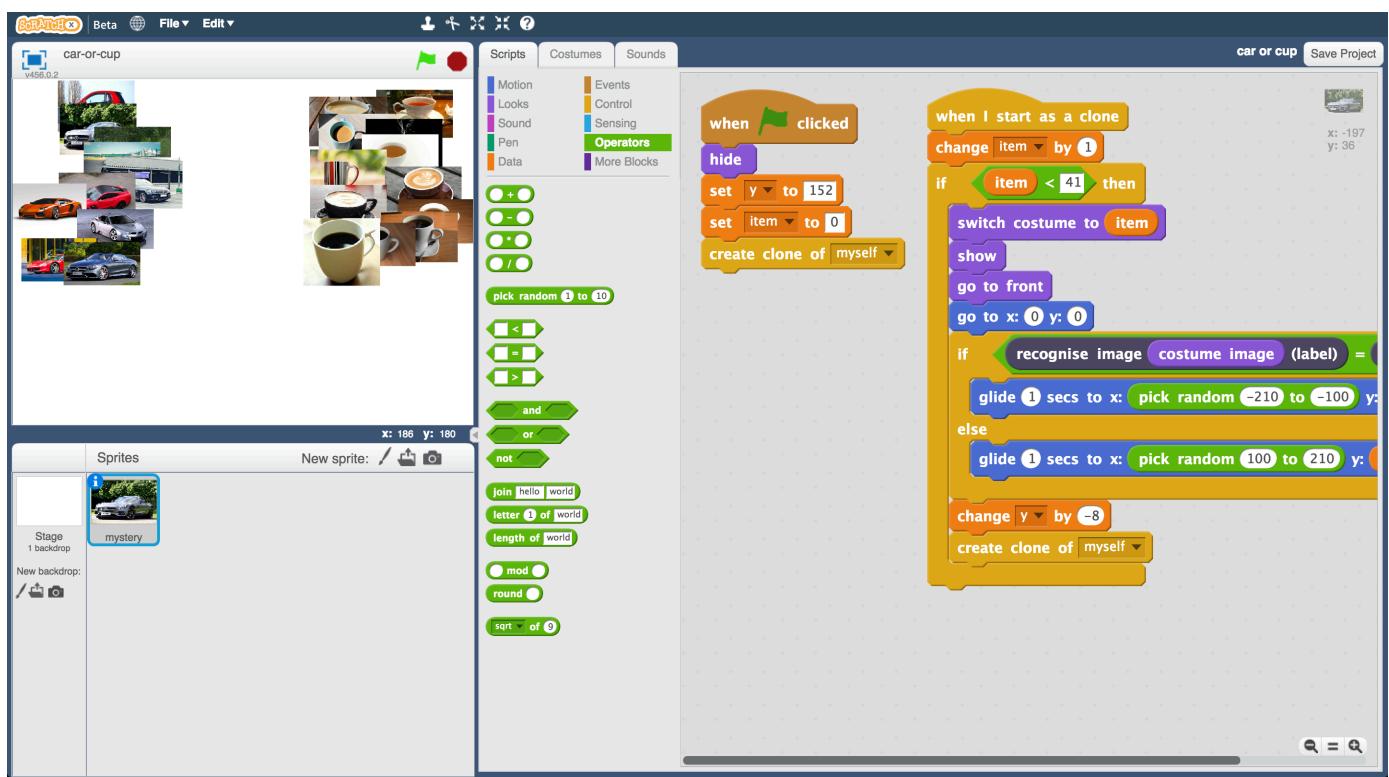


Car or Cup?

In this project you will make a Scratch project that learns to sort photos.

Your class will work together to train the computer to be able to sort a set of photos into two piles:

- * one pile of photos of cars, and
- * one pile of photos of cups



This project worksheet is licensed under a Creative Commons Attribution Non-Commercial Share-Alike License
<http://creativecommons.org/licenses/by-nc-sa/4.0/>

Teacher / Group leader instructions : Setup

This version of the “Car or Cup” activity will get your class to work together to train a single machine learning model. A version of this activity where students can work individually to each train their own machine learning can be downloaded from <https://machinelearningforkids.co.uk/worksheets>

