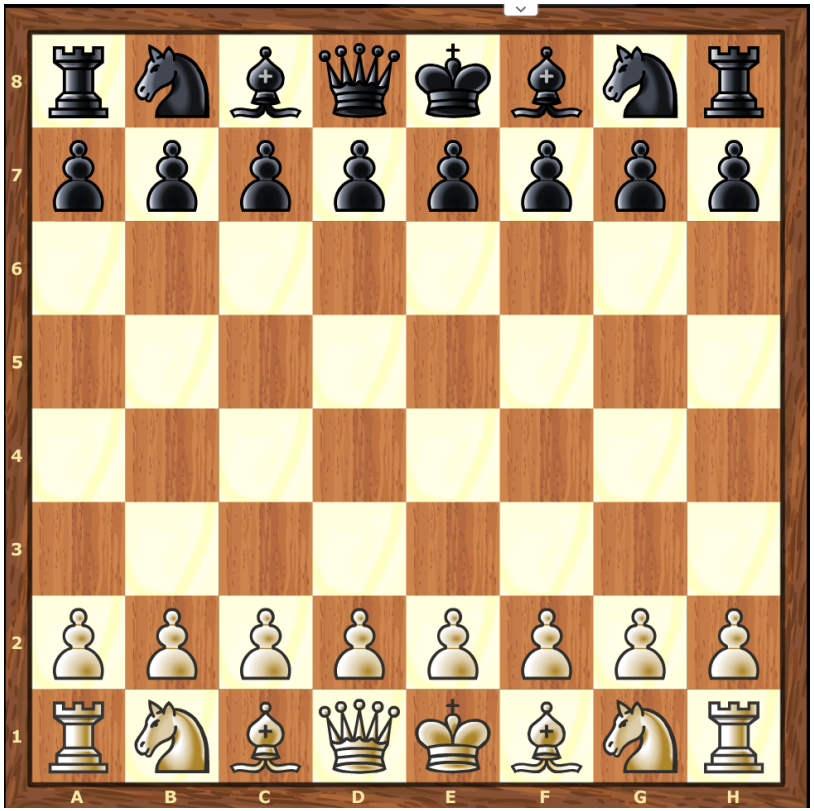


Figure 2: Intelligence artificielle

- **Why using AI?**
  - No algorithmic solution (Machine translation).

- **Why using AI?**
  - Impossibility to predict all possibilities: example of chess games (10^40 moves).



- To define AI, we first have to define intelligence?
- **Intelligence can be defined as the ability to learn from experience, reason logically, linking ideas together, solve problems, understand complex ideas, and adapt to new situations.**
- For example: Socrate is a man; all men are mortal $->$ therefore **Socrates is mortal**.
- Mathematics exercises (change of statement, change of data, etc.)

Forms of intelligences

There are different forms of intelligence:

- **Logical and mathematical intelligence:** Ability to work with numbers, and analyze a mathematical situation, etc.
- **Viso-spatial intelligence:** Positioning in space, e.g. remembering paths (car driver).
- **Verbo-linguistic intelligence:** Understand and announce ideas through language (e.g., lawyer).
- **Interpersonal intelligence:** Understand others and act appropriately (salesperson, negotiator, politician, etc.).
- Etc.

- Intelligence is not only human!
- **Collective intelligence (ants)**: huge and air-conditioned nests, rooms, corridors, search for food (ant colony algorithm).

- **Linguistic intelligence (Bees)**: Indicate the direction and distance to a pollain source via a dense (according to its shape and speed). The angle with the sun indicates the direction.

