



TITLE: AI in robotics

LEARNING SCENARIO

School:	Duration (minutes):	90
Teacher:	Students' age:	13-14

Essential Idea:

To explain what AI is, and discuss its current and future application in robotics

Topics:

- AI in robotics, robots

Aims:

- To get familiar with and understand AI in robotics

Outcomes:

- Understanding how AI is used in robotics

Work forms:

- work in pairs, group work

Methods:

- presentation, talk/discussion, interactive exercise

ARTICULATION

Course of action (duration in minutes)

INTRODUCTION

Students learn about robots with artificial intelligence and their current application.

The teacher announces the topic and starts the discussion:

- Could AI in robotics change the future?





- What is artificial intelligence in robotics?
- Do we use robots with AI already in our everyday life? How? Where?

Defining the goal of the lesson:

The purpose of today's lesson is to learn what AI in robotics is and how it can be put to use in our daily lives.

MAIN PART

The teacher encourages students to be actively involved in the teaching process.

Topics for discussion:

What is a robot?

Does every robot operate with AI?

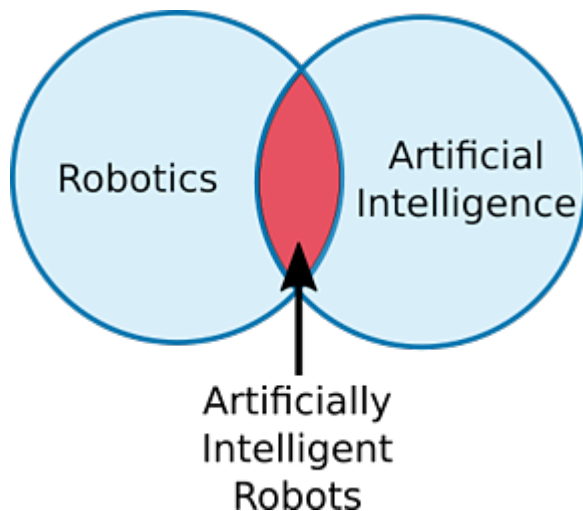
Do you know some examples of AI in robotics?

Could robots with AI replace humans?

Are robotics and artificial intelligence the same thing?

The first thing to clarify is that robotics and artificial intelligence are not the same things at all. In fact, the two fields are almost entirely separate.

A Venn diagram of the two fields would look like this:



There is a small area where the two fields overlap: Artificially Intelligent & Robots. It is within this overlap that people sometimes confuse the two concepts.

What is Artificial Intelligence?

Artificial intelligence (AI) is a branch of computer science. It involves developing computer programs to complete tasks that would otherwise require human intelligence. AI algorithms can tackle learning, perception, problem-solving, language-understanding and/or logical reasoning. According to the father of Artificial Intelligence, **John McCarthy**, it is also *"The science and engineering of making intelligent machines, especially intelligent computer programs"*.

Simply put, Artificial Intelligence is a way of **making a computer, a computer-controlled robot, or a software think intelligently**, in the similar manner the intelligent humans think.



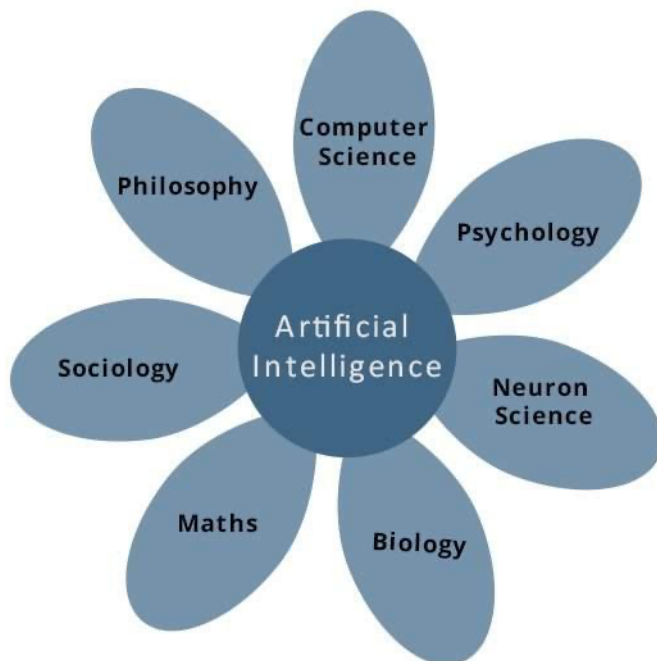


Goals of AI

- **to create expert systems** – these systems exhibit intelligent behavior, learn, demonstrate, explain, and advise its users.
- **to implement human intelligence in machines** – such systems would understand, think, learn, and behave like humans.