Objective: Create a group project & prepare it for use by your class

1. Go to <https://machinelearningforkids.co.uk/> in a web browser
2. Login using your teacher username/password
3. Click on “Projects” in the top menu bar
4. Click on the “+ Add a new project” button
5. Create a project called “Car or Cup”, set to recognise “images” and make sure you tick the “Whole-class project” checkbox

The screenshot shows a web-based form for creating a new machine learning project. At the top, there's a header with navigation links: ml-for-kids, Welcome, About, Teacher, Projects, Worksheets, News, Help, and Log Out. Below the header, the main title is "Start a new machine learning project". There's a checkbox labeled "Whole-class project?" which is checked. To the right of the checkbox is a note: "Tick this if you want your whole class to be able to work on this project together. This is useful for projects that teach crowd-sourcing as an approach to training machine learning projects." Below the checkbox, there's a field for "Project Name" containing "car or cup". Under "Recognizing", the word "images" is listed. At the bottom right of the form are two buttons: "CREATE" and "CANCEL".

6. Click “Create”
7. Click on the “Car or Cup” project in the list, and then click “Train”
8. Use the “+ Add new label” button to create training buckets for Car and Cup

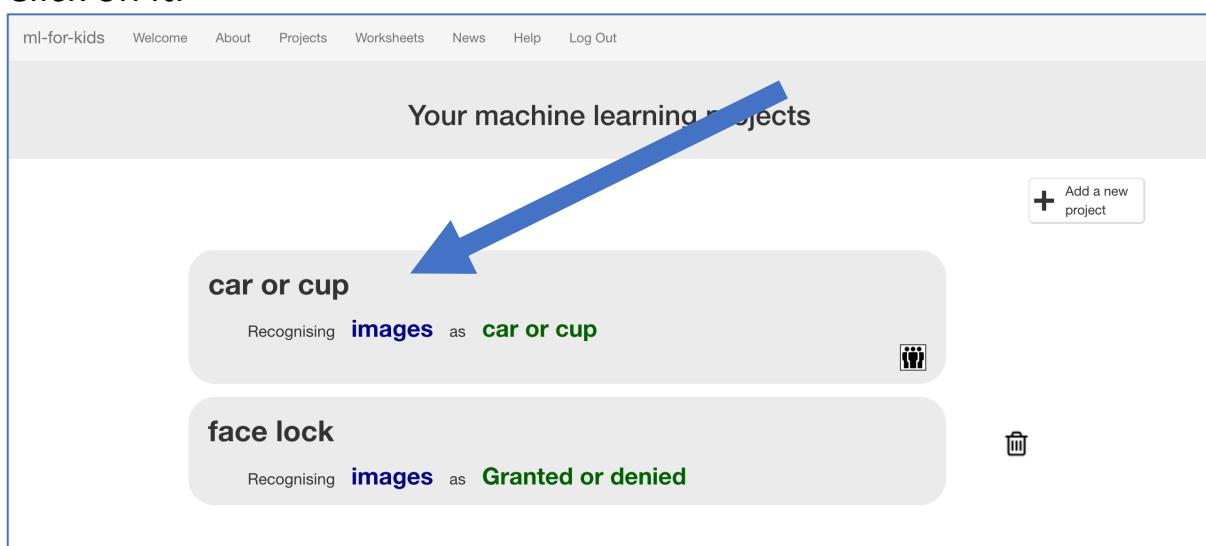
The screenshot shows the training interface for the "car or cup" project. The title at the top is "Recognising images as car or cup". Below the title, there are two large rectangular boxes: one labeled "car" and one labeled "cup". Each box has the instruction "Drag pictures from other browser windows and drop them here". Above each box is a small note: "Drag pictures from other browser windows and drop them here". To the right of the boxes is a button labeled "+ Add new label". At the bottom of each box are three small buttons: "www", "webcam", and "draw".

Student instructions

1. Go to <https://machinelearningforkids.co.uk/> in a web browser
2. Click on “**Get started**”
3. Click on “**Log In**” and type in your username and password
If you don't have a username, ask your teacher or group leader to create one for you.
If you can't remember your username or password, ask your teacher or group leader to reset it for you.

