



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

The screenshot shows a Scratch project titled "Car or Cup?". The stage contains several images of cars and cups. The script editor shows a script for a "mystery" sprite:

```
when I start as a clone
  hide
  set y to 152
  set item to 0
  if item < 23 then
    switch costume to item
    show
    go to front layer
    go to x: 0 y: 0
  end
  if [recognise image costume image] = [car]
    glide 0.1 secs to x: pick random -210 to -100 y: y
  else
    glide 0.1 secs to x: pick random 100 to 210 y: y
  end
  change y by -14
  create clone of myself
```

The sprite palette shows the "mystery" sprite with a car costume. The stage has 1 backdrop.



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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

Start a new machine learning project

Whole-class project?

Project Name *

car or cup

Recognising *

images

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.

CREATE 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

Recognising images as car or cup

< Back to project

car

Drag pictures from other browser windows and drop them here

cup

Drag pictures from other browser windows and drop them here

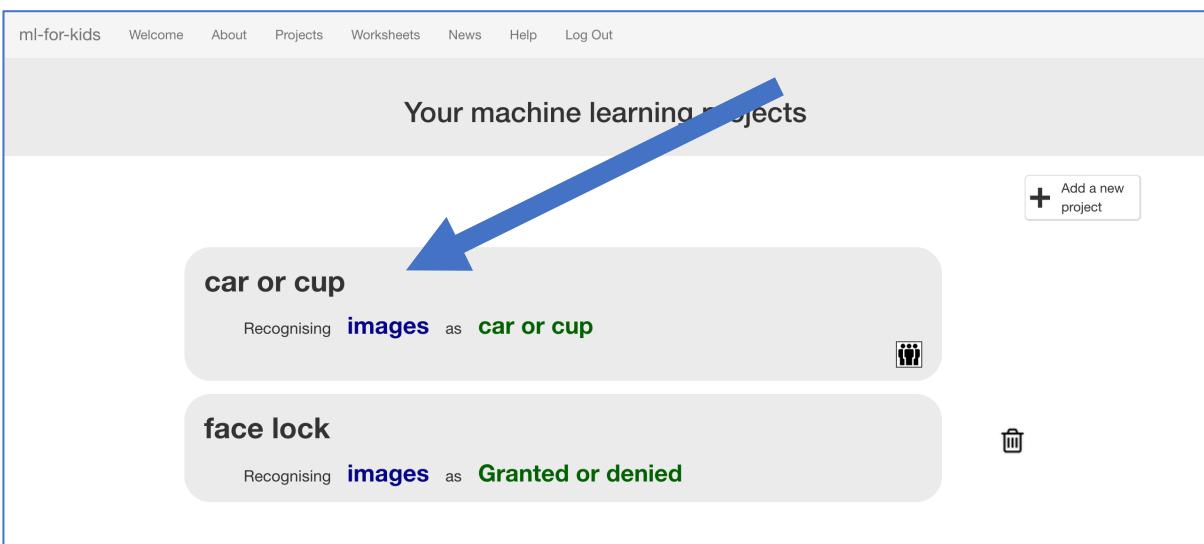
+ Add new label

www webcam draw

www webcam draw

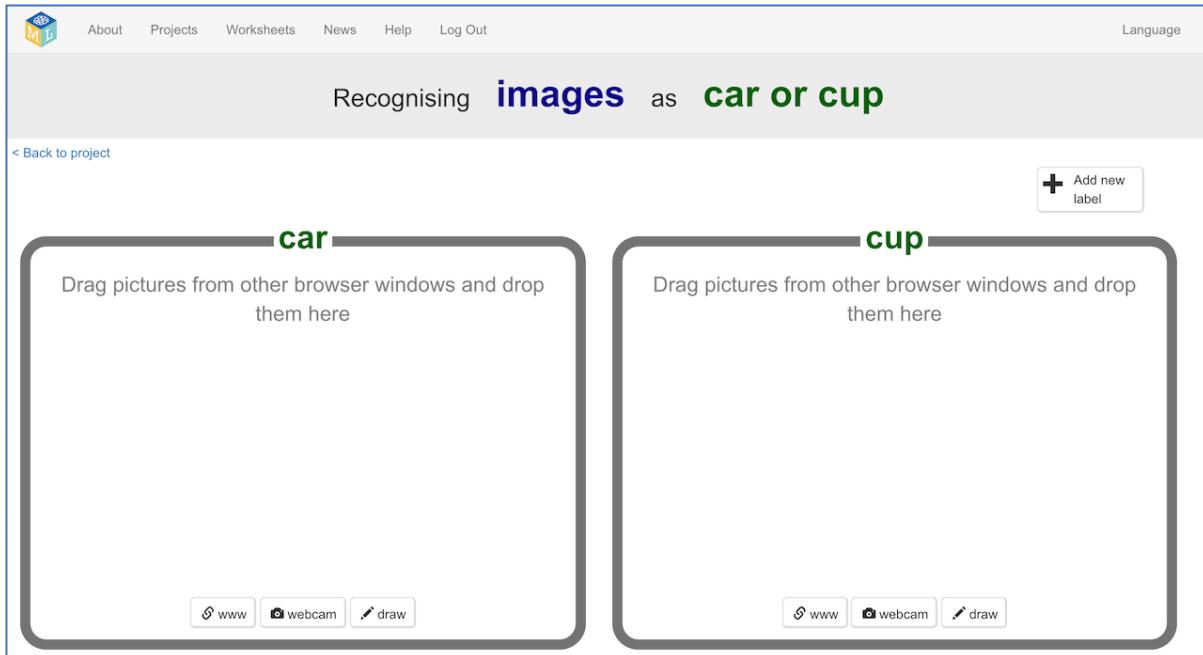
Student instructions

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.



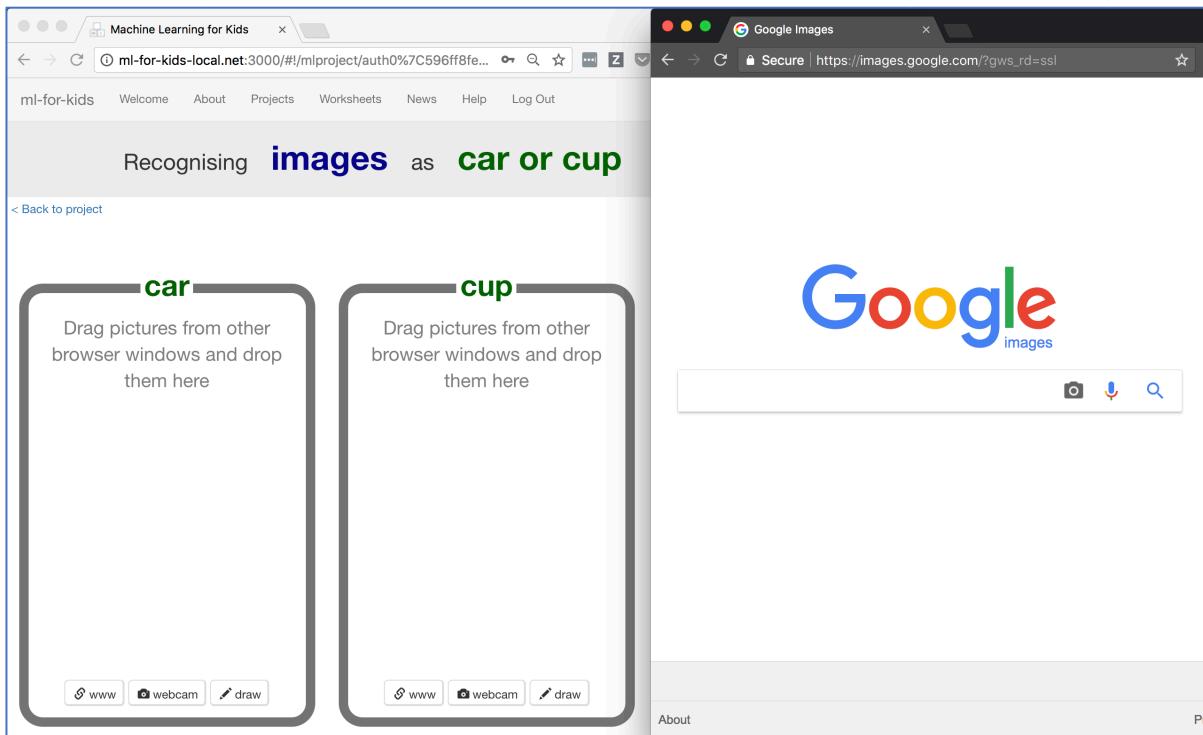
6. Click the “**Train**” button to start collecting examples of photos to train the computer with.