What Contributes to AI?

Artificial intelligence is a science and technology based on disciplines such as Computer Science, Biology, Psychology, Linguistics, Mathematics, and Engineering. A major thrust of AI is in the development of computer functions associated with human intelligence, such as reasoning, learning, and problem solving. Out of the following areas, one or multiple areas can contribute to building an intelligent system.



What is Robotics?

Robotics is a branch of AI, which is composed of Electrical Engineering, Mechanical Engineering, and Computer Science for designing, construction, and application of robots.

What are Robots?

Robots are artificial agents acting in a real world environment. They are programmable machines that are usually able to carry out a series of actions autonomously, or semi-autonomously.

Objective

Robots are developed to have the ability to manipulate objects by perceiving, picking, moving, modifying the physical properties of object, destroying it, or to free manpower from doing repetitive tasks without getting bored, distracted, or exhausted.

Aspects of Robotics

- The robots have **mechanical construction**, form, or shape designed to accomplish a particular task.





- They have **electrical components** which power and control the machinery.

They contain some level of **computer program** that determines what, when and how a robot does something.

Artificial intelligence in robotics

AI in robotics helps robots perform the crucial tasks with a human-like vision to detect or recognize various objects. Robots are developed through machine learning and training and huge number of datasets is used to train the computer vision model, so that robots can recognize various objects, carry out the actions accordingly and accomplish desired outcomes. Computer vision is simply the process of perceiving the images and videos available in digital formats. The AI in robotics not only helps to teach the model to perform certain tasks, but it also makes machines more intelligent and therefore able to act in different scenarios.

Here are some examples of most advanced Humanoid, Industrial and Service robots that are changing the future with the help of Artificial Intelligence.

Sophia



Hanson Robotics' most advanced human-like robot, Sophia, personifies our dreams for the future of AI. As a unique combination of science, engineering, and artistry, Sophia is simultaneously a human-crafted science fiction character depicting the future of AI and robotics, and a platform for advanced robotics and AI research.

The character of Sophia captures the imagination of global audiences. She is the world's first robot citizen and the first robot Innovation Ambassador for the United Nations Development Programme. Sophia is now a household name, with appearances on the Tonight Show and Good Morning Britain, in addition to speaking at hundreds of conferences around the world.

Meet Sophia: <https://www.youtube.com/watch?v=BhU9hOo5Cuc>

Digit



Digit is envisioned to help take care of people in their homes, assist with disaster response, and deliver packages to front doors. With its nimble limbs and a torso packed with sensors, Digit can navigate complex



environments and carry out tasks such as package delivery. In May 2019 Ford Motor Company and Agility announced a partnership to develop a last-mile logistics solution that combines Ford's autonomous vehicle technology and Agility's Digit.

Pepper



Pepper is the world's first social humanoid robot that is able to recognize faces and basic human emotions. Pepper has been adopted by over 2000 companies around the world. Perfect in retail and finance industries, Pepper has numerous functionalities including increasing store traffic by attracting the attention of shoppers, creating memorable in-store experiences, stimulating purchase and retain customers. Pepper can also gather comprehensive data to enrich the customer base and generate shopper insights.

Atlas



Atlas is the world's most dynamic humanoid robot built by BostonDynamics, a company that was previously owned by Google and now by SoftBank. Atlas is becoming more sophisticated year by year, thanks to its state-of-the-art hardware and algorithm that allows it to quickly understand instructions. With its 28 hydraulic joints, 4.9 feet in height and 176 pounds in weight, the robot can perform both impressive and terrifying acts including navigating uneven terrain, jumping around a parkour course, and doing somersaults. All these activities demonstrate human-level agility so the robot can be perfect for search and rescue operations and performing human tasks in environments where humans could not survive.

Spot



Spot is a robot dog designed for industrial uses such as carrying goods through a warehouse and inspecting a remote site with an unfavorable environment for human operators. It can run at 5.2 feet per second, has 360-degree cameras, and can operate in temperatures ranging from 4 to 113 Fahrenheit. With its API and



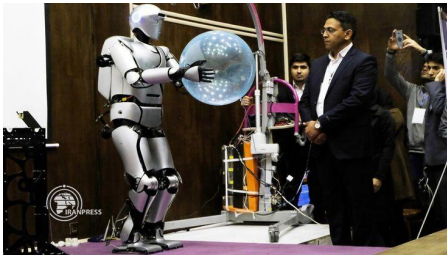
flexible payload interface, the robot can be easily customized for desired tasks. Spot is also manufactured by BostonDynamics and is now being leased to eligible companies.

