



Carpool Cheats

In this project you will make a smart traffic camera that recognizes if a car is allowed to be in the carpool lane.

You will teach the computer to recognise whether there are passengers in the car by giving it examples of pictures of cars with and without passengers.

The screenshot shows a Scratch project titled "Carpool Cheats". The stage features a red car with two passengers driving on a road labeled "CAR POOL". A grey capture area is positioned on the road. The script editor on the left displays the following script:

```
when I receive [check car v]
  set [image data v] to [backdrop image v]
  set [camera label v] to [ML recognise image image (label) v]
  set [camera confidence v] to [ML recognise image image (confidence) v]
  if [camera label v] = [no passengers v] then
    broadcast [flash v]
```

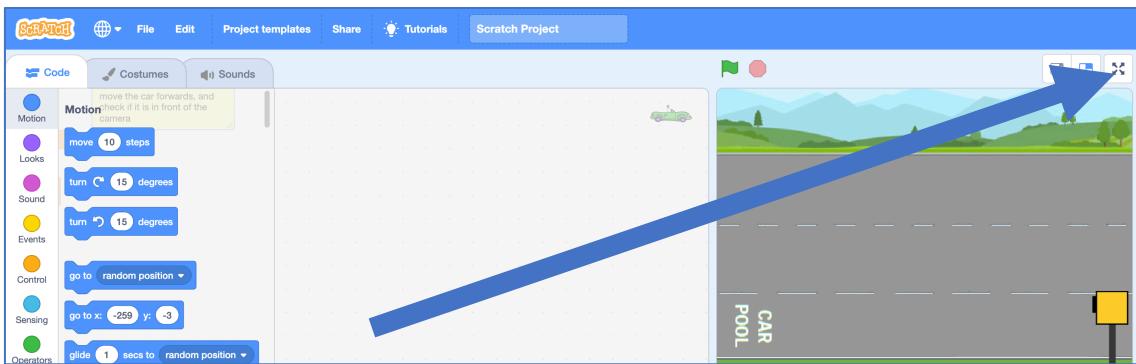
The stage includes a backdrop of a green landscape with mountains, a timer set to 27, and a score of 0. The sprite palette shows three sprites: "car", "camera", and "capture area".



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This worksheet was initially contributed by Jack Wright, from Henry Beaufort School.

1. Go to <https://machinelearningforkids.co.uk/scratch>
2. Click on the **Project templates** menu
3. Click on the “**Carpool Cheats (test)**” project
4. Click on the full-screen button



You will have 30 seconds to get as many cars along the road as you can.

Cars drive at different speeds depending on which lane they are in.

medium speed	
slow speed	
fast speed	Only cars with passengers are allowed to use this lane

Cars always start in the middle, slow lane.

You can change lanes using the **up** and **down** arrow keys.

Use the **up** arrow for cars with only a driver.

Use the **down** arrow for cars with passengers.

The yellow traffic camera is there to catch the **Carpool Cheats** – cars with only a driver that try to use the bottom carpool lane!

If it catches you, you will lose points.

5. When you are ready to try the game, click on the **Green flag**

You probably noticed that the traffic camera isn't very smart.

It can't tell the difference between a car with only a driver and a car with passengers.

It gives a fine to every car that goes past!

In this project, you will train a machine learning model to recognise if a car has passengers, and use this to make a smarter traffic camera.

6. Go to <https://machinelearningforkids.co.uk/>

7. Click on “**Get started**”

8. Click on “**Try it now**”

9. Click the “**+ Add a new project**” button.

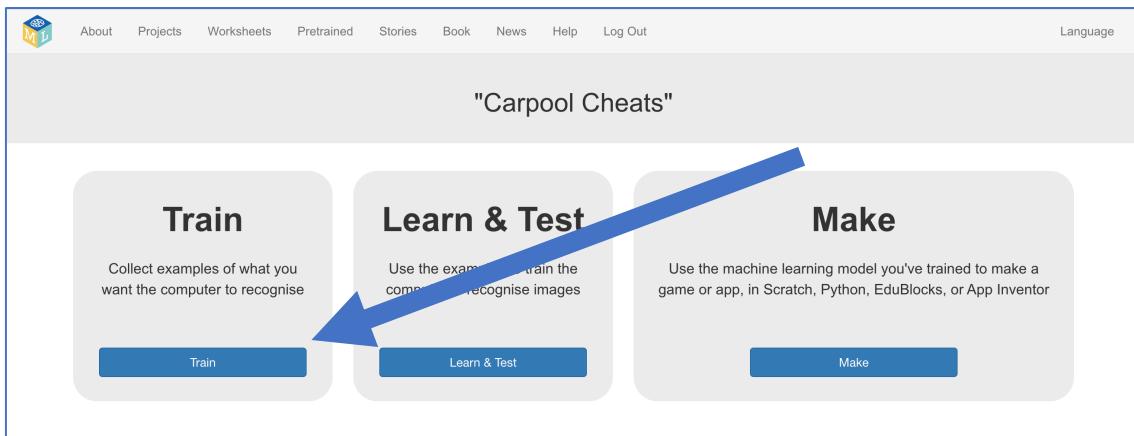
10. Name your project “Carpool Cheats” and set it to learn how to **recognise images**. Store the project **in your web browser**.