4. Click on “**Projects**” on the top menu bar

5. You should see a “car or cup” project created by your teacher.
Click on it.



6. Click the “**Train**” button to start collecting examples of photos to train the computer with.

7. Your teacher has prepared training buckets for pictures.

The screenshot shows a web browser window with the title 'ml-for-kids'. The main content area displays two rectangular boxes side-by-side. The left box is labeled 'car' at the top and contains the text 'Drag pictures from other browser windows and drop them here'. The right box is labeled 'cup' at the top and also contains the same text. At the bottom of each box are three small buttons: a magnifying glass icon labeled 'www', a camera icon labeled 'webcam', and a pencil icon labeled 'draw'.

9. Open another web browser window.

10. Arrange the web browser windows so that they are side by side.

The screenshot shows two adjacent browser windows. The left window is titled 'Machine Learning for Kids' and displays the same interface as the previous screenshot, with 'car' and 'cup' training buckets. The right window is titled 'Google Images' and shows the Google Images search results page with the 'Google Images' logo and a search bar.

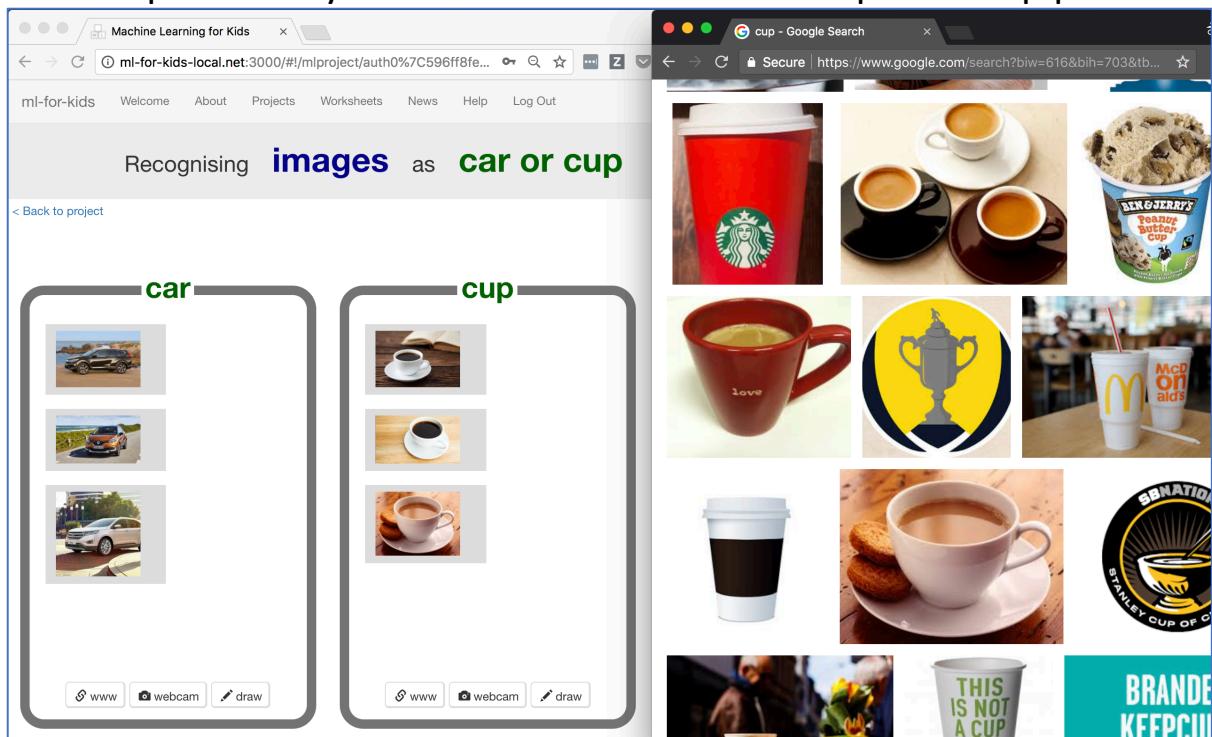
- 11.** In the new browser window, search for pictures of cars.
Drag pictures that are good examples of a car into the left bucket.

The screenshot shows a web-based machine learning project interface. On the left, there are two rectangular buckets labeled 'car' and 'cup'. The 'car' bucket contains one small thumbnail image of a car. The 'cup' bucket is empty. Below these buckets are three buttons: 'www', 'webcam', and 'draw'. To the right of the buckets is a larger area showing a grid of various car images from a Google search. One specific red car image is highlighted and has a blue selection box around it, indicating it is being selected for dragging. At the bottom of this right-hand area are several other small car images.

