

GCC Fall Fun with Machine Learning!

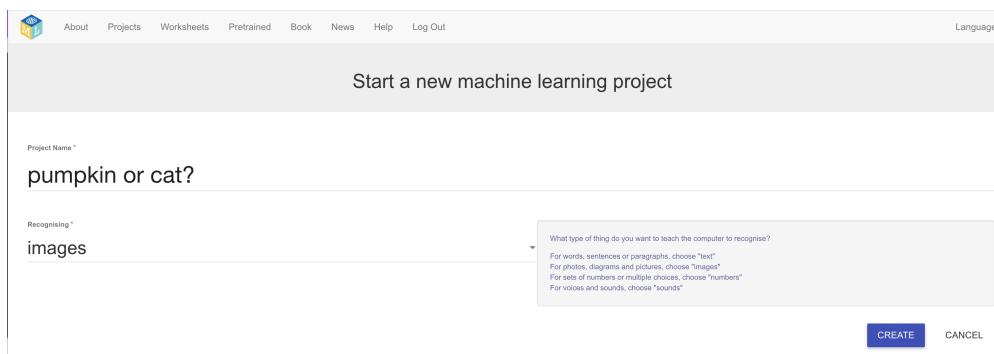
Activity: Find the cat in the pumpkin patch!

Can you teach a computer to recognize images? Using **machine learning**, a type of **artificial intelligence (AI)**, you can! In machine learning, you **train** (teach) a **model** to recognize a pattern (like an image) that helps the computer learn. Then, you **test** your model to see if the computer can recognize a pattern or image that it has never seen before. In this activity, you will teach a computer to find the cat in this pumpkin patch. To begin, go to the Machine Learning for Kids website.

<https://machinelearningforkids.co.uk/>

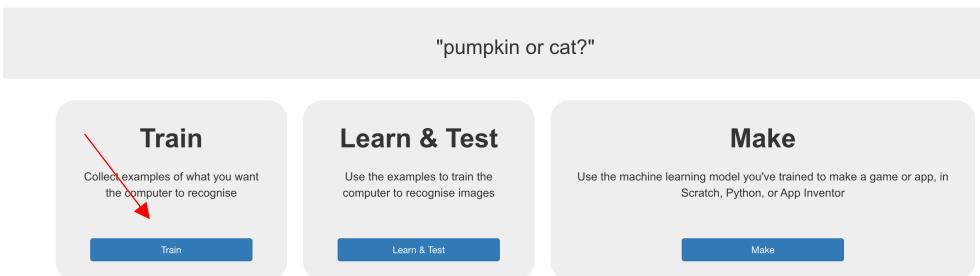
Create your model

Create a new machine-learning model called “pumpkin or cat?” recognizing images. Click “create” when you’re done.

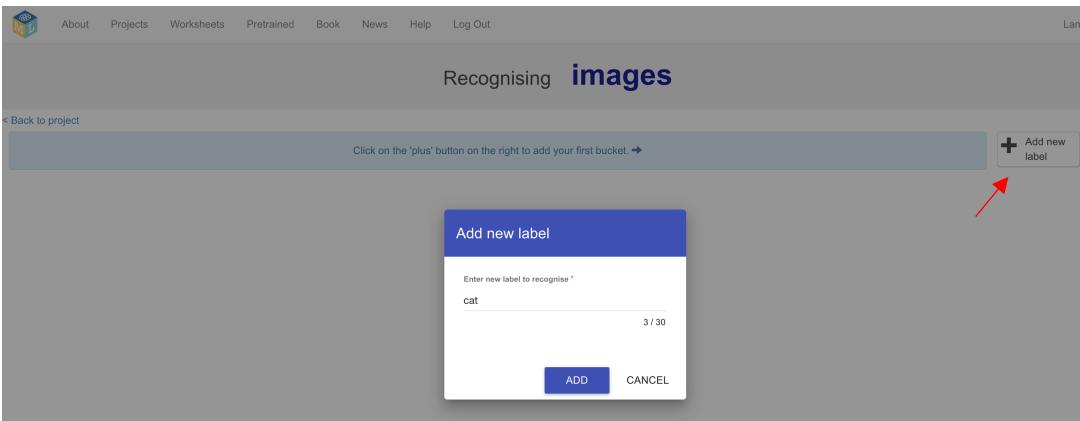


Train your model

In your project, you will first train your model, test it by drawing a picture, and then use it to search an image of a pumpkin patch to locate the cat. First click “Train”.



