Artificial Intelligence

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What is AI?

Artificial intelligence, AI for short, is a broad term used to describe a computer program which uses the computer's resources (things like the processor and memory) to perform tasks that a human would normally do. These AI systems run algorithms that have been created by humans and are trained using example data.

Why would we want to create a program like this?

It would mean we could get the AI to carry out jobs that take humans a long time it would mean we could get it to carry out jobs that take humans a long time. This might be jobs like sorting through lots of pictures to find one with exactly what you're looking for, or to recognise when a piece of machinery in a factory is broken, or even to make video games more interactive and fun.

Training an AI system

Unlike humans, computer programs don't have the benefit of context. If you wanted to train a computer to know what a cat looked like, but you only showed it a picture of one cat, then it would say any cat that looked different was 'not a cat'.

This wouldn't be very useful, so you would need to give that computer program tens of thousands of images of different cats to teach it what they could look like, so it wouldn't make as many mistakes.

Taking that one step further, what about things that might look a bit like a cat? For example, a dog also has 4 legs, a tail and ears… just like a cat. Humans know how to tell the difference, but a computer program wouldn't, so we would also have to teach the computer about dogs to prevent it getting confused.

Once we make a good AI system, we would then have something that really could be used to do jobs like a human… or even perform better than humans! If we get to that point, robots might be able to move by themselves without needing to be controlled. We aren't quite there yet, but there's still lots of things AI is used for even today.

Ethics and AI

Remember that AI systems are created by humans and therefore may be biased to reflect that person's views, beliefs or interests, so it's important that we think about ethics and how we can use AI to benefit society.

For our first activity, we'll create some simple rules to give an AI robot the teaching it needs to recognise an object, and then we'll test those rules to see if they work.

Plugged-in activities

If you'd like to have a go at a plugged-in version of this activity, there's lots that you can try:

- Amazing image identifier - create a Python application which can recognise images and classify them – https://tinyurl.com/yckxryew
- Teach a computer to read - train a computer to recognise numbers and learn how to measure the effectiveness of the AI you created - https://tinyurl.com/5hcwrbru

Find out more

- Computers in the workplace - https://tinyurl.com/2skzrhtb
- How computers have changed - https://tinyurl.com/2mf3dft2
- What is artificial intelligence? - https://tinyurl.com/bbxn9n7y
- We need a Big Conversation about AI - https://tinyurl.com/4932xr47
- Driverless: Who is in control? - https://tinyurl.com/2s6j6vdp
- The Future of Artificial Intelligence - https://tinyurl.com/bd9rwh2s

Teacher Links

- Free online course for teachers - https://tinyurl.com/3drhmmr5
- Hello World Issue 12 – Machine Learning - https://tinyurl.com/4e7cvjbj

Activity One

What is a cat?
Can you create a set of rules (algorithm) that will teach an AI system to recognise cats?

For this first activity, we're going to write some algorithms for our AI computer program to give it some context. This will help the AI to recognise animals and sort them into their different species.

1. Look at the various pictures of cats on this page. First off, make a list of the main features that you notice about the cats – what defining features tell you that they are all cats?

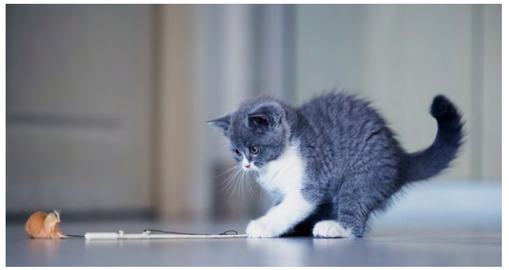
2. Next up, make a list of things that are different about the cats that you can see. Do any of them have unique features?

3. Now come up with a list of general statements that are always true about cats.

4. Are there any exceptions you can think of? Check out the images on pages 5 and 6 for some examples you may not have considered.

5. Once you've considered the possible exceptions, draw up a final list of 5 rules that you would want to give to an AI system to teach it to recognise cats. These 5 rules will make up your algorithm - keep them close by as we'll need them in Activity Three.

Now we understand how to train an AI system to recognise images of cats, we can start to think about training it to learn more about the world. This time, rather than a living animal, we're going to try a set of objects you might find at home or in a classroom.



Activity Two

Building a kit list for a pencil case using AI
Can you create a set of rules (algorithm) or a decision tree that will teach an AI system to recognise objects which belong in a pencil case?

1. On the right hand side are several images of things you might typically find in a pencil case. We're going to make our AI system more complex now, so your next task is to list the 5 most common things you think you would find in a pencil case. Then, similar to the last activity, make a list of features that you think are always true for each of those 5 objects.

2. For each of your 5 objects, narrow down your list of features that are always true to just 1. We've added a table on page 8 for you to write them down.

3. Test these out with a partner and make any changes as required before progressing to the next step.

Now that you've got your list of pencil case algorithms and cat algorithms from Activity One, we're going to use them to help guide a robot to recognise images of cats and pencil case items and figure out which type it is looking at.

Before progressing to Activity Three, can you create a rule that sits at the top of the cat and pencil case sorting algorithms, to ensure that the AI system goes down the right branch of the tree?

Activity Three

Cat or pencil case

Your goal in this final activity is to help your AI determine if a picture is of a cat or an item that belongs in your pencil case.

- If the image is of a cat, you should leave it alone.
- If the image is of something that belongs in a pencil case then you should collect it.

The goal is to fill your pencil case with all of the items you selected during Activity Two.

For this activity, print and then cut out the pictures we've supplied on pages 5, 6 and 7 (we recommend you print on card if possible as we're going to be shuffling the images like a deck of cards during the activity). You'll also need a timer of some sort to see who can identify all of the objects needed to complete the pencil case in the quickest time.