- 12.** Repeat until you've collected a few examples of car photos.
- 13.** Search for pictures of cups.
Drag pictures that are good examples of a cup into the right bucket.

This screenshot shows the same web-based machine learning project interface as the previous one, but for identifying cups. The 'car' bucket now contains three car images, and the 'cup' bucket is still empty. The 'www', 'webcam', and 'draw' buttons are at the bottom. To the right is a Google search results page for 'cups', displaying a grid of various cup images. A white cup image is being selected and dragged towards the 'cup' bucket on the left.

14. Repeat until you have collected a few examples of cup photos.



15. Your classmates will also be adding photos to the same training buckets as you, but they won't show up while you've got the page open.
Refresh the page to see all the training so far from the whole class.

16. Keep going until your class have collected enough examples.
Don't move past this step until your teacher tells you that it is time to move on.

Teacher / Group leader instructions : Train a ML model

Objective: Monitor class progress & train a machine learning model

1. Click on “Projects” in the top menu bar
2. Click on the “car or cup” project
3. Click on the “Learn & Test” button
4. Review the summary of the progress the class has made

The more examples they collect, the better the model should perform, but they need at least ten examples of each to be able to create a model at all.

This screenshot shows the 'Machine learning models' page. At the top, there's a navigation bar with links: ml-for-kids, Welcome, About, Teacher, Projects, Worksheets, News, Help, and Log Out. Below the navigation, the title 'Machine learning models' is centered. Underneath it, a link '[< Back to project](#)' is visible. The main content area is divided into two sections: 'What have you done?' and 'What's next?'. The 'What have you done?' section contains text about collecting images for a car or cup model, a list of collected items (3 examples of car, 3 examples of cup), and a 'Train new machine learning model' button. The 'What's next?' section contains text encouraging users to keep going and collect more examples, stating that at least ten examples of each are needed. A blue arrow points from the 'What have you done?' section towards the 'Train new machine learning model' button.

5. When you’re ready to proceed, click “Train new machine learning model” to train a new model using their examples.
This may take a minute or two. The status on the page will change from “Training” to “Active” once it has finished.

This screenshot shows the 'Machine learning models' page after the training process has started. The 'What have you done?' section remains the same as in the previous screenshot. The 'What's next?' section now displays a message: 'Ready to start the computer's training? Click the button below to start training a machine learning model using the examples you've collected so far. (Or go back to the Train page if you want to collect some more examples first.)'. Below this message is a large blue arrow pointing down to the 'Train new machine learning model' button. A blue box highlights this button, and another blue box highlights the text 'Info from training computer:' above it.

6. Once it is ready, you can tell the class it’s time to move on.

Student instructions

- 17.** Click the “< Back to project” link.
- 18.** Your teacher has used the examples your class collected to train a machine learning model.
- 19.** Click the “**Make**” button, then the “**Scratch**” button.
This page has instructions on how to use the new blocks in Scratch.

Using machine learning in Scratch

< Back to project

Your project will add these blocks to the **More Blocks** tab in Scripts.

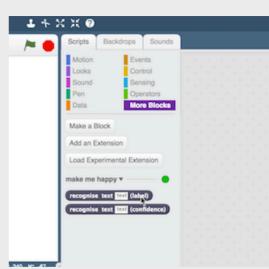
recognise images [costume image] (label)
Put images in the input for this, and it will return the label that your machine learning model recognises it as.

recognise images [costume image] (confidence)
This will return how confident your machine learning model is that it recognises the type of images. (As a number from 0 - 100).

car **cup**
These blocks represent the labels you've created in your project, so you can use their names in your scripts.

costume image
This block is in the Looks palette for Sprites and will return the image of the currently selected costume.

It will look something like this - except with the name of your project.