7. Your teacher has prepared training buckets for pictures.



9. Open another web browser window.

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



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

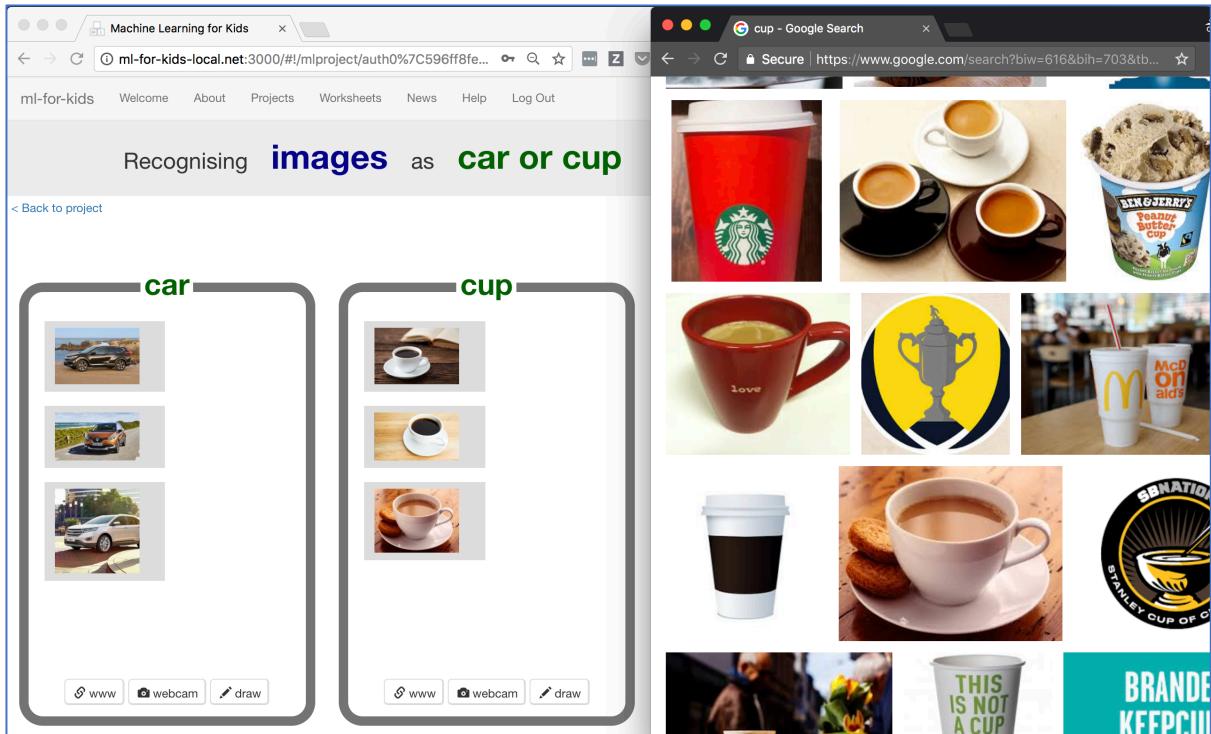
The screenshot shows a web-based machine learning project interface. On the left, there are two large rectangular boxes labeled 'car' and 'cup'. The 'car' box contains a small thumbnail of a silver SUV. Below the boxes are three buttons: 'www', 'webcam', and 'draw'. To the right of the boxes is a grid of various car images from a Google search. The first row has two images: a red Lightning McQueen toy car and a red Lightning McQueen race car. The second row has two images: a blue Ford self-driving car and a dark grey SUV. The third row has two images: a white race car and a red hatchback. The fourth row has two images: a blue futuristic race car and a red Lightning McQueen race car. The fifth row has two images: a black race car and a yellow race car. The sixth row has two images: a white race car and a white race car.