11. Click the “**Create**” button

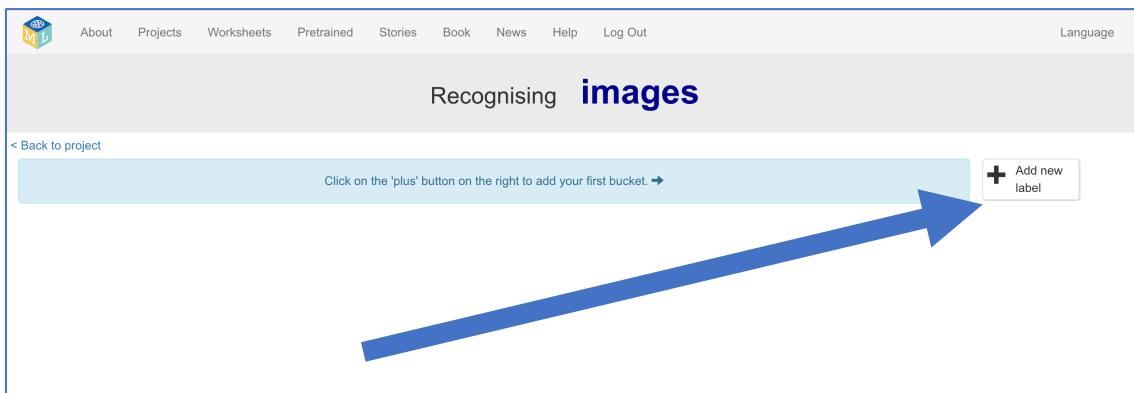
The screenshot shows a web-based form for creating a new machine learning project. At the top, there's a navigation bar with links for About, Projects, Worksheets, Pretrained, Stories, Book, Help, and Log Out. On the right side of the header, there's a Language selection dropdown. The main area has a light gray background with a title "Start a new machine learning project". Below the title, there are three input fields: "Project Name *", "Project Type *", and "Storage *". The "Project Name *" field contains "Carpool Cheats". The "Project Type *" field contains "recognising images". The "Storage *" field contains "In your web browser". To the right of the "Project Type" field, there's a small callout box with instructions: "What do you want to teach the computer to do? To recognise words, sentences or paragraphs, choose "recognising text". To recognise photos, diagrams or pictures, choose "recognising images". To predict sets of numbers or multiple choices, choose "recognising numbers". To recognise music or sounds, choose "recognising sounds". To predict numbers, choose "predicting numbers". To generate new text based on a language model, choose "generating text".". At the bottom right of the form are two buttons: a blue "CREATE" button and a smaller "CANCEL" button.