To train your model, you'll first need to come up with categories called **labels** to sort your images. For this model, we want to have two labels: cat and pumpkin. Add a new label for both cat and pumpkin.

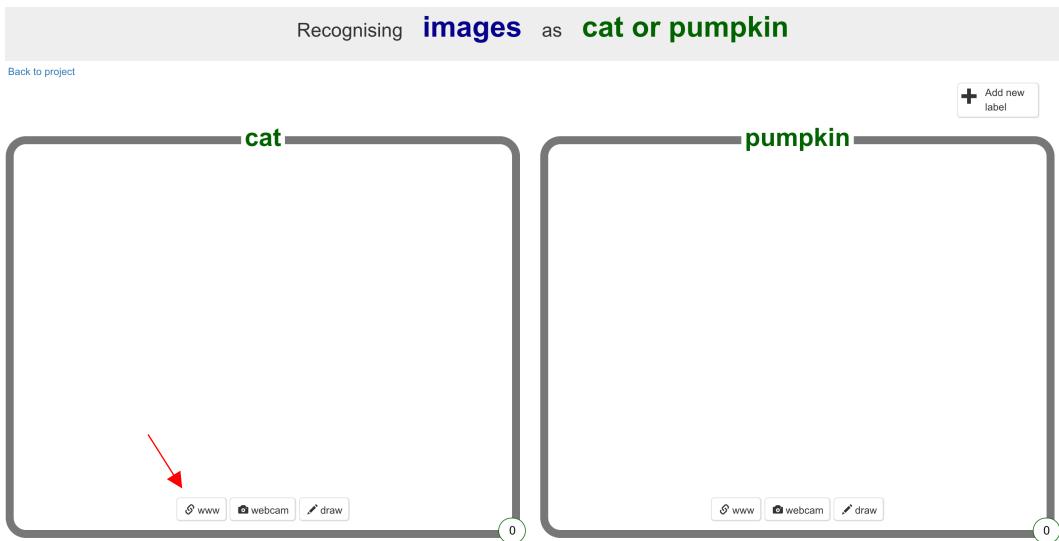


This will create two boxes for our ***training data***. Our training data are images of cats and pumpkins that we will use to help our model learn. We will use seven images of cats and seven images of pumpkins as our training data.

To load our training data into the model, click the www button for the cat and copy/paste the following links, one at a time. Each link is an image of a cat.

Cat training data:

1. https://storage.googleapis.com/coding_club/full_fun_with_machine_learning/pumpkin_patch_search/training_cat/black-cat-looking-up-at-owner.jpg
2. https://storage.googleapis.com/coding_club/full_fun_with_machine_learning/pumpkin_patch_search/training_cat/black-cat-sits-by-the-rocks_close.jpg
3. https://storage.googleapis.com/coding_club/full_fun_with_machine_learning/pumpkin_patch_search/training_cat/black-cat-with-green-eyes.jpg
4. https://storage.googleapis.com/coding_club/full_fun_with_machine_learning/pumpkin_patch_search/training_cat/cat-ge1bfa9a32_1920.jpg
5. https://storage.googleapis.com/coding_club/full_fun_with_machine_learning/pumpkin_patch_search/training_cat/close-up-of-black-cat-portrait.jpg
6. https://storage.googleapis.com/coding_club/full_fun_with_machine_learning/pumpkin_patch_search/training_cat/pep_pep.jpg
7. https://storage.googleapis.com/coding_club/full_fun_with_machine_learning/pumpkin_patch_search/training_cat/two-black-cats-on-the-rocks.jpg