- 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.

The screenshot shows the same web-based machine learning project interface. On the left, the 'car' box now contains three car images (a silver SUV, a silver hatchback, and a silver SUV). The 'cup' box is still empty. Below the boxes are three buttons: 'www', 'webcam', and 'draw'. To the right of the boxes is a grid of various cup images from a Google search. The first row has three images: a pink sippy cup, a white coffee cup on a saucer, and a white coffee cup on a saucer. The second row has three images: a dark purple mug, a clear glass pitcher, and two colorful cups (orange and pink). The third row has three images: a white travel mug, a white coffee cup with a brown sleeve, and a blue sippy cup. The fourth row has three images: a white mug, a white mug, and a green coffee cup.

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 car or cup recognition, a list of collected examples (3 car, 3 cup), and a note about needing at least ten examples. The 'What's next?' section encourages keeping going, asks the teacher to go back to the 'Train' page to collect more examples, and notes that more examples lead to better performance.

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 same 'Machine learning models' page as the previous one, but with a large blue arrow pointing from the 'What's next?' section down to the 'Train new machine learning model' button. This button is located at the bottom of the 'What's next?' section, below the text about starting training. The button is highlighted with a blue border.

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 3**” button.

This page has instructions on how to use the new blocks in Scratch.

The screenshot shows the Scratch 3 interface. At the top, it says "Using machine learning in Scratch". Below that is a "Scripts" tab. A script is shown in the stage area:

```
make me happy
when green flag clicked
  [recognise test [cup?]
  [confidence] v
  say [I'm happy!] for [1] sec]
```

On the left, there's a sidebar with categories: Motion, Looks, Sound, Control, Sensing, and Data. The "More Blocks" tab is selected. Below the sidebar, there are three sections of text and images:

- 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.

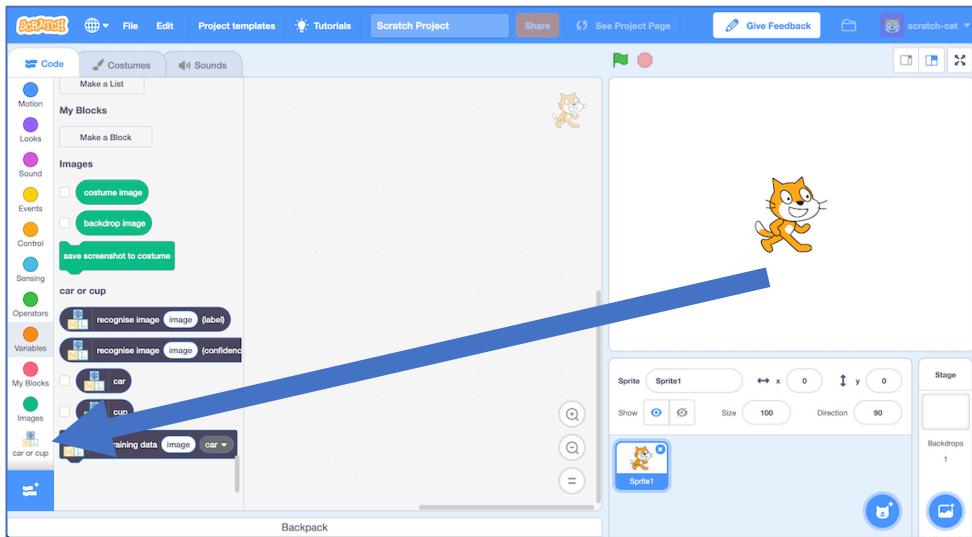
What have you done so far?

