The Royal Institution
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Masterclass network

Session Leader Notes

Primary OTS Masterclass: Artificial Intelligence

Thank you very much for leading this Masterclass. We hope that you enjoy working with this material as much as we enjoyed putting the activities together. We do appreciate all the effort that our volunteers put into bringing inspirational Computer Science Masterclasses to students around the country.

Inspiration for this topic:

This workshop explores the question of what it means to be "intelligent", and asks students to decide whether a machine can ever be truly intelligent. Students investigate how artificial intelligence (AI) is trained, how it recognises patterns, makes decisions, and why fairness and bias matter in its design. Through role-play, games, and creative prototyping using Google's Teachable Machine, they'll discover how machines can learn from data just like we do, and how we can design fairer, more inclusive technologies by training AI carefully and critically. By becoming the "brains" behind their own AI bots, students will develop a deeper understanding of machine learning, decision-making, and the ethical questions shaping our digital future.

Overview of Activities:

1. Intelligent piece of paper activity – students play noughts and crosses against a piece of paper.
2. AI or not activity – students guess whether the image shows an AI system or not.
3. Neural networks activity – students play a game of snap to demonstrate a neural network.
4. AI Dance Trainer activity – students teach an 'AI' to dance.
5. Worksheet 1 – Training an AI
6. Teachable Machine activity – students create their own machine learning model.
7. Worksheet 2 – My AI Model
8. Extension: Worksheet 3 – The ethics of AI discussion points

General Masterclass resources needed:

- Register of children
- Consent forms and emergency information to hand
- Stickers and markers for name badges
- Adult register
- Ri child protection policy
- Paper and pencils
- 2 different coloured post-it notepads (for feedback at the end)
- Drinks and biscuits

Specific resources needed (tailor to the number of students attending):

- 1 copy of Activity 0 – the intelligent piece of paper
- 1 copy of Worksheets 1 and 2 per student
- Laptops, computers, or tablets with internet access (Google Chrome, Microsoft Edge, and Safari are currently supported), 1 per student or pair of students

Optional:

- 1 copy of Worksheet 3 per group of students.
- Webcams, microphones, or headsets if wanted for the teachable machine activity.

Support resources:

- PowerPoint slides
- Session Script

Things to prepare in advance

- Gather the complete list of resources as detailed above
- Print worksheets, additional information, and any other resources as needed
- You may wish to set the following webpages to be bookmarked on the students' devices or have the links easily accessible for the students.

- Teachable Machine – www.teachablemachine.withgoogle.com/train.

Ask the Ri

Don't forget to collect any questions which arise, and email them to the Masterclass team at the Royal Institution: masterclasses@ri.ac.uk

Feedback

We would very much welcome your feedback on this session. If you have time, please collect feedback from the students at the end of the Masterclass and send it through to us. We would also appreciate feedback on how you have used the session, what you think worked well and what improvements would be useful.

Time plan of Masterclass:

Slides & Time	**Overview**	**Activity (see script for further details)**
Slides 1 -2 15 minutes (15)	**Artificial Intelligence** Introduction	Welcome students to the masterclass. Begin the session by asking students how they would describe intelligence. Encourage students to discuss with the people around them and take in suggestions on what intelligence means to them. You may wish to provide some more prompts, such as what things would they consider to be intelligent, and how would you describe intelligence to an alien. Give students some thinking and discussion time, then take in answers.
	Intelligent piece of paper activity	Go to slide 2, and explain that we are going to start the session by using artificial intelligence. Hold up the intelligent piece of paper. Announce that the piece of paper you are holding is intelligent, perhaps even more intelligent than everyone in the room. Do not show the writing side to the students. Ask the students if they believe you, or if they do not think the paper could be intelligent. Ask the students how they think it could be intelligent. Explain that the paper has never lost a game of noughts and crosses The paper has won about half the games it has played against humans like themselves, and drawn the rest. Ask for two volunteers to test the paper's intelligence. Give one volunteer the intelligent piece of paper, and the other a blank noughts and crosses board. Tell the first volunteer to read out the instructions for the paper, and to only follow the instructions given. The second volunteer will be the opponent. Once the instructions have been followed, the game should either end in a win or a draw. Ask the students whether they now think the paper is intelligent. Discuss where the 'intelligence' has come from – the human who wrote the instructions on the piece of paper. Explain that all computers blindly follow instructions, and by that definition a computer can never be intelligent! Explain that today we are going to investigate what we call artificial intelligence.