12. You should now see “Carpool Cheats” in the list of your projects.
Click on it.

13. Click the Train button

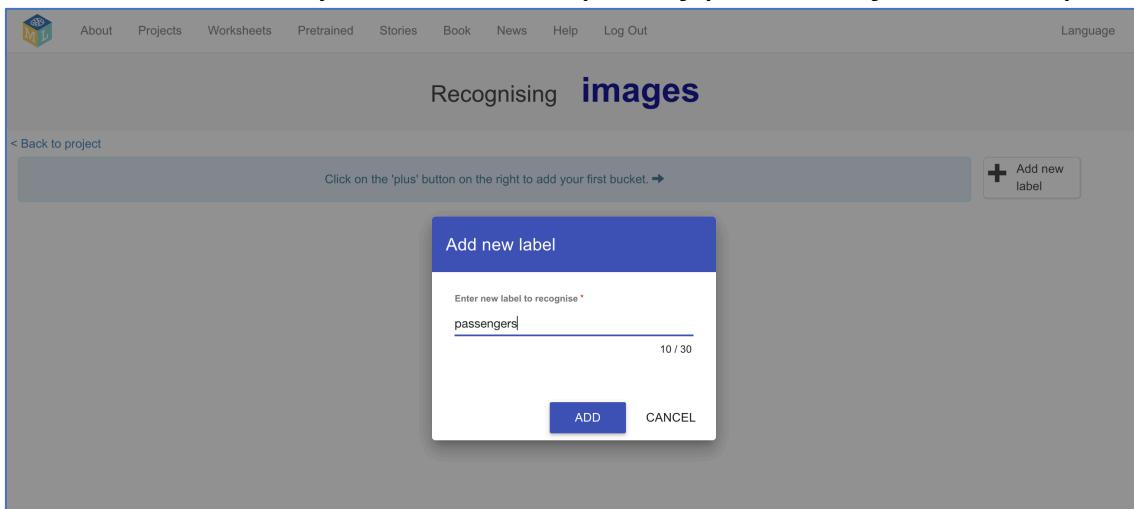


14. Click on “+ Add new label”

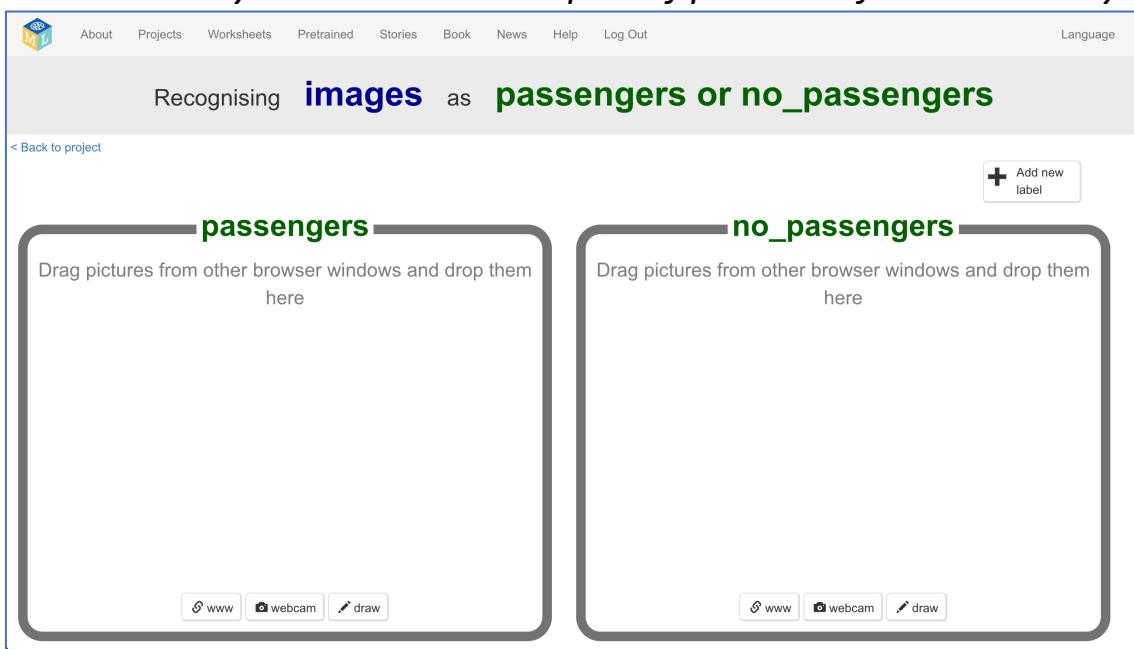


15. Call your first label “passengers”

This will be where you store examples of pictures of cars with passengers

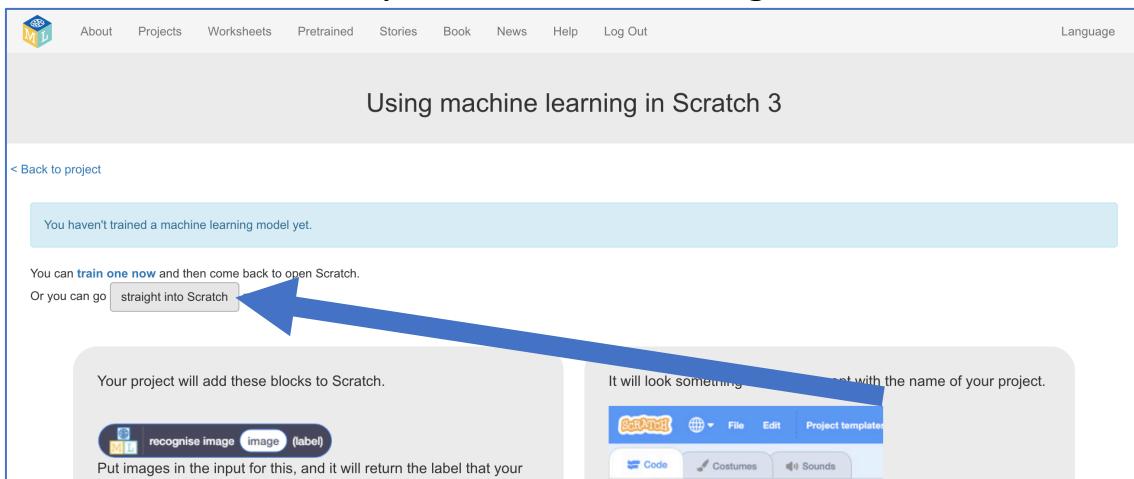


- 16.** Do that again, and create a second bucket called “**no passengers**”.
This is where you will store examples of pictures of cars with only a driver



- 17.** Click on the “< Back to project” link in the top-left
- 18.** Click on the “**Make**” button.
- 19.** Click on the “**Scratch 3**” button
- 20.** Click on the “**straight into Scratch**” button

The page is warning you that you don't have a machine learning model yet. That is okay, as you will be using Scratch to collect training pictures and use them to train your machine learning model.



21. Click on the **Project templates** menu

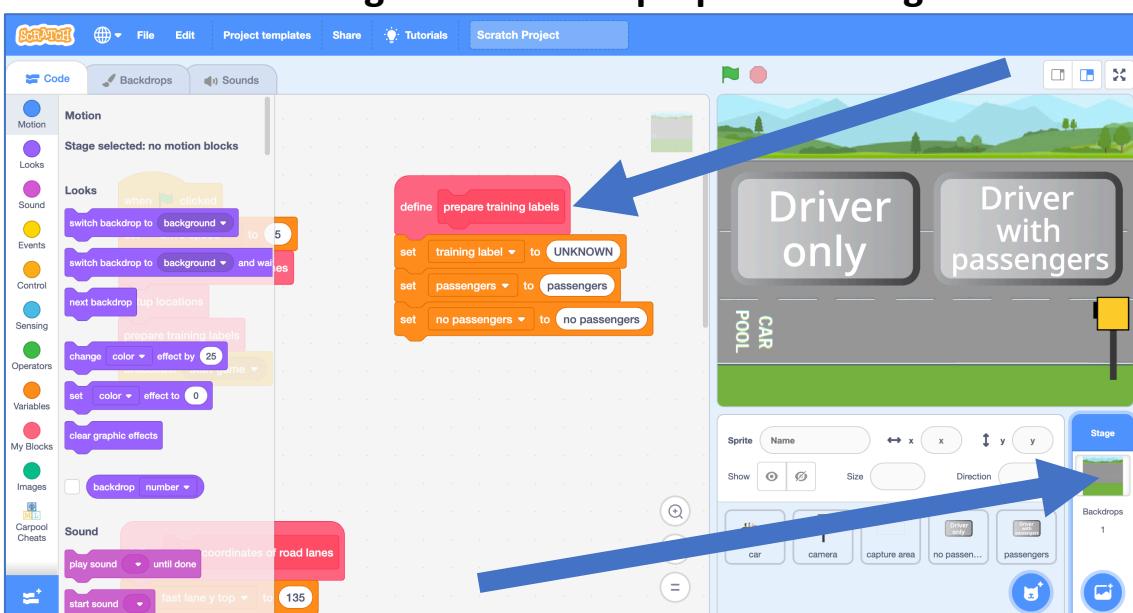
22. Click on the “**Carpool Cheats (train)**” project

*This is a **different** project to the one you used before!*

You will use this Scratch project to collect training examples: examples of pictures of cars with and without passengers.