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”.

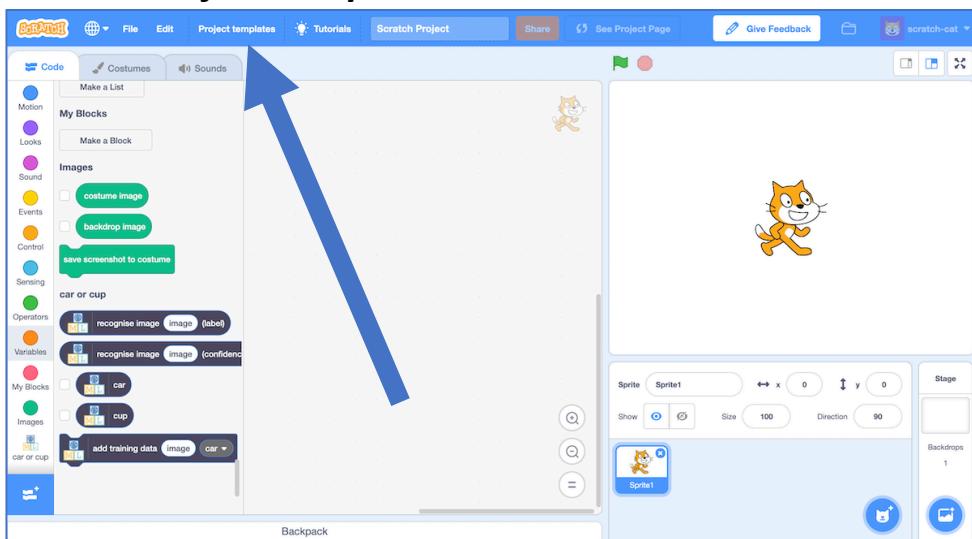
This is called “supervised learning” because of the way you are supervising the computer’s training.

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 3” 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
Click on Project templates and then click on the Car or Cup template.



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.

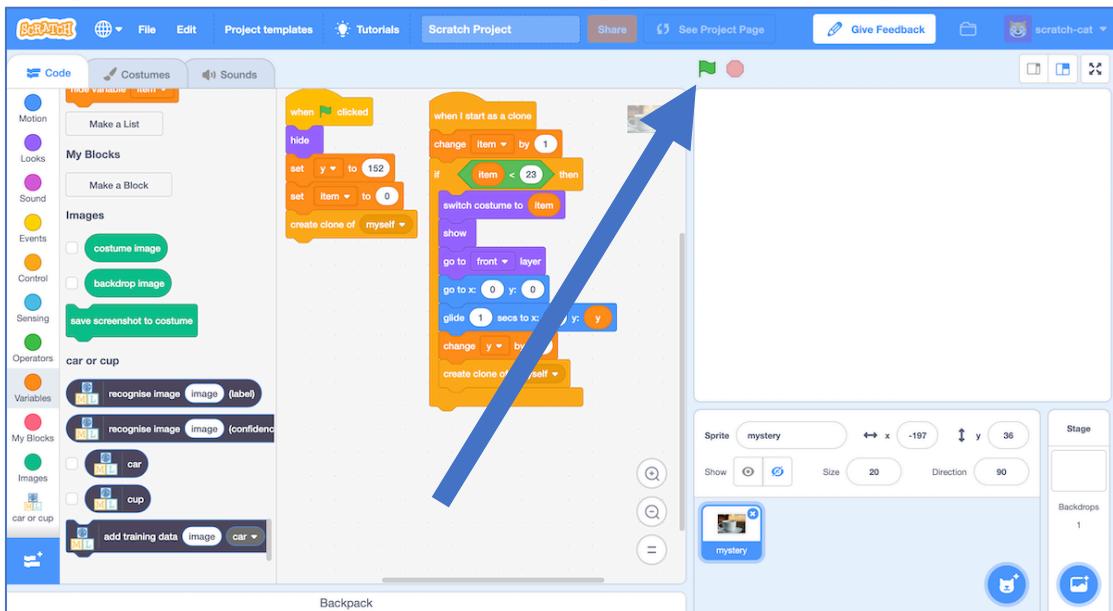
For example, make sure that you include some examples with different backgrounds.