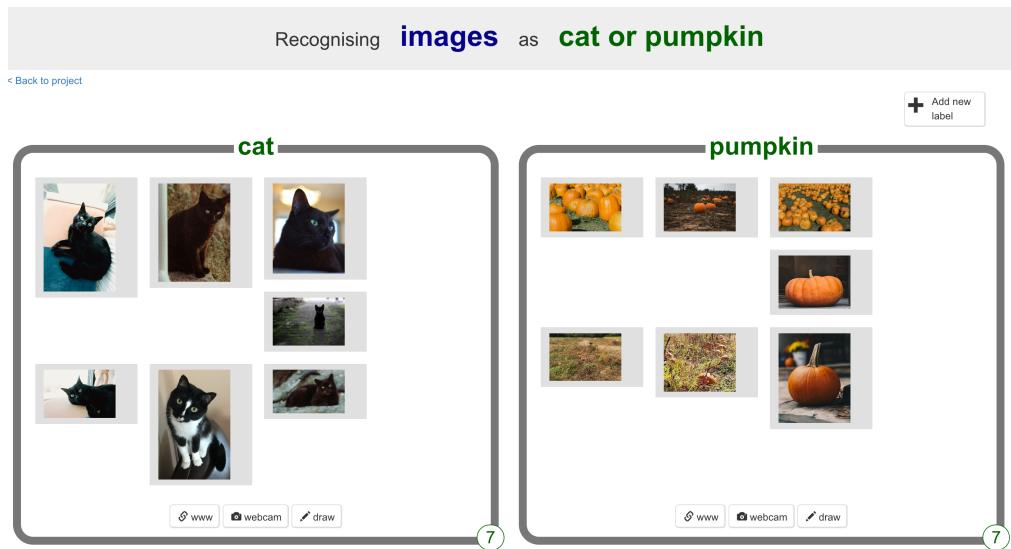


Now load in the training data for the pumpkin by clicking on the www button in the pumpkin box and copy/pasting the following links.

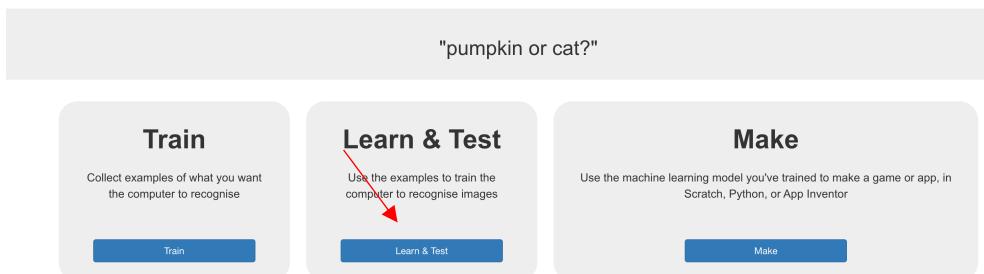
Pumpkin training data:

1. https://storage.googleapis.com/coding_club/full_fun_with_machine_learning/pumpkin_patch_search/train_pumpkin/big-orange-pumpkins.jpg
2. https://storage.googleapis.com/coding_club/full_fun_with_machine_learning/pumpkin_patch_search/train_pumpkin/pumpkin-patch-at-harvest_far.jpg
3. https://storage.googleapis.com/coding_club/full_fun_with_machine_learning/pumpkin_patch_search/train_pumpkin/pumpkin-patch-selection.jpg
4. https://storage.googleapis.com/coding_club/full_fun_with_machine_learning/pumpkin_patch_search/train_pumpkin/pumpkin-sat-on-the-top-step-of-porch.jpg
5. https://storage.googleapis.com/coding_club/full_fun_with_machine_learning/pumpkin_patch_search/train_pumpkin/pumpkin_patch1.jpg
6. https://storage.googleapis.com/coding_club/full_fun_with_machine_learning/pumpkin_patch_search/train_pumpkin/pumpkin_patch2.jpg
7. https://storage.googleapis.com/coding_club/full_fun_with_machine_learning/pumpkin_patch_search/train_pumpkin/small-pumpkin-on-steps.jpg

When we're done adding our training data, our model should look like this.



Click "Back to project" to return to our main project page. Next, you'll want to select "Learn & Test".



We can now teach our computer the differences between cats and pumpkins by training our new machine-learning model! Click “Train new machine learning model”.

What have you done?

You have collected examples of images for a computer to use to recognise when images are cat or pumpkin.

You've collected:

- 5 examples of cat,
- 5 examples of pumpkin

What's next?

Ready to start the computer's training?

Click the button below to start training a machine learning model using the examples you have collected so far

(Or go back to the [Train](#) page if you want to collect some more examples first.)