You can use these examples to train the computer to recognise what a car without passengers looks like.

23. Click on the **Stage** and find the **prepare training labels** code

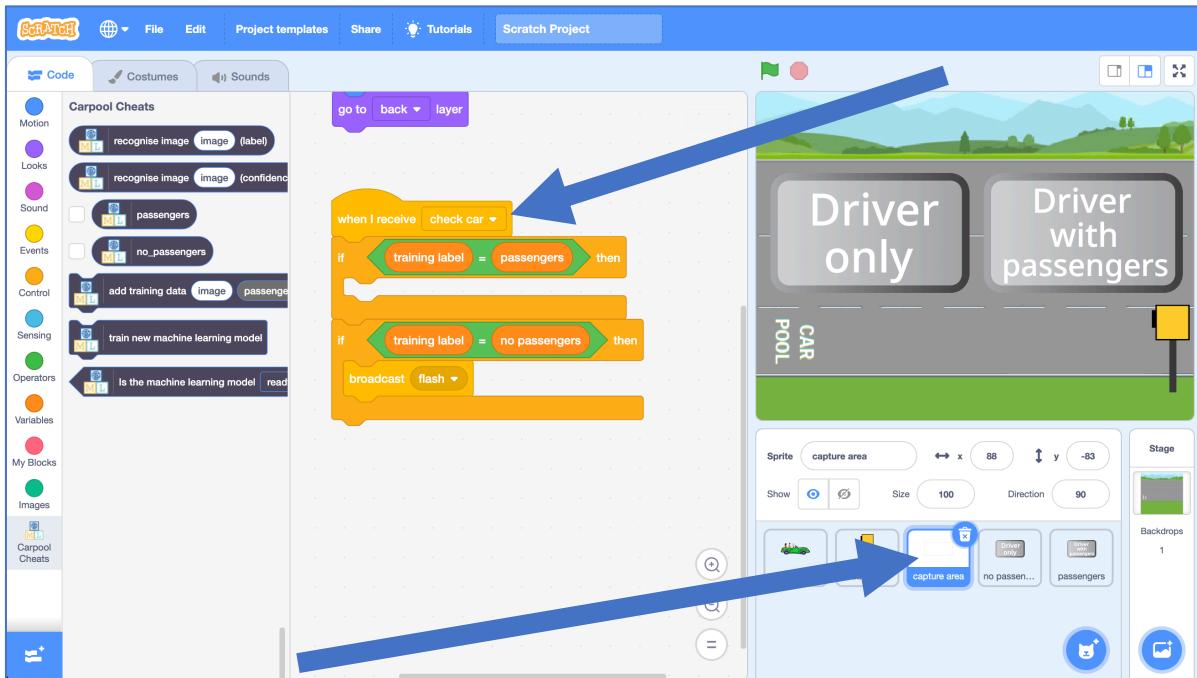


24. Add blocks from your machine learning project to this code

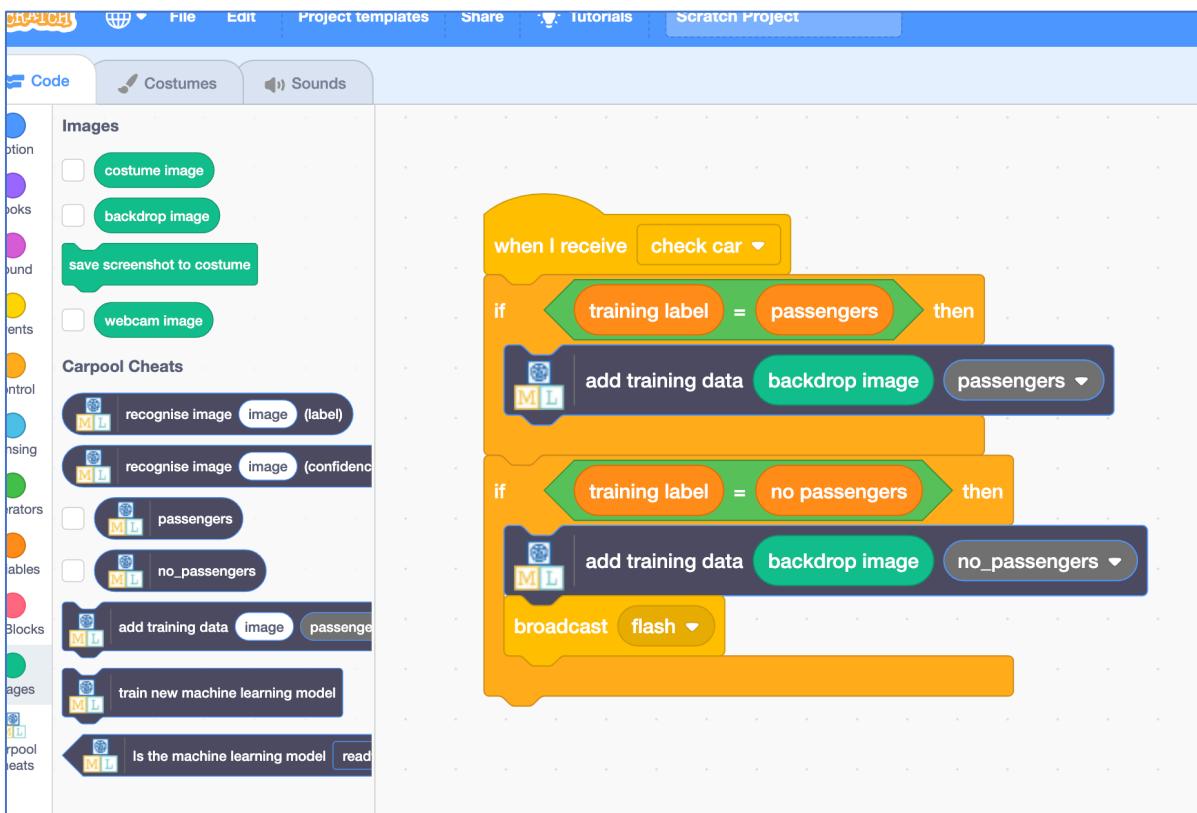
You need to make it look like this:



