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

TITLE: How can computers learn and solve problems?

LEARNING SCENARIO		
School:	***Duration (minutes):***	90
Teacher:	***Students age:***	10

Essential Question:	**How do computers imitate the human brain and solve problems?**

Topics:

- artificial intelligence, machine learning, neural networks

Aims:

- get to know and understand the concept of machine learning and neural networks
- developing the ability of searching for, collecting, organizing and using information from various sources
- developing elements of students' cooperation, exchange of ideas and experiences with the use of technology

Outcomes:

- the ability to test models related to image recognition
- developing algorithmic thinking

Work forms:

- individual work, work in pairs, group work

Methods:

- presentation, talk/discussion, interactive exercise

ARTICULATION
The course of action (duration, minutes)
INTRODUCTION The purpose of this course is to make pupils aware of the changing ways of living under the influence of the newest technology.

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Let's get to know artificial intelligence, machine learning, neural networks and how artificial intelligence can solve computational thinking problems.

Topics for discussion:
Can a computer or other smart devices think or solve problems?
Can a computer or other smart devices learn?
What is machine learning? The definition.
How do computers imitate the human brain and solve problems?

Announcement of the goal of the lesson:
Today we will learn about machine learning and neural networks.

MAIN PART

The teacher explains to the students in an interesting and close way: machine learning and neural networks. The teacher encourages students to be actively involved in the teaching process.

Machine learning as a subfield of AI

Machine learning gives computers the ability to learn without being explicitly programmed. It is a subfield of computer science.
The idea came from work in artificial intelligence. Machine learning explores the study and construction of algorithms that can learn and make predictions on data. Such algorithms follow programmed instructions, but can also make predictions or decisions based on data. They build a model from sample inputs.

Machine learning is done where designing and programming explicit algorithms cannot be done.
Examples include spam filtering, detection of network intruders or malicious insiders working towards a data breach, optical character recognition (OCR), search engines and computer vision.

Neural networks

A neural network (also called an ANN or an Artificial Neural Network) is an artificial system made up of virtual abstractions of neuron cells. Based on the human brain, neural networks are used to solve computational problems by imitating the way neurons are fired or activated in the brain. During a computation, many computing cells work in parallel to produce a result. This is usually seen as one of the possible ways artificial intelligence can work. Most neural networks can still operate if one or more of the processing cells fail.

Neural networks can learn by themselves, an ability that sets them apart from normal computers. Today's computers cannot do anything they are not programmed to do.
There are three ways a neural network can learn: Supervised learning, Unsupervised learning and Reinforcement learning. These methods all work by either minimizing or maximizing a cost function, but each one is better at certain tasks.

Supervised learning

In Supervised learning, the neural network is trained by using example inputs and the correct output. The network can then work out the relationship between the input and output. For example, a network could be trained by showing it details about houses and the sale price. Once it has finished training it could estimate the sale price of another house by analyzing information like the number of bedrooms and local crime rate. Another example is the ALV (Autonomous Land Vehicle). DARPA funded this project in the 1980s. In a demonstration in 1987, it traveled 600 meters at 3 km/h over difficult land, with sharp rocks, vegetation and

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steep ravines. This vehicle could drive itself as fast as 30 km/h. This network watched a 'teacher' drive and saw the road using laser radar. The learning process was repeated for different road types. ALV used a kind of neural network called a multi-layer perceptron in which multiple layers of neurons are connected in series.

Unsupervised learning

Unsupervised learning only trains using inputs, and the network has to figure out how they relate to each other. This method is used to solve Clustering problems, estimation problems, and self-organizing maps. For example, a self-organizing map can be used to categorize iris flowers by stem size and colour.

Reinforcement learning

A reinforcement learning neural network learns by watching a teacher's actions. It works out the smallest cost and tries to use this to work out how to make the smallest cost in the future. It can be thought of as a Markov decision process. Another simple way to think of this is as "carrot and stick" learning (learning that rewards good behaviour and punishes bad behaviour).
Recently, a research team from the University of Hertfordshire, UK used reinforcement learning to make an iCub humanoid robot learn to say simple words by babbling.

Interactive exercise:
The teacher introduces the students to three online tools and explains the way and possibilities of work.
The teacher introduces students to machine learning and neural networks in an interactive and fun way.
Students use tools in pairs and independently.
Students participate in a class competition using the tools listed:

- https://www.autodraw.com
- https://quickdraw.withgoogle.com
- http://misfire.io

Interactive exercise:

- Choose one of the tools:
  - https://www.autodraw.com
  - https://quickdraw.withgoogle.com
  - http://misfire.io
- Explore the tool.
- Answer the following prompts:

Tasks for students:

1. Write a brief description of your tool.
2. Which stakeholders might be interested in this technology? Who might be affected by this technology most? Brainstorm at least 10 stakeholders.
3. If this technology was used for evil, how might that be done?
4. If this technology was used to help other people, who might it help?
5. In 50 years this technology could do the most good by…
   1.
   2.
   3.
6. In 50 years this technology could do the most harm by…
   1.
   2.
   3.

- Present the results to the students in the class. Discuss. Save your work to the class e-portfolio.

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CONCLUSION

Machine learning gives computers the ability to learn.
Neural networks are used to solve computational problems by imitating the way neurons are fired or activated in the brain.

Methods		*Work forms*
presentation	***interview***	***individual work***
talk/discussion	***demonstration***	***work in pairs***
work on the text	***role playing***	***group work***
graphic work		***frontal work***
interactive exercise /simulation on the computer		

Material

- https://www.autodraw.com
- https://quickdraw.withgoogle.com
- http://misfire.io

Literature

- https://www.forbes.com/sites/bernardmarr/2019/12/16/the-10-best-examples-of-how-ai-is-already-used-in-our-everyday-life/?sh=213f08da1171
- https://www.ibm.com/cloud/learn/what-is-artificial-intelligence
- https://kids.kiddle.co/

PERSONAL OBSERVATIONS, COMMENTS AND NOTES