Testing the algorithms

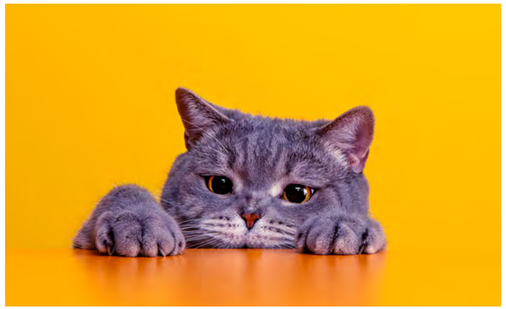
- Get into pairs and decide who is going to play the role of the 'AI system' and who is going to play the 'robot'.
- In your pairs sit back-to-back.
- The person playing the robot should select a picture card at random.
- The person playing the AI system should ask the questions on the algorithm/ decision tree, with the aim of telling the robot to put the card into either a cat or a pencil case pile.
- Repeat steps 3 and 4 until you have gone through all of the picture cards.
- How did you do? Do you need to debug your algorithms? Do you need more algorithms? Have a go at improving your algorithms.
- Now swap around and have another go.

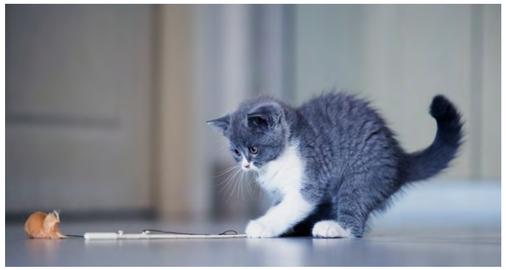
The point overall is to understand how complex AI becomes once you're trying to get it to identify specific items and compare them with others. This is true with any AI system – they get really complex really quickly, so it takes a very powerful computer to process all the data in an AI system.

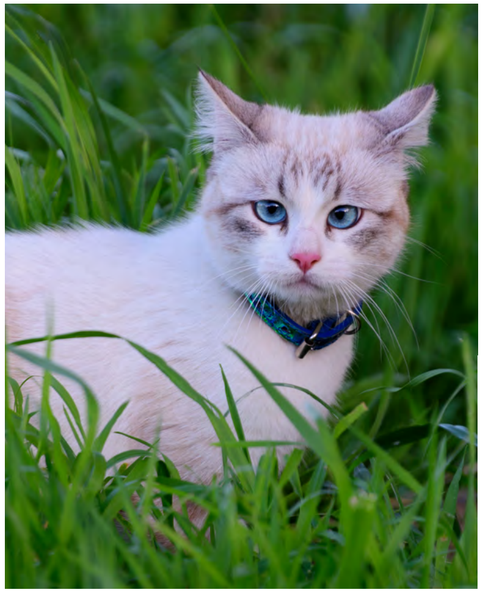
Extension

1. Try including more cats and pencil case items.
2. Try adding another set of objects e.g. birds, dogs etc.
3. You could also think about how to expand the game further – what if the robot needed to navigate through a maze to find cards before asking the questions? You would need to think about how to give specific directional instructions to the robot to get around the maze first.
4. Perhaps you could introduce a points system and if you find a cat you lose points, but if you find an object you're looking for you get extra points. How quickly can you fill your pencil case?

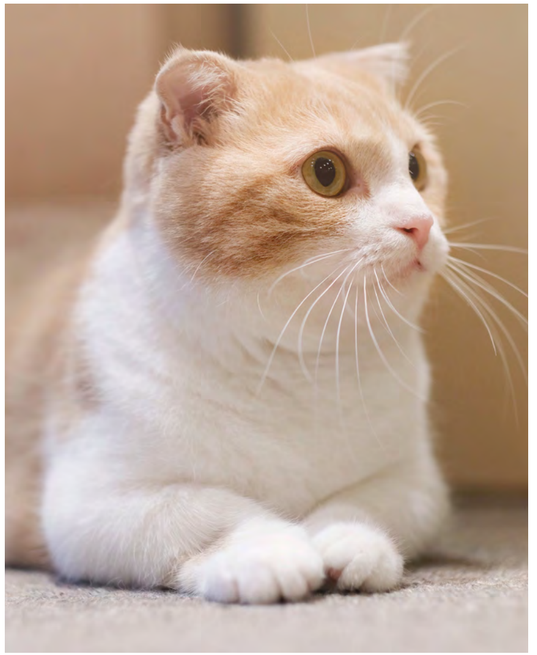
Cat Page!







Unusual Cat Page!



Pencil Case Items

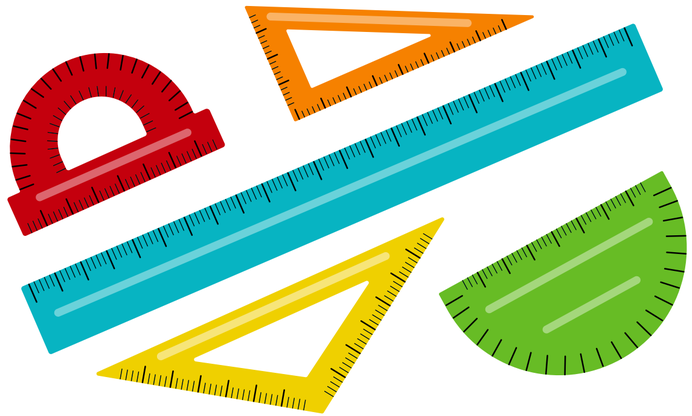


Table Page

	Object	Features
1		
2		
3		
4		
5		