



# 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 in the carpool lane. The background is a landscape with mountains and trees. A green banner at the bottom of the stage reads "CAR POOL". On the right side of the stage, there are controls for "camera label" (passengers), "camera confidence" (73.326033), "timer" (27), and "score" (0). The script editor on the left contains the following script:

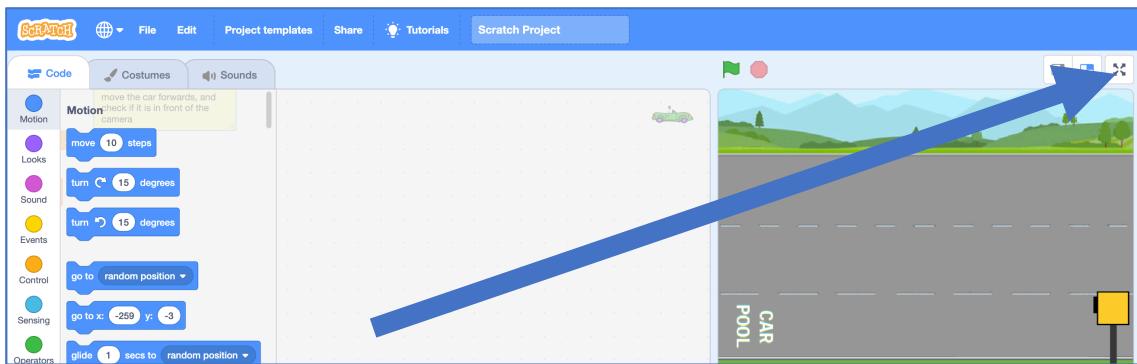
```
when I receive [check car v]
set [image data v] to [backdrop image]
set [camera label v] to [ML recognise image [image] (label)]
set [camera confidence v] to [ML recognise image [image] (confidence)]
if [camera label = no passengers] then
  broadcast [flash v]
```

The script uses the "ML" extension blocks to recognize images and broadcast events. The stage also includes a "capture area" sprite and a "camera" sprite.



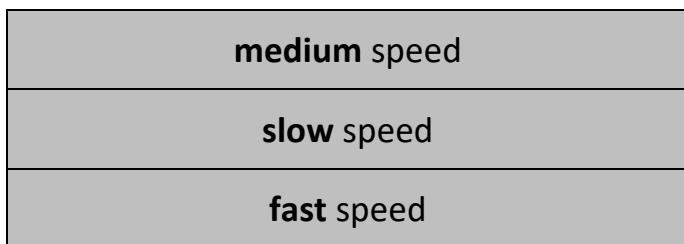
This project worksheet is licensed under a Creative Commons Attribution Non-Commercial Share-Alike License  
<http://creativecommons.org/licenses/by-nc-sa/4.0/>

1. Go to <https://scratch.machinelearningforkids.co.uk>
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.



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/>

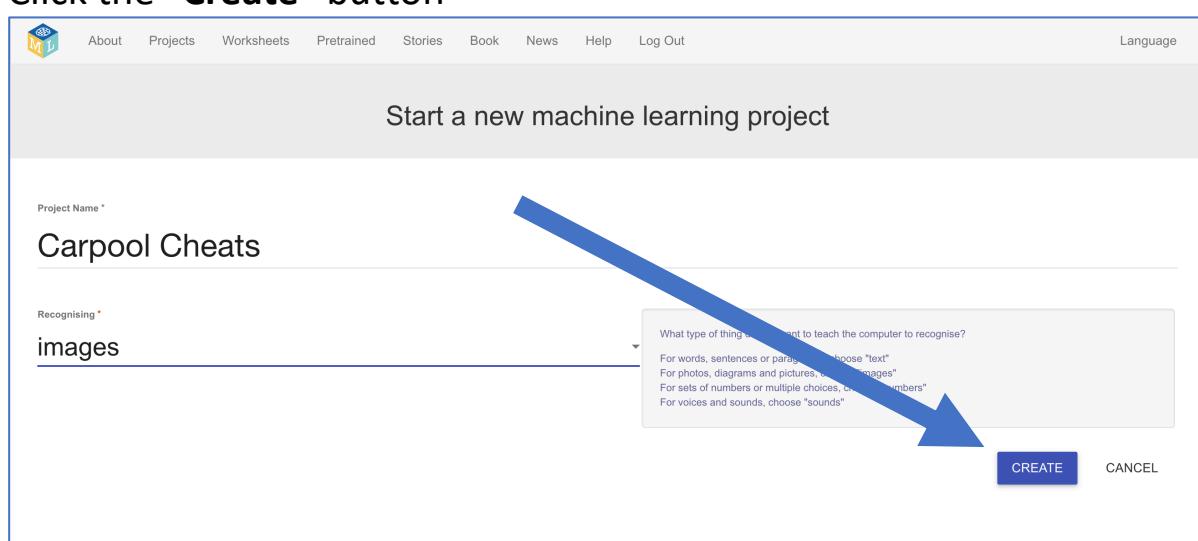
## 7. Click on “**Get started**”