Definitions

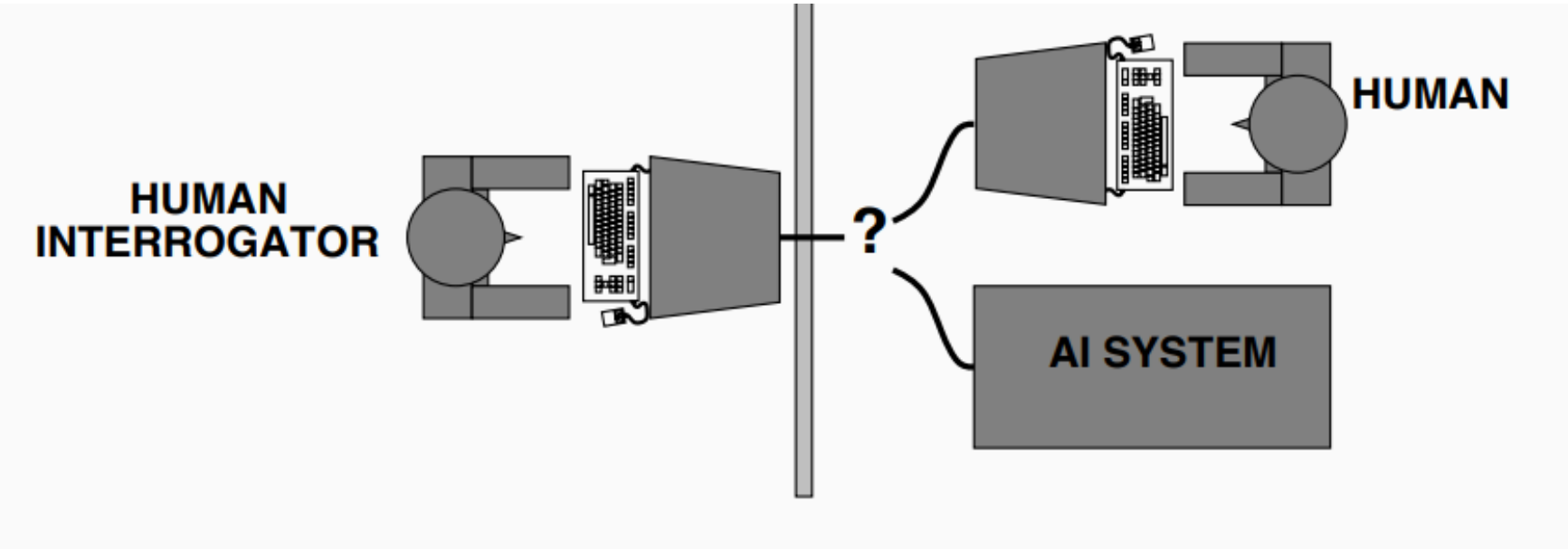
- The field of computer science that focuses on creating intelligent machines that work and learn like human beings.
- It involves the development of algorithms and computer programs that are capable of performing tasks that typically require human intelligence, such as perception, reasoning, learning, and decision making.
- Give an adequate response to the environment.
- Problems whose resolution mechanism cannot be predicted.

Turing test

- The Turing Test is a measure of a machine's ability to exhibit intelligent behavior that is indistinguishable from a human's.
- The test was proposed by British mathematician and computer scientist Alan Turing in 1950.
- The Turing Test involves a human evaluator who engages in a text-based conversation with both a human and a machine, without knowing which is which.
- If the evaluator is unable to reliably distinguish the responses of the machine from those of the human, then the machine is said to have passed the Turing Test.

Turing test

- The Turing Test is considered a classic benchmark for evaluating a machine's ability to exhibit intelligent behavior, and is still widely discussed and debated in the field of artificial intelligence.



History of AI

- The history of AI can be traced back to ancient Greece, where myths about robots and mechanical servants were prevalent.
- However, the modern concept of AI began to take shape in the mid-20th century, with the advent of computers and the realization that machines could be made to perform tasks.
- During the 1950s and 60s, AI researchers developed early forms of machine learning, such as decision trees and linear regression.
- However, this initial period of excitement was followed by a period of reduced funding and progress, known as the "AI winter."
- In recent decades, AI has experienced a resurgence, driven by advances in computing power, data availability, and algorithm development.

Key milestones in the history of AI

- 1956: Dartmouth Conference - The Dartmouth Conference is considered the birthplace of AI as a field of study. Researchers gathered to discuss the potential for building machines that could think and reason like humans.
- 1965: ELIZA - Joseph Weizenbaum at MIT developed the first AI chatbot, ELIZA, which used natural language processing and pattern matching to respond to user inputs.
- 1969: ARPANET - The development of ARPANET, the first wide-area computer network, laid the foundation for the modern internet and made it possible for AI researchers to share data and collaborate on projects.
- 1980s: Expert systems - The development of expert systems, computer programs designed to make decisions in a specific domain, marked a significant step forward for AI.