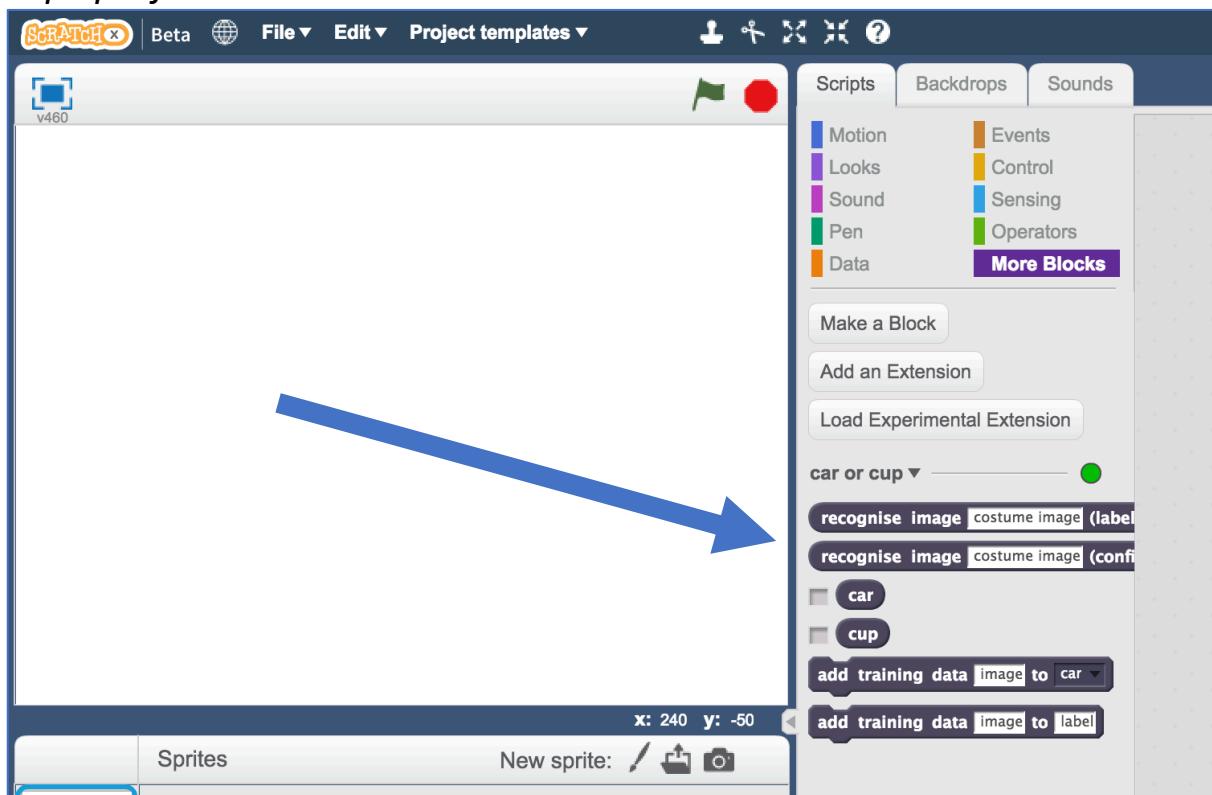
What have you done so far?

You've started to train a computer to recognise pictures of cups and cars. Instead of trying to write rules to be able to do this, you are doing it by collecting examples. These examples are being used to train a machine learning “model”.

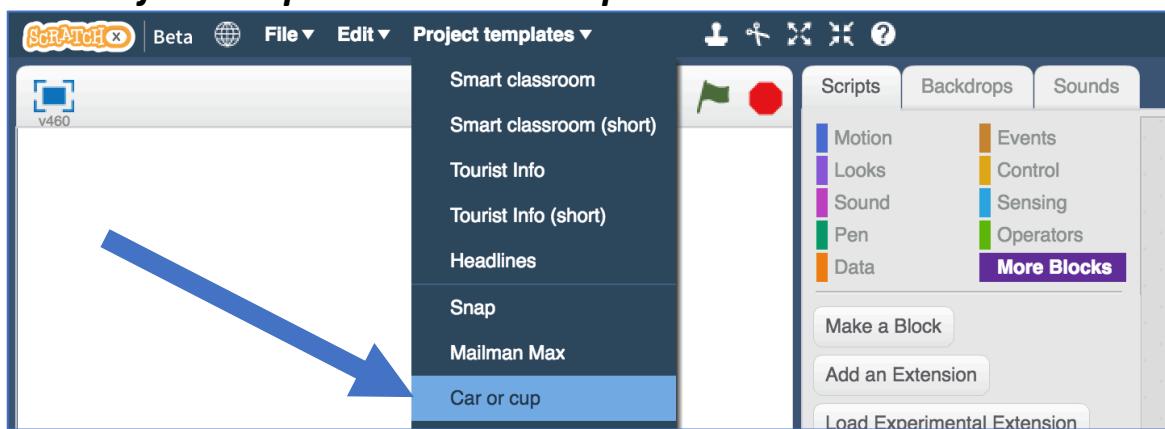
This is called “supervised learning” because of the way you are supervising the computer’s training.