## 8. Click on “**Try it now**”

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

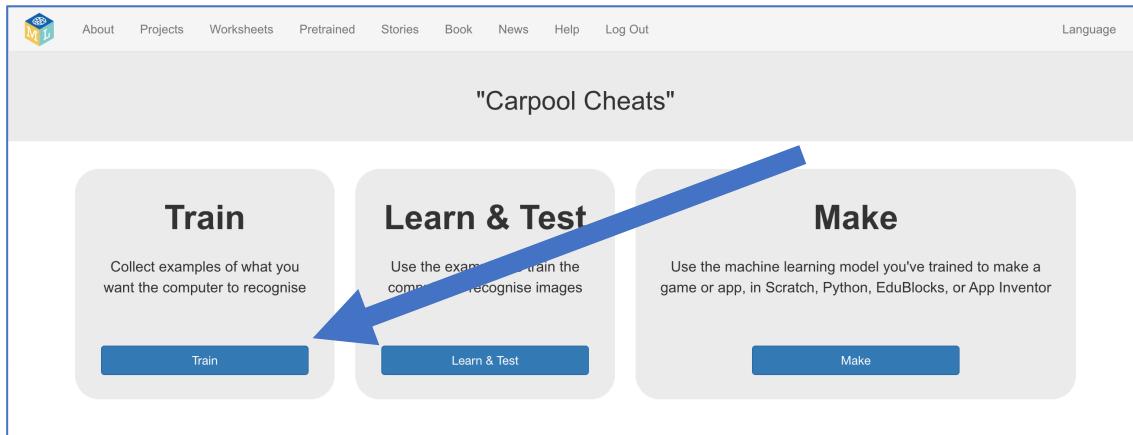
## 10. Name your project “Carpool Cheats” and set it to learn how to recognise “**images**”.