key milestones in the history of AI

- 1997: Deep Blue vs. Garry Kasparov - Deep Blue, an AI system developed by IBM, defeated world chess champion Garry Kasparov in a highly publicized match, demonstrating the capabilities of AI in strategic reasoning.
- 2006: Neural networks - The rise of deep learning, a form of machine learning based on neural networks, marked a major milestone in the development of AI.
- 2011: Siri - Siri, Apple's virtual assistant, was introduced as a feature of the iPhone, popularizing AI-powered personal assistants.
- 2016: AlphaGo - AlphaGo, an AI system developed by Google DeepMind, defeated world Go champion Lee Sedol, demonstrating the potential of AI in complex, strategic games.

key milestones in the history of AI

- 2018: GPT-2 - OpenAI released GPT-2, a large language model trained on a vast corpus of text, which demonstrated the power of AI in natural language processing and generation.
- 2022: ChatGpt.

Types of AI

Artificial Intelligence (AI) can be classified into several different categories, based on the techniques used to achieve intelligent behavior in computers. Some of the main categories of AI include.

- **Rule-based systems:** Also known as expert systems or production systems, these use a set of if-then rules to make decisions and solve problems.

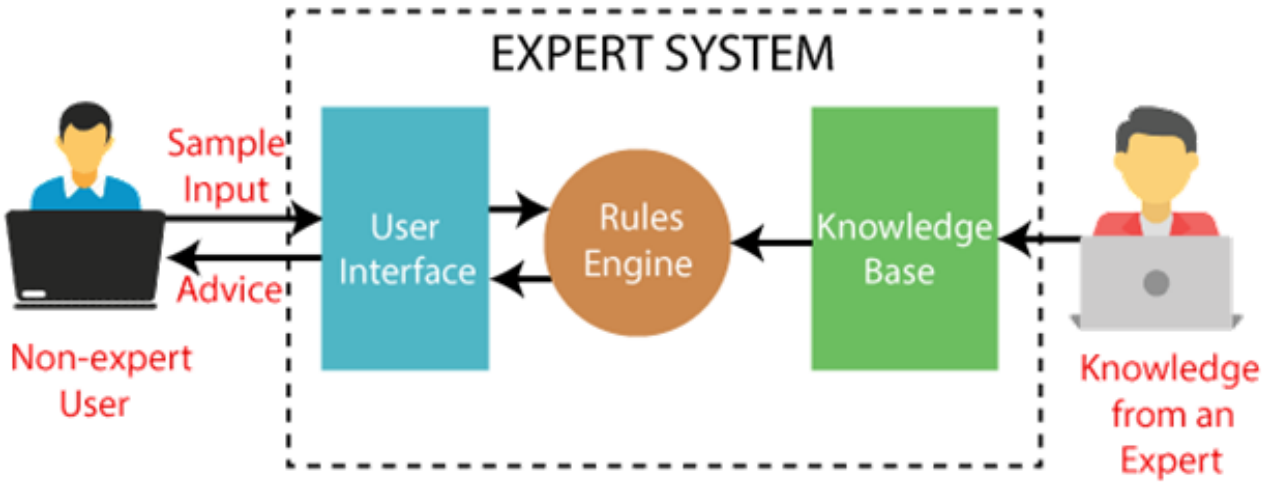


Figure 3: Expert systems.

Types of AI

- **Machine learning:** This involves training computer algorithms on data, so that they can "learn" to make predictions or decisions.