Info from training computer:

[Train new machine learning model](#)

Test your model

We now want to test our model on images it has never seen before. This is called the **test data**. Our test data are images of cats or pumpkins that are NOT in our training data. To do a quick test of your model, click “Test by drawing”.

Try putting in an image to see how it is recognised based on your training.

[Test with webcam](#) [Test by drawing](#)

Test with a web address for an image on the Internet [Test with www](#)

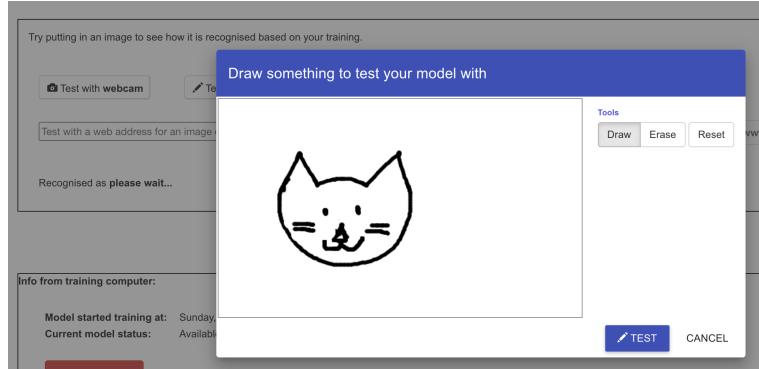
Info from training computer:

Model started training at: Sunday, October 23, 2022 7:34 PM
Current model status: Available

[Delete this model](#)

[Train new machine learning model](#)

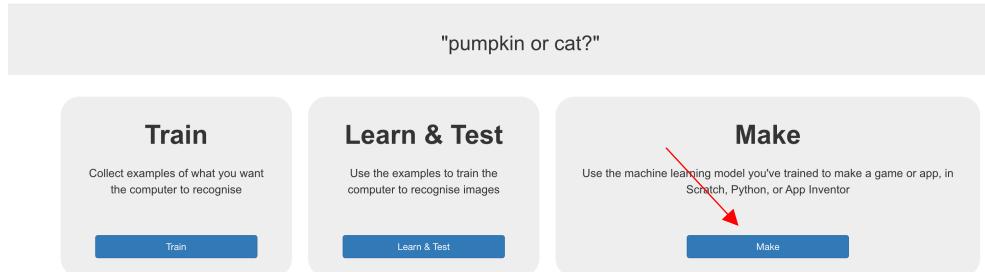
This will pull up a box where you can use your mouse/trackpad to draw a picture. Try drawing a cat and click “Test”. The model will output the label (either cat or pumpkin) and the confidence (a percentage (%)) that tells us how sure the model is that the label is correct – how sure the computer is that your picture is a cat or pumpkin).



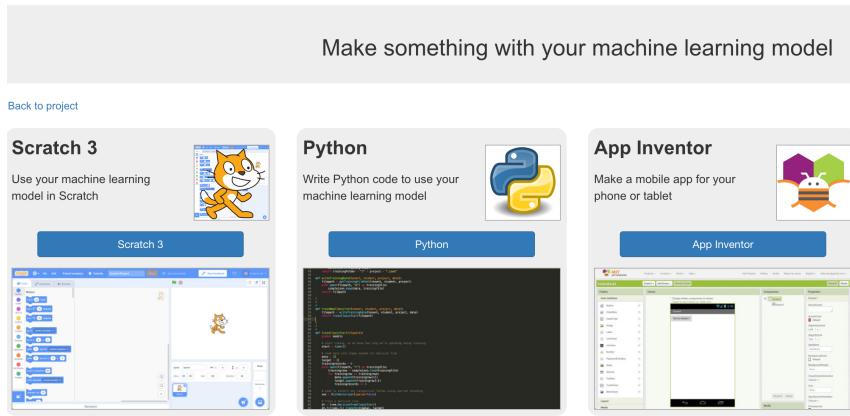
It's okay if the computer doesn't get it right from the drawn picture – real images usually have more details that are picked up by the model. Take a few minutes to draw different pictures of cats and pumpkins to see how often the computer gets it right!

Apply your model to find the cat in the pumpkin patch

Click “Back to project” to return to our main project page. Next, you’ll want to select “Make”.