The computer will learn from patterns in the example photos you’ve chosen, such as the shapes and the use of colour. These will be used to be able to recognise new images.

- 20.** Click the “Open in Scratch” button to launch the Scratch editor.
You should see new blocks in the “More blocks” section from your “car or cup” project.



- 21.** Load the Car or cup template
Use Project templates -> Car or cup as shown below.



Tips

More examples!

The more examples you give it, the better the computer should get at recognising whether a photo is a cup or car.

Try and be even

Try and come up with roughly the same number of examples for cups and cars.

If you have a lot of examples for one type, and not the other, the computer might learn that type is more likely, so you'll affect the way that it learns to recognise photos.

Mix things up with your examples

Try to come up with lots of different types of examples.

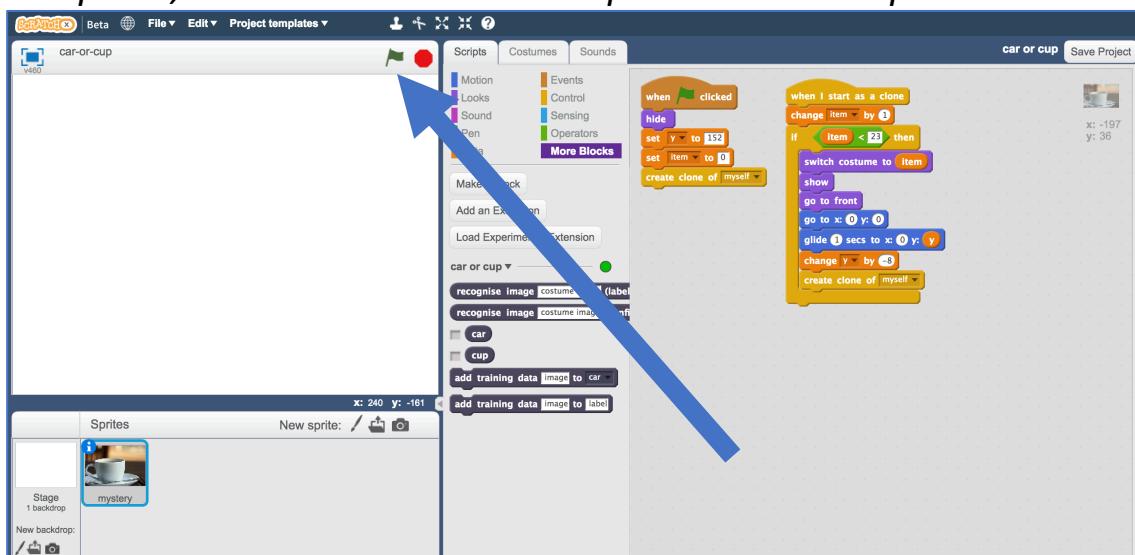
For example, make sure that you include some examples with different backgrounds.

If every photo of a car you use for training has grass in the background, and every photo of a cup you use for training is on a wooden table, you might end up training the computer to recognise grass or wood instead.