Click the “**Create**” button

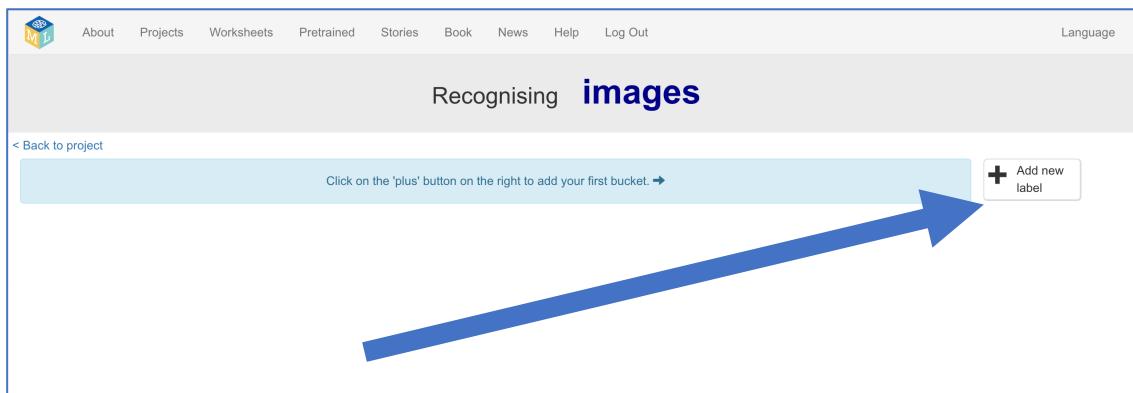


**11.** You should now see “Carpool Cheats” in the list of your projects.  
Click on it.

**12.** Click the Train button

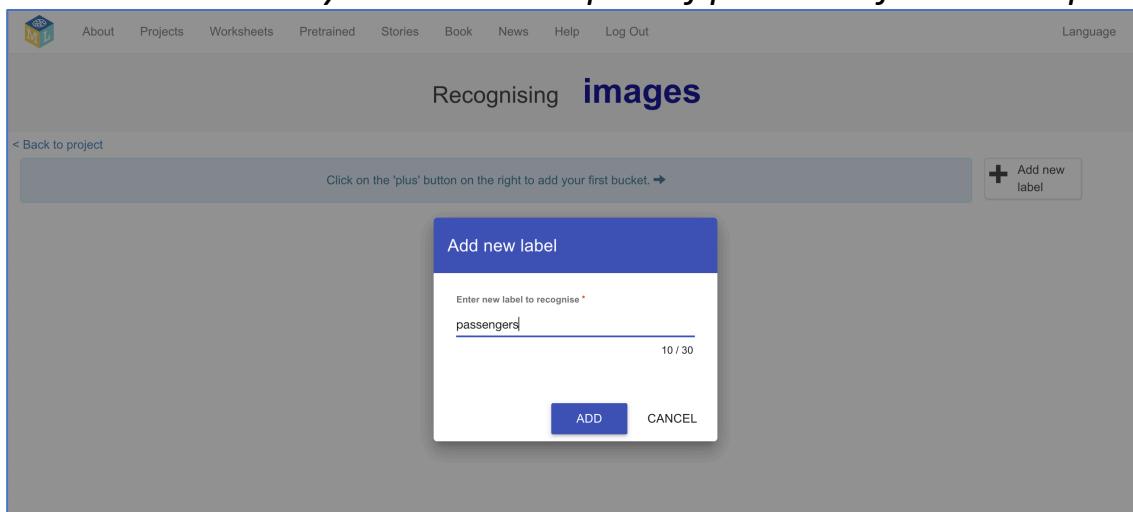


**13.** Click on “+ Add new label”

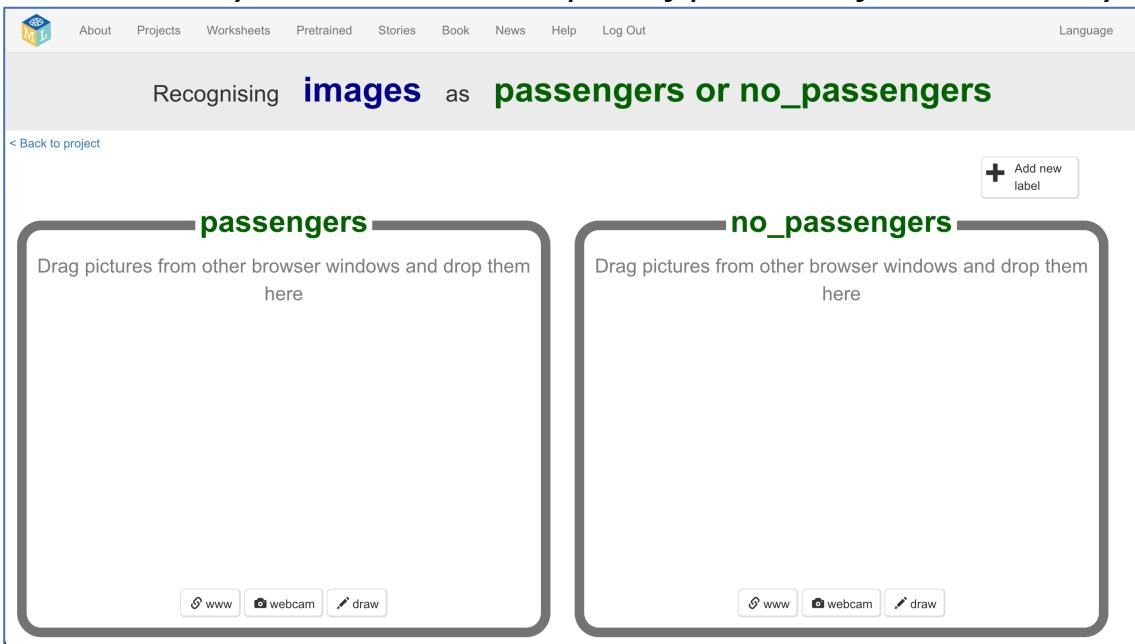


**14.** Call your first label “passengers”

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

