Raspberry Pi Foundation

Lesson 1: What is AI?

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Introduction

In this lesson, students will explore the current state of artificial intelligence (AI) and how it is used in the world around them. They will consider some of the benefits and drawbacks of AI systems.

First, students will think about the term 'intelligence' and take part in a game of noughts and crosses (tic-tac-toe) against an algorithm ('the intelligent piece of paper'). Students will then be introduced to artificial intelligence and examine the difference between rule-based and data-driven approaches, before being given time to explore two AI applications. Students will be asked to consider the benefits that each application could bring to society, as well as to think about any negative consequences that their use could lead to.

Learning objectives

- Describe the difference between 'data-driven' and 'rule-based' approaches to application development
- Name examples of AI applications
- Outline some benefits and issues of using AI applications

Key vocabulary

Artificial intelligence (AI), algorithm, data, rule-based, data-driven, model, generative AI, computer vision

Preparation

You will need:

- Slides
- 'The intelligent piece of paper' activity resource (one printed copy for demonstration)
- Lesson 1 worksheet

Introduction: The 'intelligent piece of paper' activity requires a small amount of preparation, and the 'intelligent piece of paper' activity resource needs to be printed before the lesson. This activity is adapted from an activity created by Peter McOwan and Paul Curzon of Queen Mary University of London with support from EPSRC and Google, available on the Teaching London Computing website.

You can find detailed instructions on how to run the activity in the lesson plan below. If you wish, you can also visit the Teaching London Computing website to read more about the activity or to watch a video of the activity being delivered.

Activity 2 and 3: These two activities require the students to visit websites to complete a task. In advance of the lesson, you will need to ensure that you and the students can access these websites:

- craiyon.com
- ai-activities.raspberrypi.org/computer-vision

Subject knowledge:

Activity 1: This activity is designed to help the students understand the difference between a rule-based approach to programming and a data-driven approach taken with modern AI systems. You will be required to support students with their understanding of the differences. The video on slide 8 and the descriptions and examples on slides 9 to 14 will support you with this.

Activity 2 and 3: In these activities, you will be required to lead discussions around the societal benefits and drawbacks of generative AI and computer vision. You do not need detailed knowledge of how they work, and discussion prompts are provided in the lesson plan below.

Plenary: For this activity, you will need to be able to support the students in identifying whether AI is being used in the given scenarios. Answers are provided in the slide deck.

Assessment opportunities

During Activity 2 and 3, you will be able to assess through question and answer whether or not the students are able to reflect on societal benefits and drawbacks of the applications they are asked to use. Use the discussion prompts in the lesson plan to help guide discussion and assess their understanding.

The plenary activity will allow you to assess whether or not the students are able to make the link between the description of AI and the applications that use it.

Outline plan

Please note that the slide deck labels the activities in the top right-hand corner to help you navigate the lesson.

**Timings are rough guides*

Starter activity (Slide 2) 3 mins	**What is intelligence?** As the students enter the classroom, display slide 2 with the title "What is intelligence?" As the students are arriving and settling into the class, ask them to discuss their thoughts with the person next to them. The aim of this part of the lesson is to set the scene and to focus the students' attention. You do not need to take answers from the students; instead, reveal the definition on the slide: "Commonly, people describe intelligence as the ability to learn and adapt/react to new situations." Highlight that the key point is being able to learn something and use that learning to **adapt and react to new situations**.
Introduction (Slides 4–6) 10 mins	**The 'intelligent' piece of paper** Display slide 4 and hold up the intelligent piece of paper to show to the class. The side with the instructions on should be facing you, and the class should see the blank side. Announce that this piece of paper **is** intelligent. Tell the students that not only is it intelligent, but it is also more intelligent than anyone in this room. Assure the students that it is just a piece of paper and there is no computer chip embedded in it. Ask the students to raise their hands if they think they are more intelligent than the piece of paper. Congratulate the students who did not think they are more intelligent than the piece of paper, as they are very wise. Tell the students who think they are more intelligent than the piece of paper that you can provide them with evidence that the piece of paper is intelligent. Tell the class that to prove that the piece of paper is intelligent, they will play noughts and crosses against it. Move on to slide 5. Inform the class that the piece of paper has never lost a game of noughts and crosses and it will not be beaten by them.