25. Click on the capture area sprite and find the “check car” code



26. Add blocks from your machine learning project to this code
You need to make it look like this:



This will add a picture of whatever is in front of the traffic camera to one of the training buckets you created for your project.

27. Click on the **full-screen** button

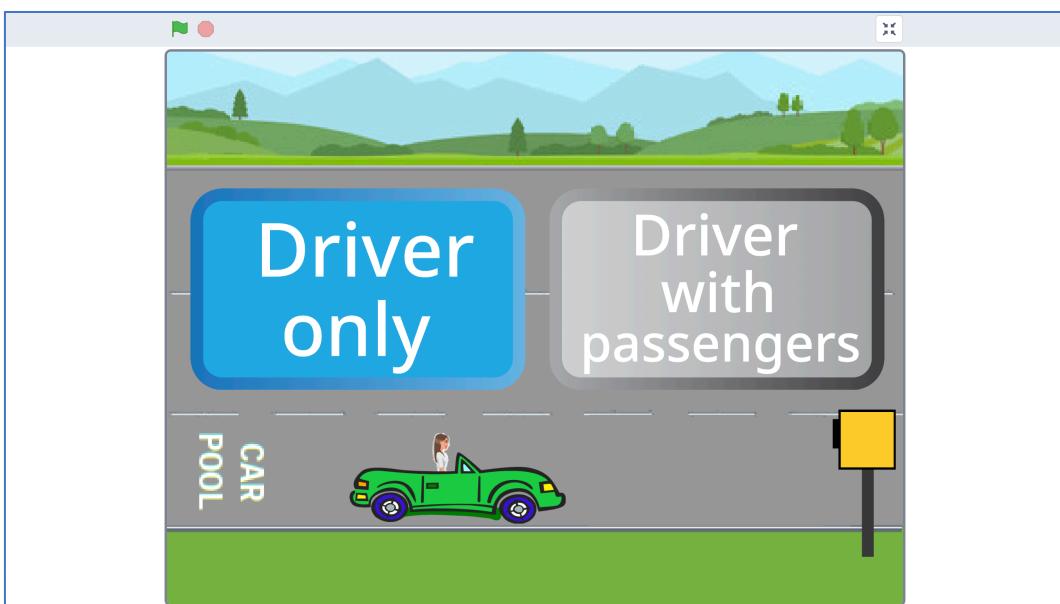
28. Click on the **Green flag**

It's time to train!

You will see a series of randomly selected cars – some with passengers, and some with only a driver.

Click on the “Driver only” or “Driver with passengers” button to add the picture of the car to your training bucket.

*Collect pictures of about **ten** cars*



29. In the training window, click on the “< Back to project” link

About Projects Worksheets Pretrained Stories Book News Help Log Out Language

Using machine learning in Scratch 3

< Back to project

You haven't trained a machine learning model yet.

You can [train one now](#) and then come back to open Scratch.
Or you can go [straight into Scratch](#) now.

30. Click the **Train** button

31. Look at the training pictures that you've collected

The screenshot shows a web-based machine learning project interface. At the top, there are navigation links: About, Projects, Worksheets, Pretrained, Stories, Book, News, Help, Log Out, and Language. Below the navigation is a title: "Recognising **images** as **passengers or no_passenger**s". A "Back to project" link is located above the main content. On the right, there is a button labeled "+ Add new label".

The main area contains two sections: "passengers" and "no_passengers".

The "passengers" section contains 7 images:

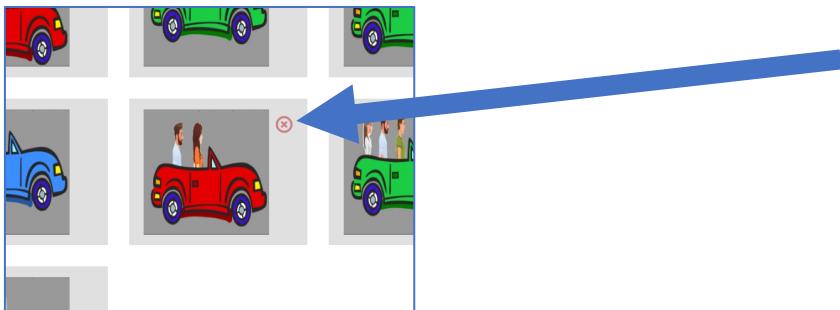
- Row 1: Red car with 2 passengers, Green car with 2 passengers, Green car with 2 passengers.
- Row 2: Blue car with 2 passengers, Red car with 2 passengers, Green car with 2 passengers.
- Row 3: Blue car with 2 passengers.