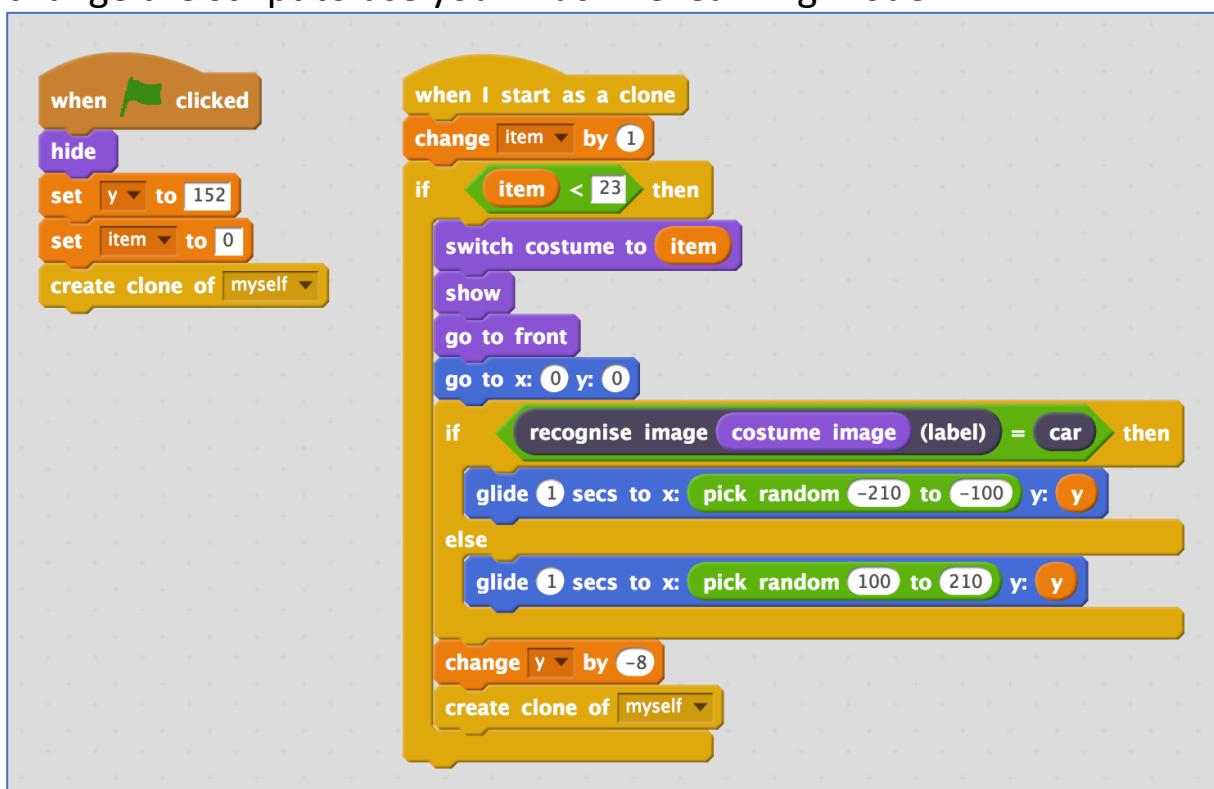
22. Click the green flag to give it a try.

The project has several random photos or cars or cups.

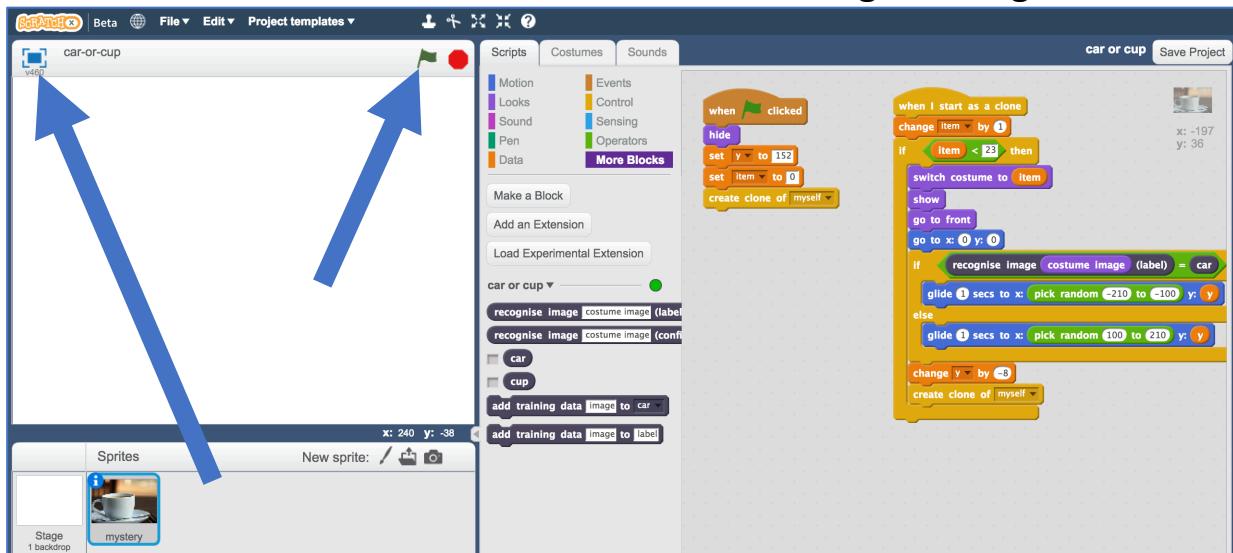
Next you will modify the project to use the training you've given the computer, so that it can sort these photos into two piles.