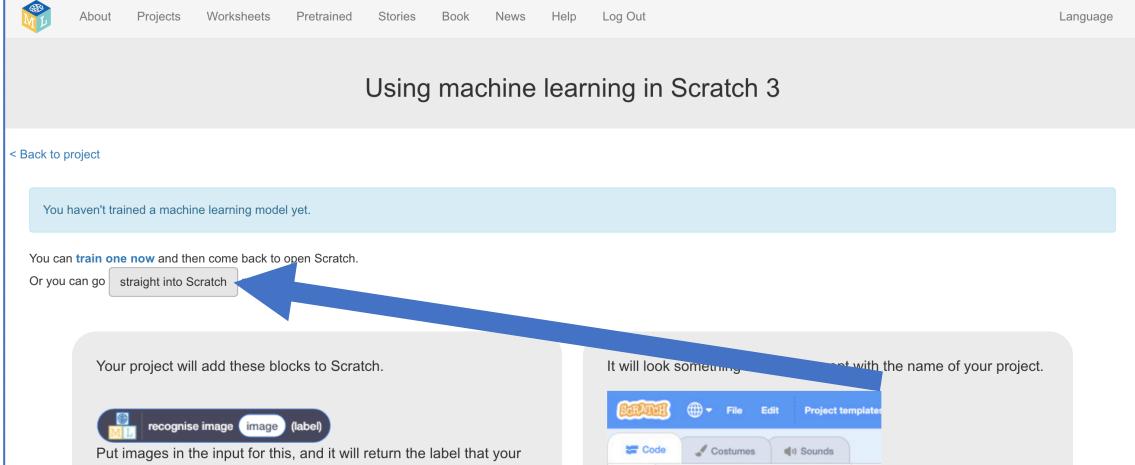


- 15.** Do that again, and create a second bucket called “**no passengers**”.  
*This is where you will store examples of pictures of cars with only a driver*



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



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

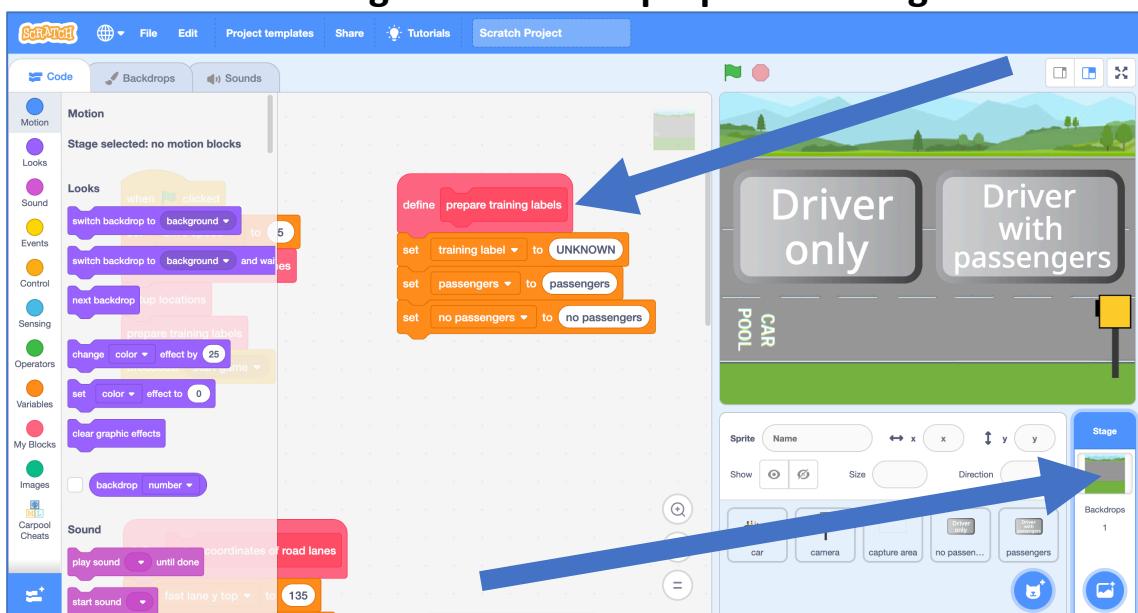
**21.** Click on the “**Carpool Cheats (train)**” project