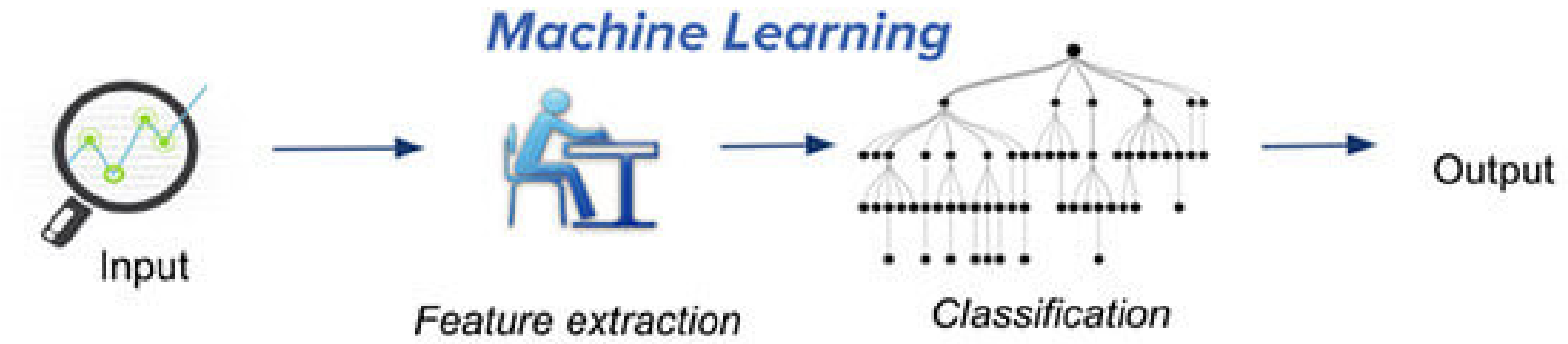


Figure 4: Machine learning.

Types of AI

- **Deep learning:** A subfield of machine learning, deep learning involves training multi-layer artificial neural networks on **large amounts of data**. This approach has been successful in a range of applications, including image and speech recognition, natural language processing, and autonomous vehicles.

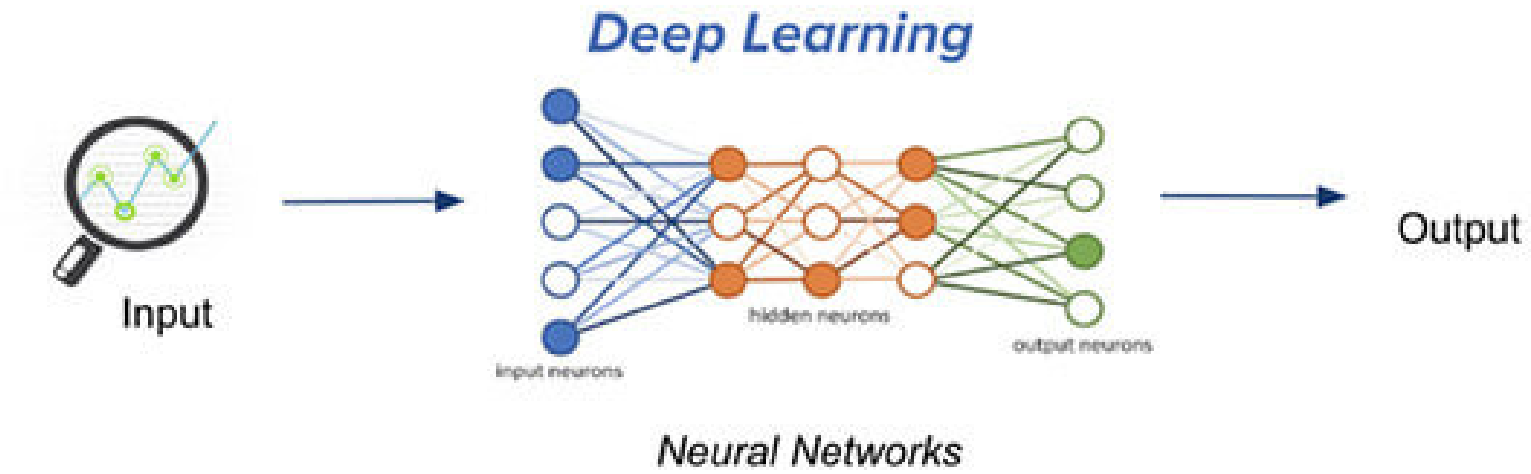


Figure 5: Deep learning.

Types of AI

- **Natural language processing (NLP)**: This involves the development of algorithms that can understand, interpret, and generate human language. NLP has applications in areas such as machine translation, text classification, and sentiment analysis.