The "no_passengers" section contains 8 images:

- Row 1: Red car with 1 passenger, Red car with 1 passenger, Green car with 1 passenger.
- Row 2: Blue car with 1 passenger, Blue car with 1 passenger, Red car with 1 passenger.
- Row 3: Red car with 1 passenger, Green car with 1 passenger.

At the bottom of each section are three buttons: "www", "webcam", and "draw". The number "7" is in a circle at the bottom center of the "passengers" section, and the number "8" is in a circle at the bottom center of the "no_passengers" section.

32. If you accidentally clicked the wrong button for any of the images, you can remove it by clicking on the red cross



33. Once you have at least **five** example pictures in **both** training buckets, it is time to give your model a try.

34. Click on the “< Back to project” link

35. Click on the “**Make**” button.

36. Click on the “**Scratch 3**” button

37. Click on the “straight into Scratch” button

This will open another, different, Scratch window.

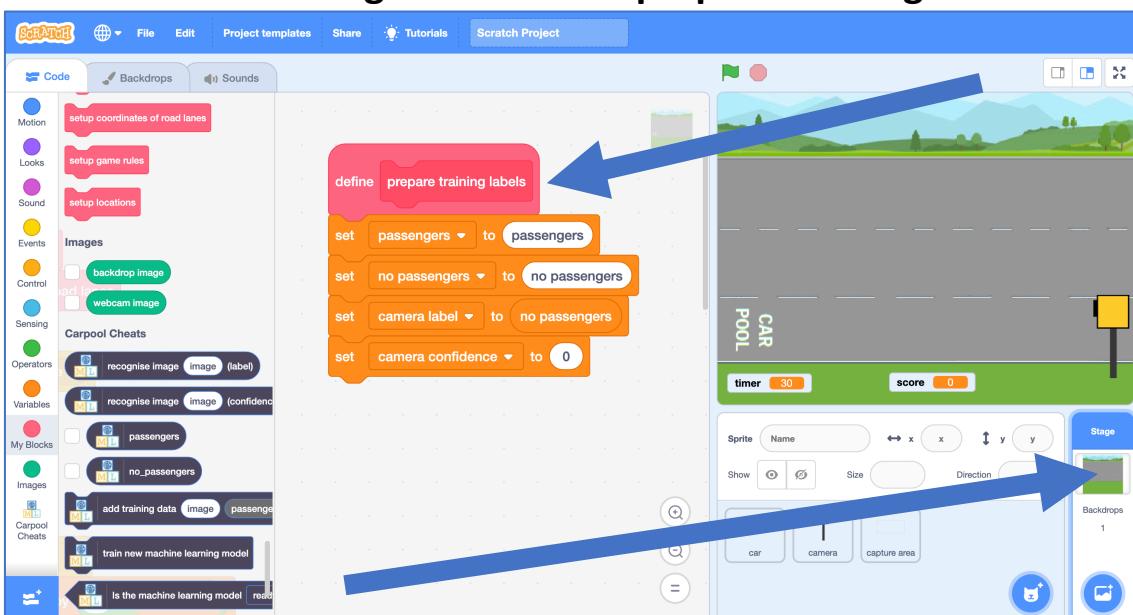
Having two Scratch windows means you can use one for training, and one for testing.

38. Click on the **Project templates** menu

39. Click on the “**Carpool Cheats (test)**” project

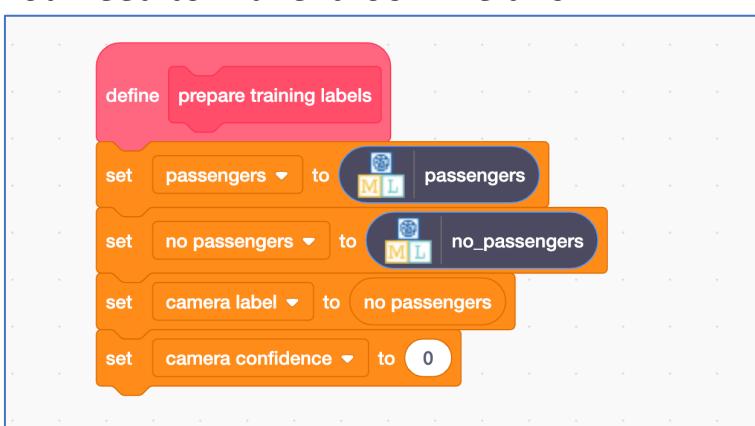
You will update it to get the traffic camera to use your machine learning model.