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.

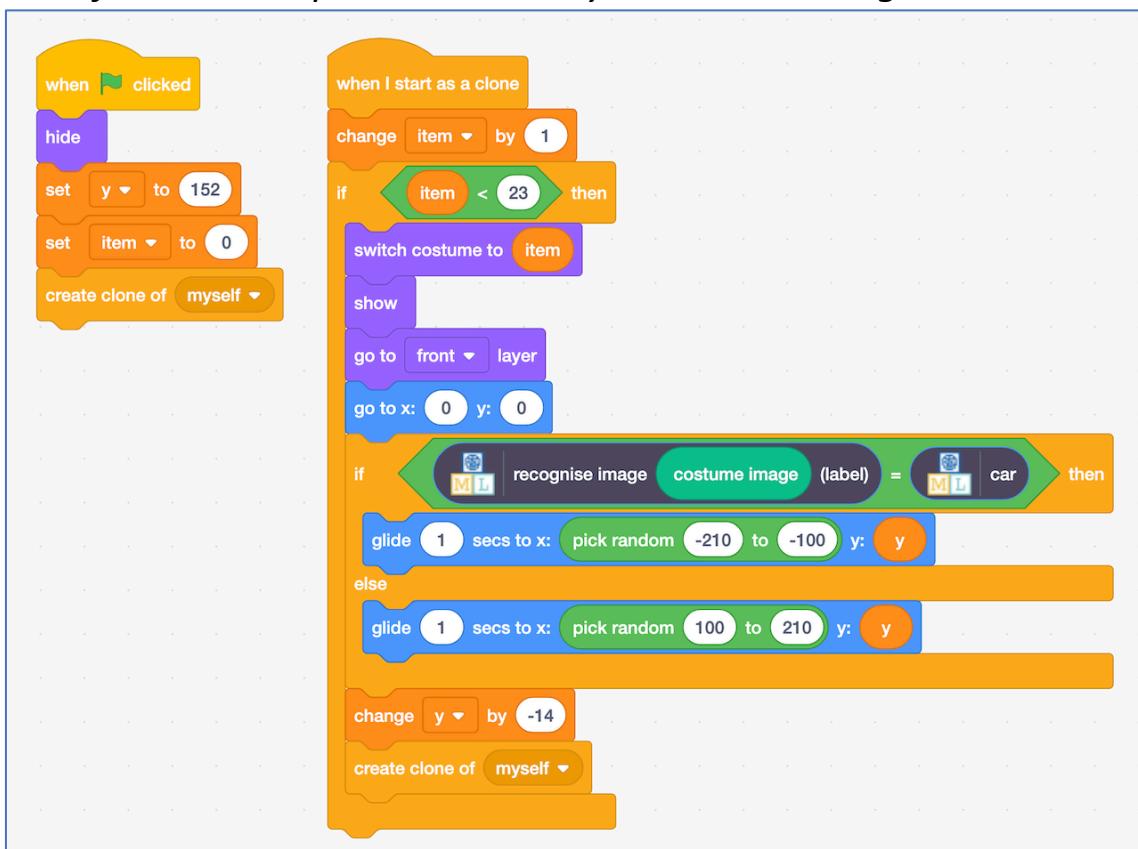
The project has several random photos or cars or cups.

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.