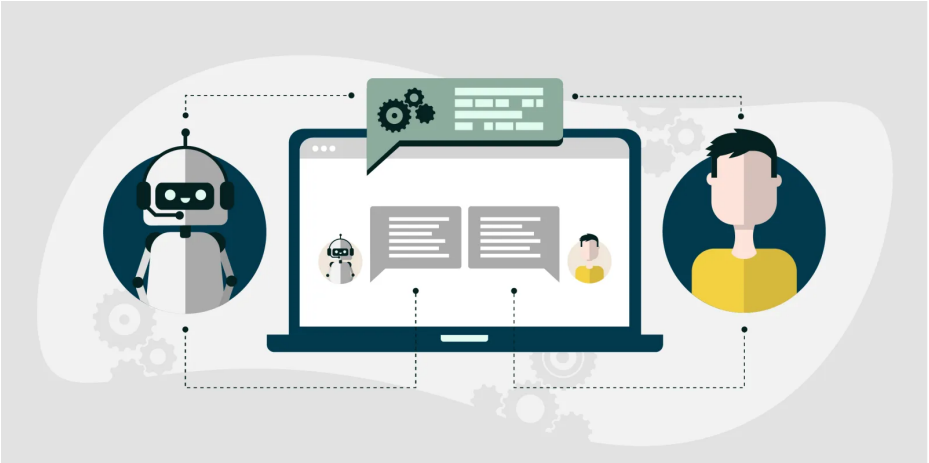


Figure 6: Natural language processing.

Types of AI

- **Robotics:** This involves the development of robots that can sense, reason, and act in the physical world. Robotics has applications in areas such as manufacturing, healthcare, and military.

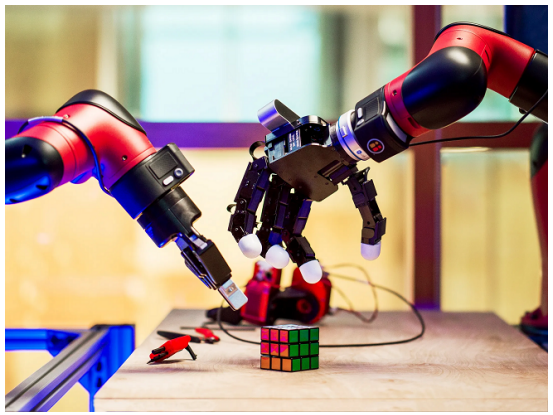


Figure 7: Robotics.

Types of AI

- **Swarm intelligence MAS:** This involves the study of decentralized systems, where a group of simple agents work together to achieve complex tasks. Swarm intelligence has applications in areas such as optimization, control, and pattern recognition.

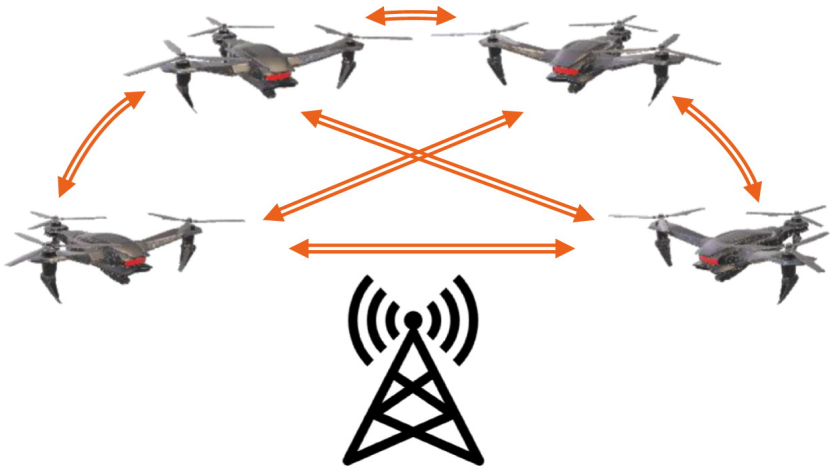


Figure 8: Swarm robotics.

Fields of application

Uses of AI Artificial Intelligence (AI) has a wide range of applications in various industries and domains. Some of the main uses of AI include:

- **Healthcare**: AI is being used to improve medical diagnosis, develop personalized treatments, and streamline healthcare operations.
- **Finance**: AI is being used to detect fraud, analyze financial data, and automate financial services.
- **Retail**: AI is being used to personalize customer experiences, optimize pricing and inventory management, and improve supply chain management.
- **Manufacturing**: AI is being used to optimize production processes, improve quality control, and predict equipment failures.

Fields of application

- **Transportation**: AI is being used to improve traffic management, optimize delivery routes, and enhance safety in autonomous vehicles.
- **Energy**: AI is being used to optimize energy consumption, predict equipment failures, and improve renewable energy integration.
- **Customer Service**: AI is being used to provide 24/7 customer support, automate simple customer service tasks, and enhance the customer experience.

Fields of application

- **Education**: AI is being used to personalize learning experiences, grade student work, and provide educational insights.
- **Security**: AI is being used to detect cyber threats, improve physical security, and enhance border security.
- **Gaming**: AI is being used to create more realistic game characters and environments, and to enhance game play