40. Click on the **Stage** and find the **prepare training labels** code

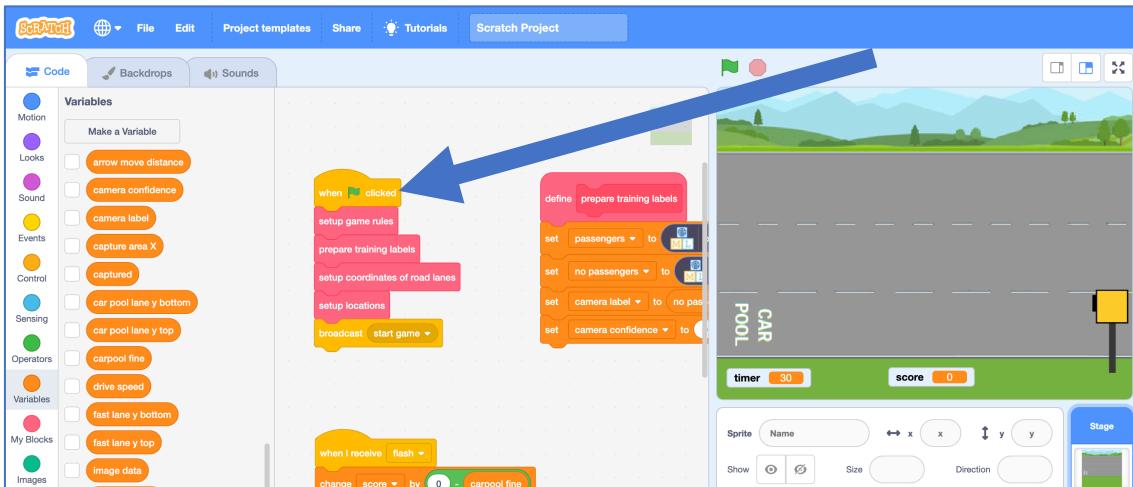


41. Add blocks from your machine learning project to this code

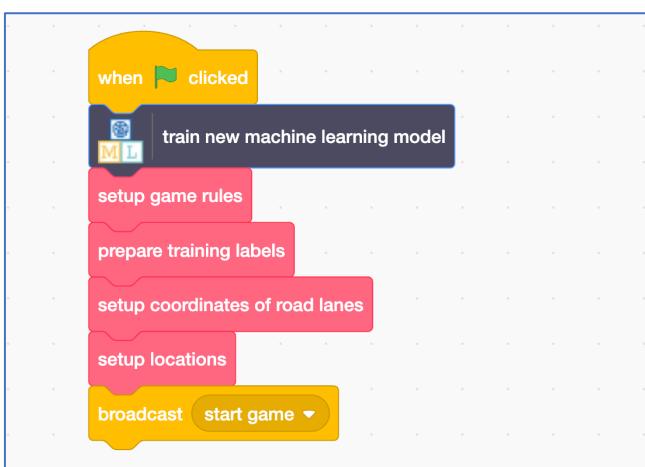
You need to make it look like this:



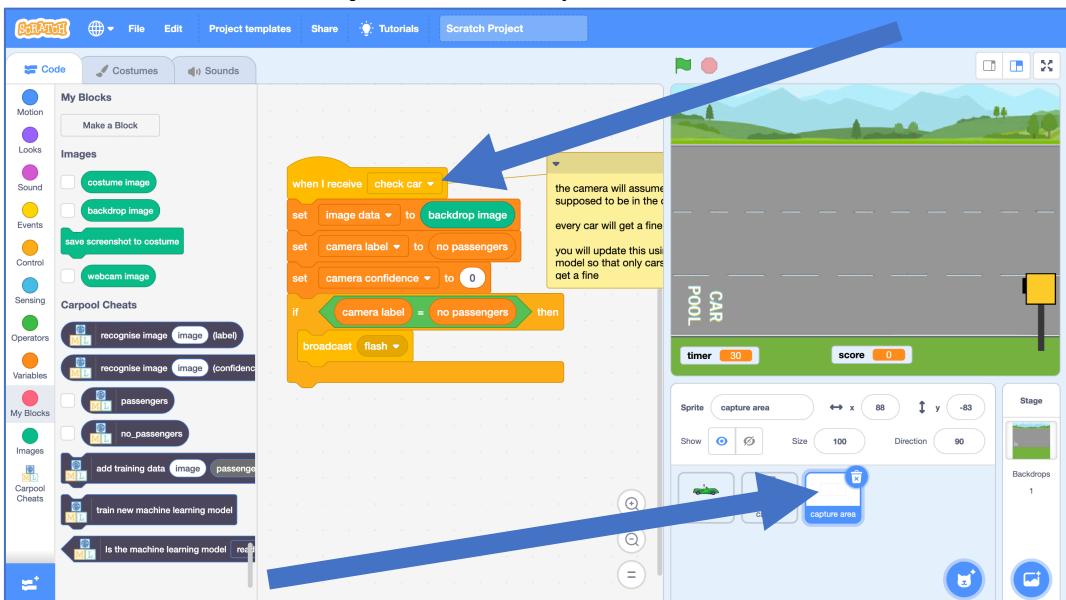
42. Find the “when Green flag clicked” code (still on the Stage)



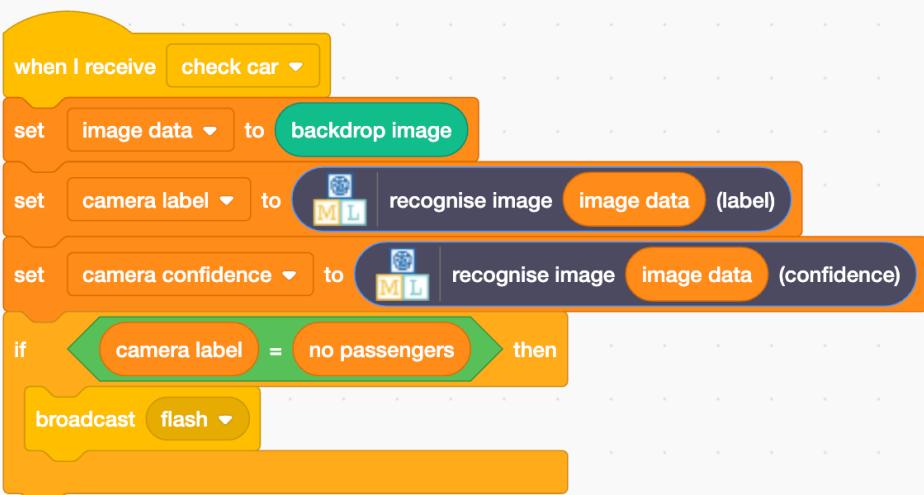
43. Add a block from your machine learning project to this code You need to make it look like this:



44. Click on the capture area sprite and find the “check car” code



- 45.** Add blocks from your machine learning project to this code
You need to make it look like this:

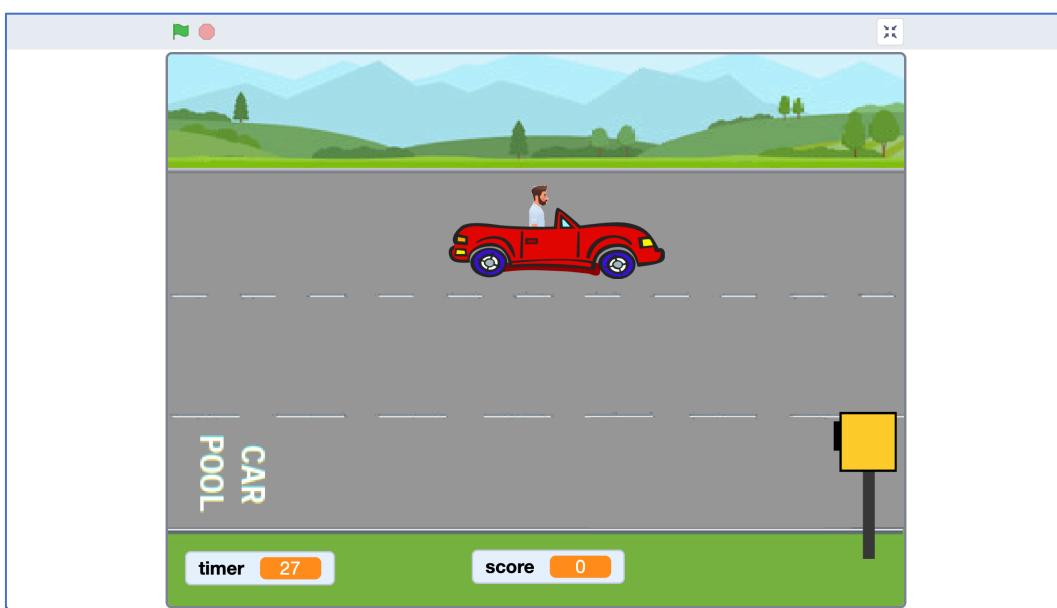


Move or delete the comment if it's in your way while you update the code.

- 46.** Click on the **full-screen** button

- 47.** Click on the **Green flag**

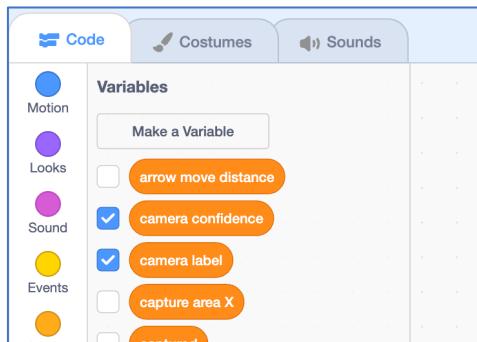
It's time to test!



Play the game as you did before.

This time, your machine learning model should mean that the traffic camera only fines cars without passengers!

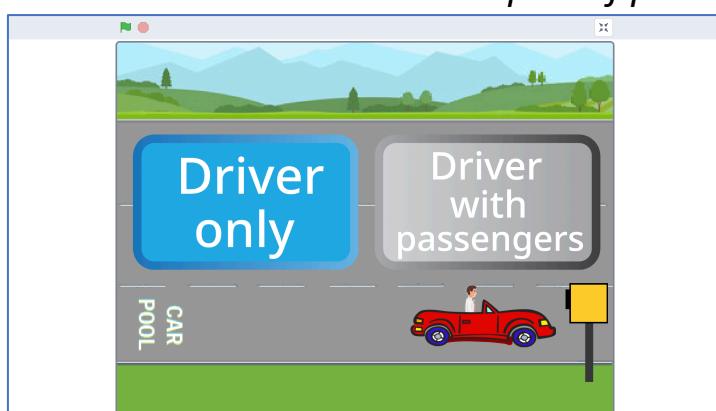
- 48.** If you want to see what your machine learning model is doing, tick the “camera label” and “camera confidence” variables



This will display the results from your machine learning model when a car goes past the traffic camera



- 49.** If your machine learning model makes too many mistakes, more training examples may improve it
Go back to the Scratch window with the “Carpool Cheats (train)” project and collect another ten examples of pictures of cars.



What have you done?

You've trained a computer to recognise a picture of a car as having passengers or no passengers. Instead of trying to write rules to be able to do this, you did it by collecting examples. These examples were being used to train a machine learning “model”.

The computer will learn from patterns in the examples you've given it. These were used by the traffic camera to recognise new pictures.

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 more vehicle types

We made it easy for your smart camera by making all vehicles very similar – they were all cars of the same shape and style.

Try adding more vehicle types (such as different shape cars, but also busses, motorbikes, and lorries) by adding additional costumes to your “car” sprite, and see what that does to your project.