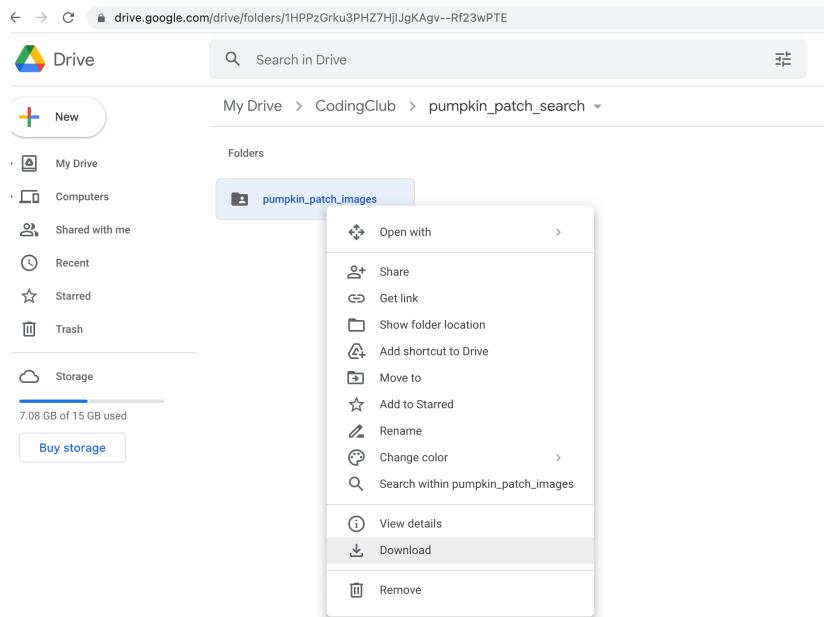
Now it's time to go to the pumpkin patch! To use our model to find the cat in the pumpkin patch, we'll need to write some code! Select Scratch 3 and then click “Open in Scratch 3.”



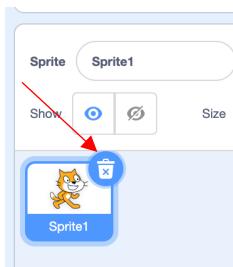
Before we start writing code, you'll need to download the `pumpkin_patch_images` folder from the Google Drive.

<https://drive.google.com/drive/folders/1HPPzGrku3PHZ7HjIJgKAgv--Rf23wPTE>

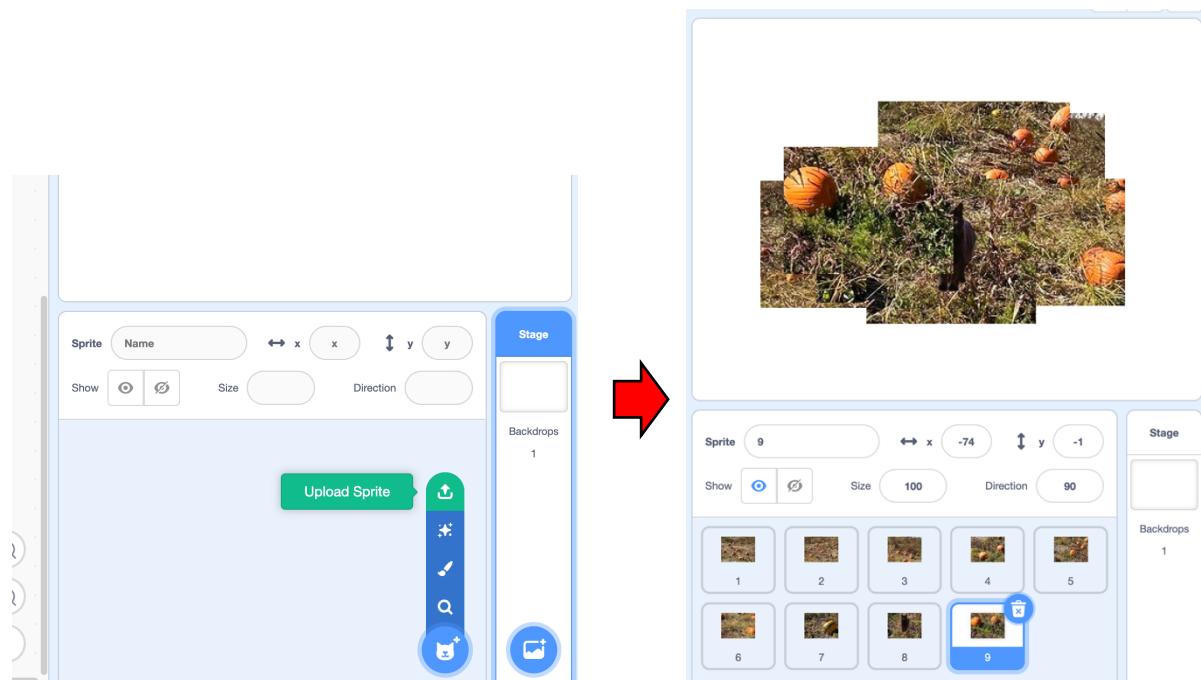
Double click the .zip file to open the folder. If you look inside the folder, you should see nine .jpg files.