HRP-5P



HRP-5P is an advanced humanoid robot designed to operate autonomously and carry out heavy labor in hazardous environments. It is equipped with environmental sensors and object recognition, full-body motion planning and control, and task description and execution management. HRP-5P is based on more than 20 years of humanoid research at AIST. In those 20 years, the institute has created 4 other robots which are the predecessor of HRP-5P.

Surena IV



Surena IV is the fourth generation of Surena humanoid robot series developed by the University of Tehran in Iran. With a height of 5.6 feet and a weight of 154 pounds, this robot is able to walk at a speed of 0.43 miles per hour. Its custom force sensors at the bottom of its feet help the robot step over uneven surfaces by adjusting the angle and position of each foot.

Aquanaut



Aquanaut is an advanced unmanned underwater transformer that can transform itself from a nimble long-distance submarine into a half-humanoid robot capable of carrying out complex underwater manipulation tasks. Designed by Houston Mechatronics Inc, Aquanaut can inspect subsea oil and gas infrastructure, operate valves, and use subsea tools with just a few mouse clicks. Operating completely untethered and

without support ships, Aquanaut can travel more than 124 miles in submarine mode, has a max speed of 7 knots and a maximum operational depth of 984 feet.

Stuntronic robot



A Stuntronic robot is an animatronic stunt double designed to entertain the crowds at Disney theme parks and resorts. With its onboard sophisticated sensors, it can make its own real-time decisions—all that while flying at 60 feet up in the air. It knows when to tuck its knees to perform a somersault, when to pull its arms to twist, and even when to slow down its spin to make sure it makes a perfect landing.

Handle



Handle is another robot from Boston Dynamics. With its deep-learning vision software, this robot can identify and locate boxes, unload trucks, palletize, and depalletize at the push of a button. Its mobility enables it to operate in multiple work-cells, moving through facilities along with the flow of goods. It can pick up to 360 boxes/hr.

Show students video (optionally) and discuss; <https://www.youtube.com/watch?v=Jky911ihAkg>

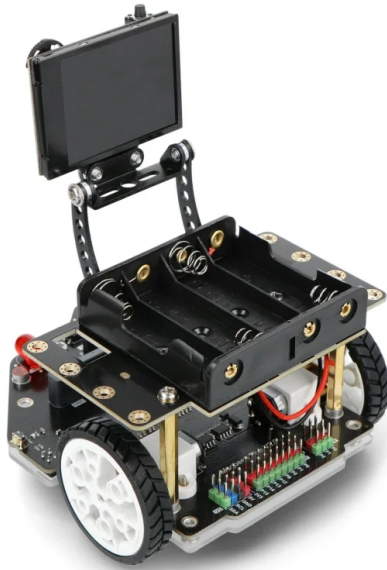
Today we are using AI in robotics in healthcare, agriculture, automotive industry, at warehouses, at supply chain ...etc.

Later on, we are going to build our own robot with AI and train him to do a face detection and recognition, object detection and speech recognition.

Here is a mobile robot with camera and AI capabilities developed exclusively for this project.



ARTIE: Artificial Intelligence in Education - challenges and opportunities of the new era:
development of a new curriculum, guide for educators and online course for students
Project co-funded by European Union under Erasmus+ Programme, 2020-1-HR01-KA201-077800



We will show you how to make it and use it for:

- Face detection
- Face recognition
- Face tracking
- Object detection
- Object tracking
- Line following

CONCLUSION

Artificial Intelligence is finally here and most of us are already actively using it in our day-to-day life (even without knowing it). Future generations need to understand how to use AI first of all! Only then can they use it to facilitate learning and solve real-world problems.

Artificial Intelligence (AI) and Robotics are strongly connected today.

AI in robotics is used in everyday life more and more and has been instrumental in the various domains such as industries, military, medicine, exploration, entertainment.

Remember, AI is most probably the most powerful technology ever invented by man. It can be used for both good and bad things. In the end, it's up to us how to use it.

Methods

presentation
talk/discussion
work on the text

interview
demonstration

Work forms

individual work
work in pairs
group work
frontal work





Material:

- <https://www.youtube.com/watch?v=Jky9I1ihAkg>
- <https://www.youtube.com/watch?v=BhU9hOo5Cuc>

Literature

- <https://www.sciencedirect.com/science/article/pii/S0004370217300310>
- <https://medium.com/vsinghbisen/what-is-computer-vision-in-machine-learning-and-ai-how-it-works-b8bc70aef3c7>
- https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_robotics.htm

PERSONAL OBSERVATIONS, COMMENTS AND NOTES

Empty box for personal observations, comments and notes.