	Pick volunteers from the class to play the game. If possible, pick one of the students who thought they were more intelligent than the piece of paper to play. They will represent all of humanity. Inform the class that because it is a piece of paper, with no robotic controls to be able to play by itself, it needs a volunteer to help it play. Give the piece of paper to the volunteer and they will see the instructions on the piece of paper. Their job is to follow the instructions on the piece of paper and do exactly as it says. Draw a noughts and crosses grid on a whiteboard for the class to see. Ask the volunteer with the piece of paper to read out the first instruction, saying that the piece of paper wants to go first. Comment that it is quite clever of it to want to go first. If someone complains about it being unfair, point out that the game should just end in a draw whoever goes first. Going second is not a reason to lose. The piece of paper's assistant should then read out the first move and make the move: playing in a corner. The player representing humanity can then take a turn. Allow the volunteers to continue playing the game. Support the student with the intelligent piece of paper, ensuring that they read out the appropriate instruction so that the rest of the class can hear it. The game will result in either a draw or a win for the intelligent piece of paper. Display slide 6. The students will now know that the piece of paper had instructions written on one side. These were followed through by the student volunteer. The instructions can be described as an algorithm. The algorithm could have been followed through by a computer if it had been written as a computer program. Ask the class, "Does that make the piece of paper intelligent?" Take answers from the students. Someone might point out that **it is not the piece of paper that is intelligent, it is the person who wrote the instructions**. If no one gives this answer, pose it as a question to the students: "Is it the person who wrote the instructions that is intelligent?" (Feel free to take the credit and thank them for saying that you are intelligent.) The person who wrote the algorithm is intelligent as they have learned about IF/THEN rules

	and are able to apply them to create an algorithm that cannot lose in noughts and crosses. They can also apply those IF/THEN rules to solve other problems. Now you can congratulate the students who thought they were more intelligent than the piece of paper in the first place, as now the class has learned that the piece of paper is not intelligent. Ask the class, "If a computer follows an algorithm written by a human, does that make a computer intelligent?" The answer should be that it does not. It is not learning or reacting to new situations, it is simply following IF/THEN rules.
Activity 1 (Slides 7–14) 12 mins	**What is artificial intelligence (AI)?** Display slide 7. Now the class has considered what is meant by 'intelligence', and they know that computers follow algorithms. Tell them that their first task is to try to think about what is meant by 'artificial intelligence'. Instruct the students to open the worksheet. Ask the students to write down what they think is meant by 'artificial intelligence' using the space provided in the worksheet. They should aim to write no more than two sentences. **Teacher support:** Students do not need to have heard of AI before to complete this task. They should be aiming to make a link between key parts of the 'intelligent piece of paper' activity. So far, students have learned that: • 'Intelligence' can be described as when something is able to learn and adapt and react to new situations • Computers follow algorithms • The piece of paper was not actually intelligent • The person who wrote the algorithm is intelligent Allow the students a short amount of time to complete this task, then move on to slide 8 and show the video on the slide. Move on to slide 9 and describe the rule-based and data-driven approaches to the students. A rule-based approach is the traditional approach that we would associate with programming, where an algorithm is followed to solve a computational problem. A data-driven approach is a way of building artificial intelligence systems

	using statistics from vast quantities of data, instead of by writing out the rules in a program. Move on to slide 10 to describe the term 'model' in more detail. A model is a representation of the real world. You can give the example of a model of a car or a model aeroplane. Explain that data-driven models are used to solve problems, and make the link to AI by describing that AI chatbots use vast quantities of data to create a conversational model. An application can then use this model to hold a conversation. Use slides 11 to 13 to relate the requirements of creating a model that can play a game of chess against another player. Move on to slide 14 and tell the students about the milestone moment in AI development when IBM's Deep Blue system beat the chess grandmaster Garry Kasparov. You can find out more in this Wikipedia article. Ask the students to consider why a data-driven approach is beneficial in creating an application to win a game of chess. The answer is that there are so many possible combinations and sequences of moves that could lead to a victory that it would be very difficult to achieve with a rule-based system.
Activity 2 (Slides 15–17) 10 mins	**AI applications — generative AI** Use slide 15 to give the students a brief introduction to what is meant by 'generative AI' and explain that it is the term used to describe artificial intelligence applications that can generate content such as images, sound, or text. The image on slide 15 shows an example of a generative AI application: the application allows you to compose music and then uses AI to generate a harmonisation in the style of classical composers. This is an example and there is no need to demonstrate this. Display slide 16 and show the students the animated GIF, which shows a preview of the AI application they are about to use (https://craiyon.com). Tell the students that they will use an online AI application to generate art. To use the tool, they must: 1. Enter a search term 2. Select their preferred style of art 3. Click on 'Draw' The animation on the slide shows artwork being generated using the search term "superhero in a ruined city". A style of art is selected, then the artwork is