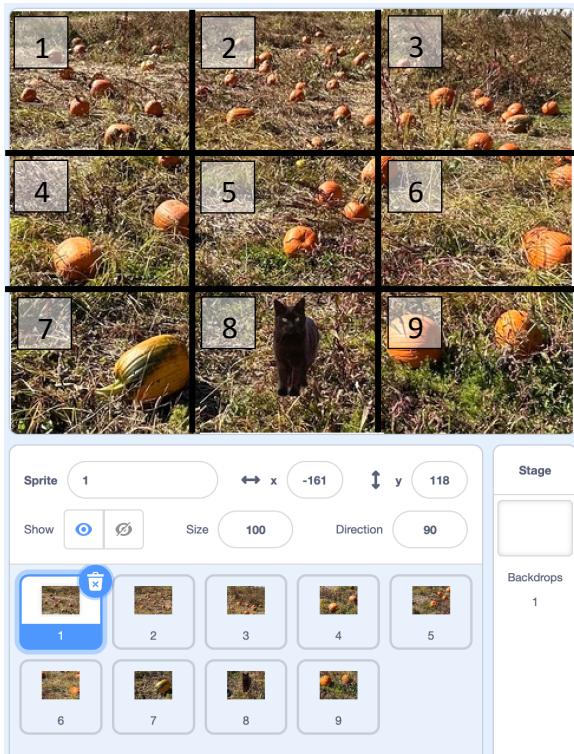
In Scratch, delete the existing Sprite1 by clicking on the garbage can.



Click on Upload Sprite. Upload images 1-9 as Sprites.



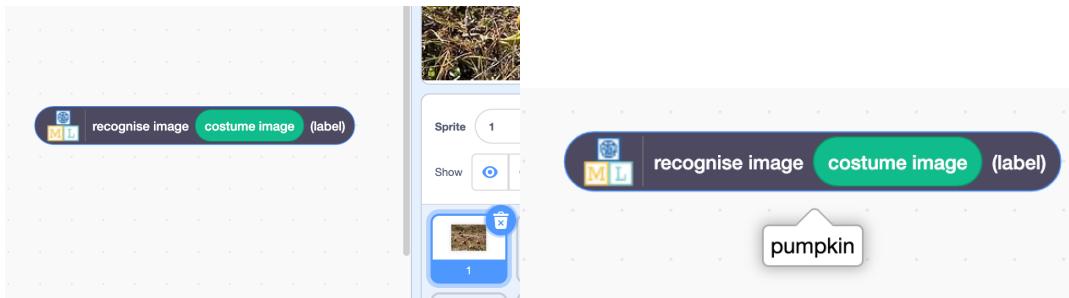
Now it's puzzle time! Click on each piece to drag it to its correct place and assemble the nine images into a grid as shown below to create the pumpkin patch.



From looking at the picture, you know that the cat is in the bottom center of the photo (grid 8). But does the computer know that? To find out, you'll need to write code to test whether your model can tell what part of the picture (which of the nine grid pieces) contains the cat.