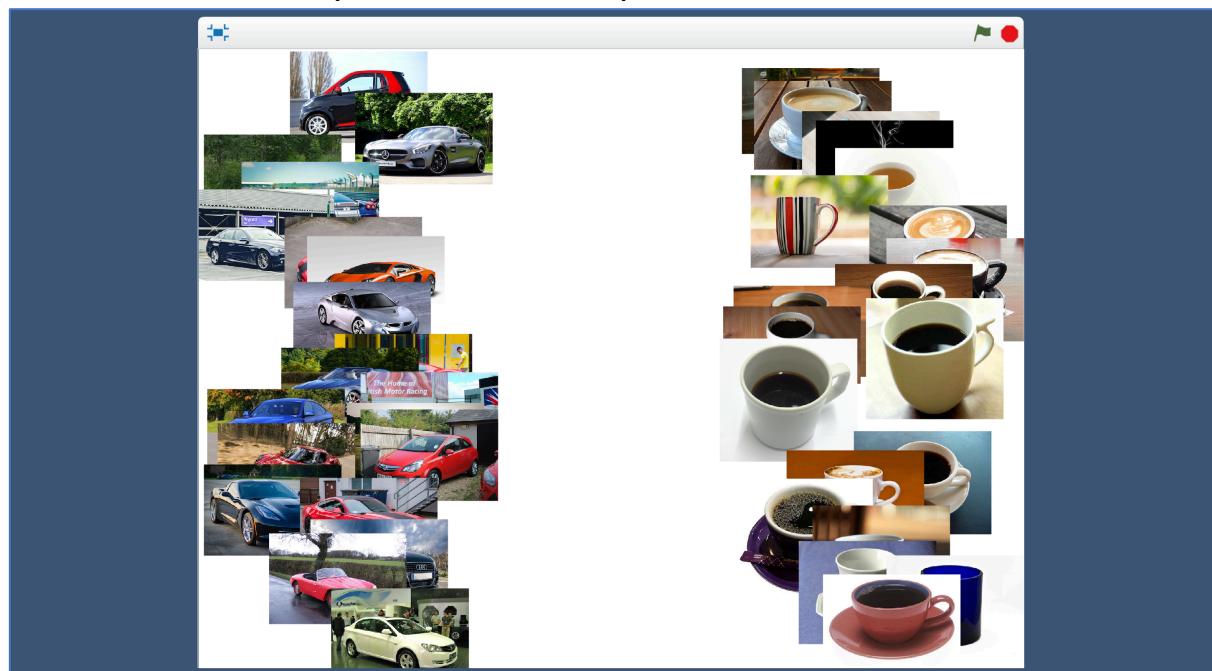
23. Click on the “mystery” sprite, and then click “Scripts” tab, and change the script to use your machine learning model.



24. Click the full screen icon, and then click the green flag



25. Watch your script use the machine learning model your class has trained to sort the photos into two piles.



26. Save your project.

*Click **File** -> **Save project***

What have you done?

You've used machine learning to build an automatic photo sorter.

Training the computer to be able to recognise photos for itself is much much quicker than trying to sort thousands of photos manually.

And the more examples you give it, the better it should get at recognising photos correctly.

Ideas and Extensions

Now that you've finished, why not give one of these ideas a try?

Or come up with one of your own?

Add a third type of photo

Instead of just recognising cups and cars, can you add a third type as well?

Try confusing the computer

Train the computer to recognise cars with ten photos of a car on a grass background.

Train the computer to recognise cups with ten photos of a cup on a plain white background.

Now see if the computer recognises a car on a plain white background.

Or if it can recognise a cup on a grass background.

Does the computer get confused? Did it learn to recognise the cup and car? Or was it more influenced by the background?

Experiment to find out how the computer learns, and how it behaves.