	generated. Move on to slide 17 and tell the students that their task is to use a generative AI application to create artwork for either: • A poster for the world climate change conference • The wall of a café or restaurant Ask the students to go back to their worksheet, where they can find the instructions for this task. **Note:** • **As with any web search, inappropriate prompts or terms may produce inappropriate results.** • **Search results can take approximately 1 minute to appear** Allow students 5 minutes to use the application, and highlight the questions on the slide for them to consider whilst using the application. **Teacher prompts:** Whilst the students are experimenting with the art generation website, circulate around the class and prompt students to consider the following: • Try generating the image again with the same prompts and the same art style. Does it generate the same artwork as last time? • Try changing your prompts. Does it work better if more or fewer words are used? • Who might use this technology? • How might artists feel about this technology? Do you think they might be worried? • Who owns the artwork you created? You or the people who made the application? Use the last 2 to 3 minutes of this activity to have a discussion about the application using the questions on the slide. Record answers from the students. You could use a whiteboard to do this, or if you have sticky notes available, you could ask students to write one answer to each question and to stick their answers on the board for you to select some answers to discuss.
Activity 3 (Slides 18–19)	**AI applications — computer vision** Use slide 18 to introduce the students to what is meant by ‘computer vision’:

10 mins	"Computer vision is a field of AI that attempts to gain meaningful information from images." Point out the example image on the slide and highlight that there are objects in the image that have been picked out. Ask the question on the slide: "Why do you think there are percentages next to each object that has been identified?" The answer is that they are confidence scores, reflecting how confident the system is that it has correctly identified the object. Do not spend long discussing this, as it is the purpose of the activity for the students to explore what is meant by the confidence score. Move on to slide 19, where there is a description of the task. Ask the students to follow the instructions for Activity 3 on their worksheet. They should visit the following website: https://ai-activities.raspberrypi.org/computer-vision Once they have opened the website, the students can select one of the sample images available to see what the AI system can identify in the image. Allow 4 minutes for students to experiment. **Teacher prompts:** Whilst the students are experimenting, circulate around the class and use the following questions to prompt discussion about what they are looking at: • Why do you think there is a confidence rating? Is that important? • Why do you think the application is more confident about some elements of images than others? • Who might use this technology? • How important is the confidence rating for a driverless car, for example? • How might visually impaired people benefit from this? • Can you see this technology being misused? • Would you be happy knowing you can be personally identified by a camera when you are walking around, for example? Next, ask the students to spend a minute discussing the questions on the slide and worksheet with the person next to them. Then, as in the previous activity, take answers from the students.
Plenary (Slides 20–25)	**AI or not AI?** The purpose of this task is for the students to reflect on what they have

10 mins	learned in this lesson and to apply their knowledge to see if they can identify when AI might be being used. Using slide 20, describe the task and direct the students to return to their worksheet and find the plenary activity. Their task is to evaluate each application listed on their worksheet and decide whether or not it uses AI. Highlight that it may not be clear to them, in which case they can answer "Could be AI". Explain that they must attempt to justify their answer for each application. Remind the students to think about whether each example is rule-based or data-driven. Allow a maximum of 5 minutes to complete the activity. Once the students have completed the activity, run through the answers on slides 21 to 23. Move on to slide 24 to summarise the key learning from the lesson. Move on to slide 25. Ask the students to consider what they would change about their first description of AI now they have completed the lesson. Instruct the students to try to improve their description using the space provided in the worksheet. Again the students should aim to write no more than two sentences.

Credit:

Introduction: 'The intelligent piece of paper' is an adapted version of an activity created by Peter McOwan and Paul Curzon of Queen Mary University of London with support from EPSRC and Google: https://teachinglondoncomputing.org/resources/inspiring-unplugged-classroom-activities/the-intelligent-piece-of-paper-activity/