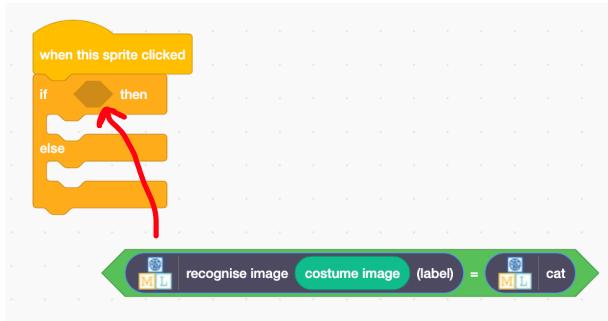
Scroll to the bottom of the Code pieces to find the black ML-model specific pieces. Click on “1” in your Sprite list, and add a black “recognise image <image> (label)”. In the blank space for <image>, add a green “costume image” piece. Together, when clicked, these pieces will show the label assigned to the first grid “1” of the image (top left corner). Click your code.

Does your model recognize the first image (grid 1) as a cat or pumpkin?

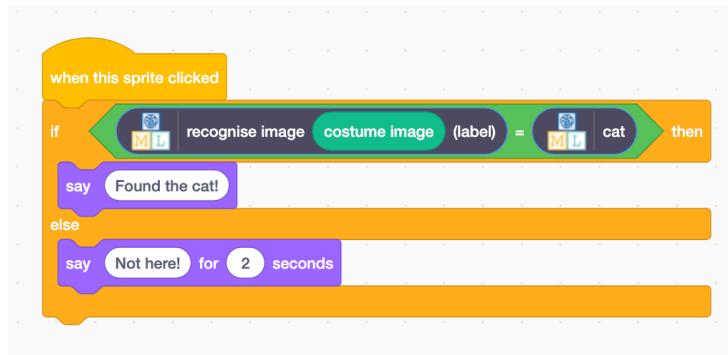


Hooray! Our model can correctly identify a pumpkin in our image. But we'd like our code to tell us only when we've found that cat. To check each grid piece for a cat, we can use an if/else statement. Specifically, when the image we click contains a cat, say, “Found the cat!”, or else just briefly say, “Not here!”.

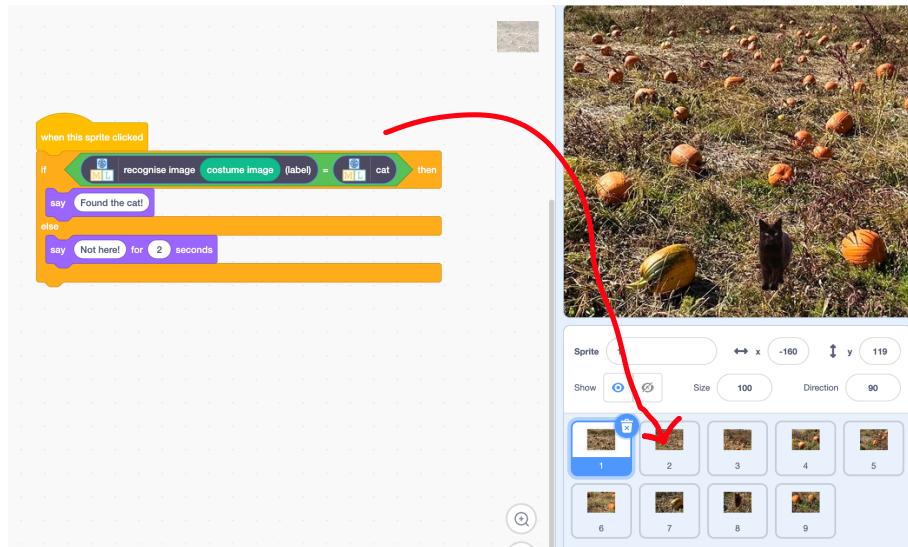
Insert your “recognise image piece” and a black “cat” label piece into a green “=” (called a **conditional**) hexagonal piece. Then, insert the green “=” piece into the if_then line of the orange if/else block. Your code should look like this.



Use the purple “Say __” and “Say __ for 2 seconds” pieces and say, “Found the cat!” if the image is a cat and “Not here!” if the image is a pumpkin (not a cat).



Now, you’ll need to copy the code to the eight other Sprites (grids 2-9). To do this, click on your block of code and drag it to each Sprite.



Once you have your code copied to each of the nine grids of the image, test your code by clicking around the image. When you click near the cat (grid 8), your code should tell you that you’ve found the cat. Was the computer able to find the cat in the pumpkin patch?



Yay! You successfully taught the computer to find the cat in the pumpkin patch.