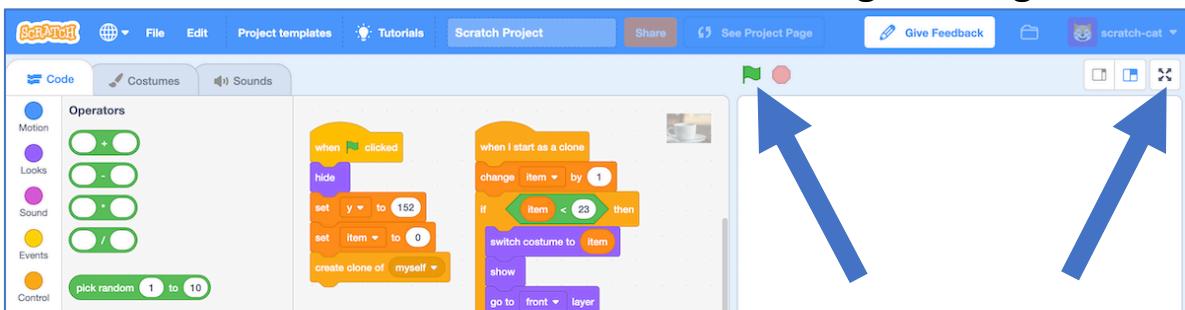


23. Click on the “mystery” sprite, then the “Code” tab, and change the script to use your machine learning model.

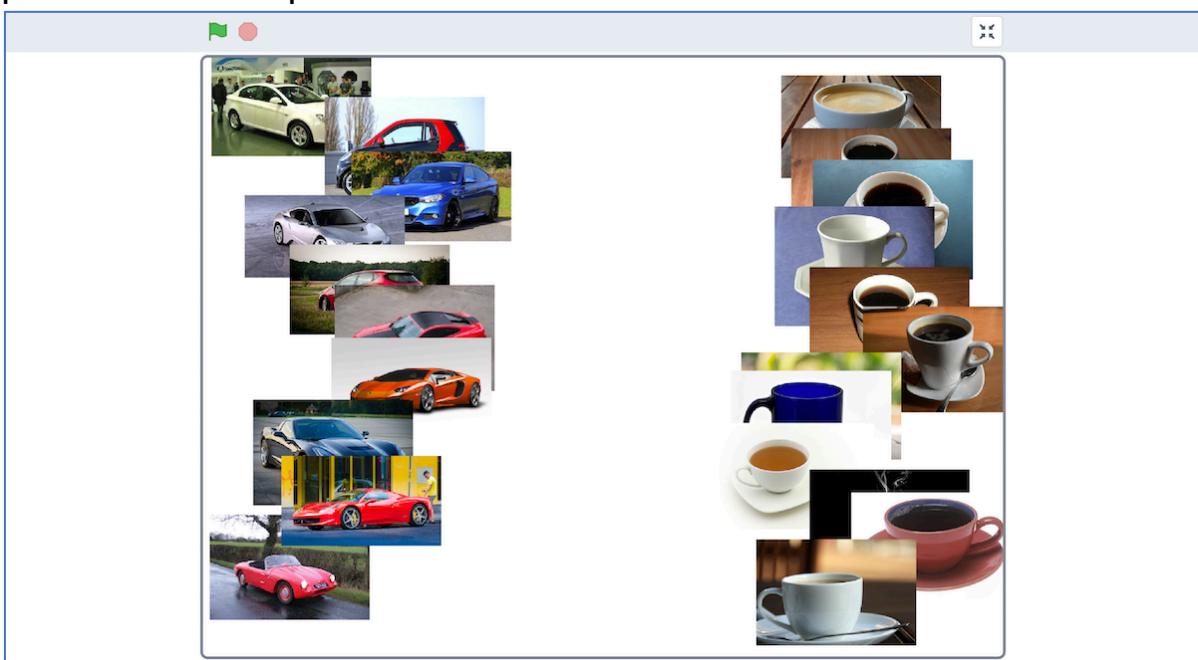
Start from the script that is already there and change it to look like this.



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



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



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.