Slides & Time	Overview	Activity (see script for further details)
Slide 3- 11 10 minutes (25)	**What is AI?** **AI or not?**	Go to slide 3 and explain the definitions we might use for artificial and intelligence. Explain that generally we consider AI to be something that can learn, make decisions, and adapt to new information. It is important to note that AI does not understand what it is doing, or why, it simply follows the instructions it is given, and mimics human emotions, behaviours, and understanding. Continue on to slide 4 and explain that we are going to play a game of AI or not. Students must decide whether they think the object shown uses AI or not. They could display this by putting their hands up if they believe it is AI, or by standing in a different spot in the room on a sliding scale, for how much they agree that the object is intelligent or not. The examples are: a self-driving vehicle (AI), a toaster (not AI), a robot vacuum cleaner (AI), navigation systems (AI), calculator (not AI), a voice assistant (AI), YouTube recommendations (AI), and a dolphin (not AI. Ask for inputs or explain how each of the objects makes us of AI. For each of the objects that do not typically use AI, ask the students how they might add in AI. For each slide, click to reveal whether it is AI or not.
Slide 12-14 10 minutes (35)	**The Turing Test and testing for intelligence**	Move onto slide 12 and explain that Alan Turing was a computer scientist who was able to decipher the codes created by the Germans' Enigma Machine during the second world war. Explain that he later went on to design a test called the Imitation Game, or the Turing Test, to see whether a machine could imitate a human during a short conversation well enough to fool another human. Ask the students what questions they think would have been asked in the conversations. Move onto slide 13 and explain that the short conversations didn't have to include questions that a human would find very tricky – an average human would probably not be able to answer a hard maths or science question straight away. Explain that the questions should be easy and natural for humans to answer. Ask the students to discuss the last questions, and mention that whilst an AI could give false information, it cannot lie (since it is doing exactly what it has been programmed to do). Ask the students if they can come up with any other questions that they would ask an AI to determine if it was human or not. Ask the students if they think any AIs have passed the Turing Test. Explain that in March 2025, ChatGPT's GPT-4.5 system was able to deceive 73% of human participants in two separate Turing tests. Move onto slide 14 and ask the students if they think that the Turing test is a good test for 'intelligence'? Ask them how they would want to test for intelligence. Explain that some AI researchers do not see it as a good test for how good an AI performs, and it has been compared to the design behind planes – a plane is tested for how well it flies, not for whether it could be mistaken for a bird. Explain that an AI's use might change how we decide whether it is 'intelligent' or not, or how well it performs the job we want it to do.

Slides & Time	Overview	Activity (see script for further details)
Slides 15-26 15 minutes (50)	**Neural Networks**	Move onto slide 15, and ask the students how we might go about creating an AI that could pass the Turing test. Explain that many AIs are based off the human brain, which uses something called a neural network to pass along information through the body. Explain how sensory neurones, relay neurones and motor neurones work together to do this. Move onto slide 16 and explain to the students that we are going to demonstrate how a neural network works by playing a game of snap. Ask for seven student volunteers. Students 1– 4 will face towards the board and be the sensory neurones in the brain, who can see the colour of the two squares. Each are given a rule for when they should tap the relay neurone (e.g. person one will tap the relay neurone on the shoulder, when square 1 is red.) Students 5 and 6 are the relay neurones, responsible for delivering messages from the brain to the body. When they receive two taps on the shoulder, they should then tap student 7, the motor neurone. Student 7 is the motor neurone, responsible for delivering an action in the body. When they receive any tap on the shoulder, they should shout Snap. Students 5-7 should face away from the board, so they cannot anticipate the response. You may wish to have two groups compete against each other to see who will shout snap first. If the motor neurone is paying attention to which side they were tapped on, they could guess whether the matching colour was red (left shoulder), or black (right shoulder). Go through slides 17 – 24 to test the game of snap. Ask the students to return to their seats and move onto slide 25. Explain how AI is based on our own brains and follows artificial neural networks. For example, we can train an AI to decide whether an image is of a dog or a cat, by first telling it to classify an image of a dog as a dog.
Slide 26 10 minutes (60)	**AI Dance Trainer**	The next activity focuses on a Dancing AI that has not been trained yet, and it is up to the students to train them. Either use yourself or a student volunteer as the dancing AI. Ask the students to give a dance move for the AI dancer to copy – students will all do different moves, and you must try to get the AI dancer to copy them all, possibly ending up looking a little bit silly. Ask students why the AI did this – because it received messy data! Ask the students how we could help it learn? By giving it more consistent and clear instructions. Now ask the students to properly train the AI. The class will need to agree on one clear move to teach the AI first. They will teach the AI dancer by repeating the same move over and over. When the AI performs the move now, it should be correct because the data was consistent. The class can repeat this with a few new dance moves, so the AI learns a whole routine.
10 minutes (70)	**Break**	**Drinks and biscuits and comfort break.**

Slides & Time	Overview	Activity (see script for further details)
Slide 28 10 minutes (80)	**Training an AI –** worksheet 1	Handout worksheet 1, one worksheet per student. Students complete the worksheet on training an AI using a funfair bot example. The worksheet has a series of examples where the bot does not provide a prize due to insufficient training. The students must identify in each situation a) why the prizes have not been given, and b) how the AI bot could be improved. Go through the answers to the worksheet with the students, and explain that when we train an AI, we need to make sure that it has enough information to be able to find a pattern that it can apply to new inputs.
Slide 29 - 30 30 minutes (110)	**Training our own AI** My AI Model - Worksheet 2	Students train their own AI to detect movement, noises, or images using Google's teachable machine - https://teachablemachine.withgoogle.com/. They will first train it, then test it, and then make improvements. Remind students that they will normally need a 'normal' or 'neutral' class when training an AI, especially when creating a AI that uses a webcam or microphone. Ensure that they make a class that shows them in a 'neutral' pose or contains background noises. Once they have tested their AI, give the students the opportunity to share their creations with others in the group.
Slide 31 10 minutes (120)	Further activities Feedback, tidy up, questions time Ask the Ri	Introduce the extension material – Ethics of AI Don't forget to collect any questions which arise, and email them to us: masterclasses@ri.ac.uk. We will send you answers as soon as possible. These can be reported back to the students at their next Masterclass session. We are also very grateful for any feedback you can provide us on the use of the resources, and we would love to hear your stories of how your masterclasses went!
Slide 32 Extension Activities	**Ethics of AI** – worksheet 3	Introduce some scenarios for the students to discuss or debate surrounding different uses of AI. Hand out the worksheet so students can talk through each scenario or use the ideas on the worksheet as a basis for discussion.