*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.*

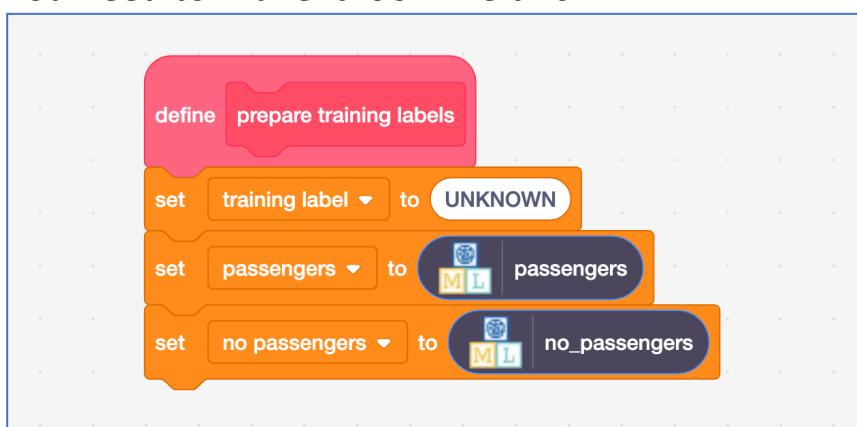
*You can use these examples to train the computer to recognise what a car without passengers looks like.*

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

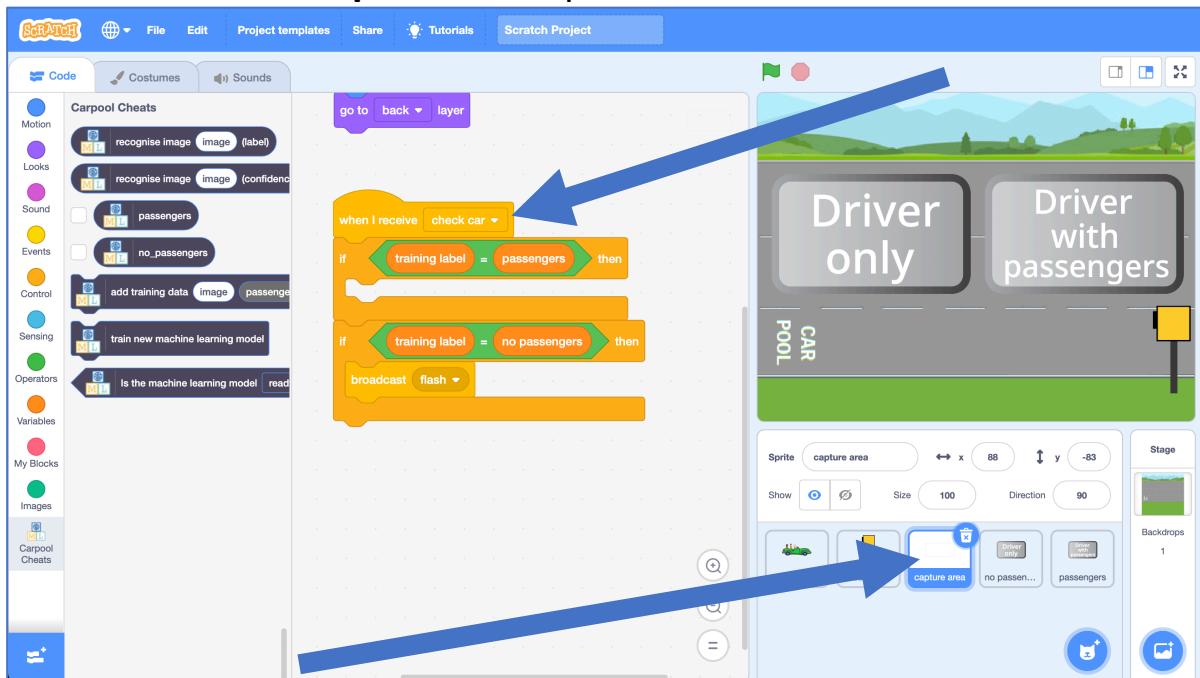


**23.** Add blocks from your machine learning project to this code

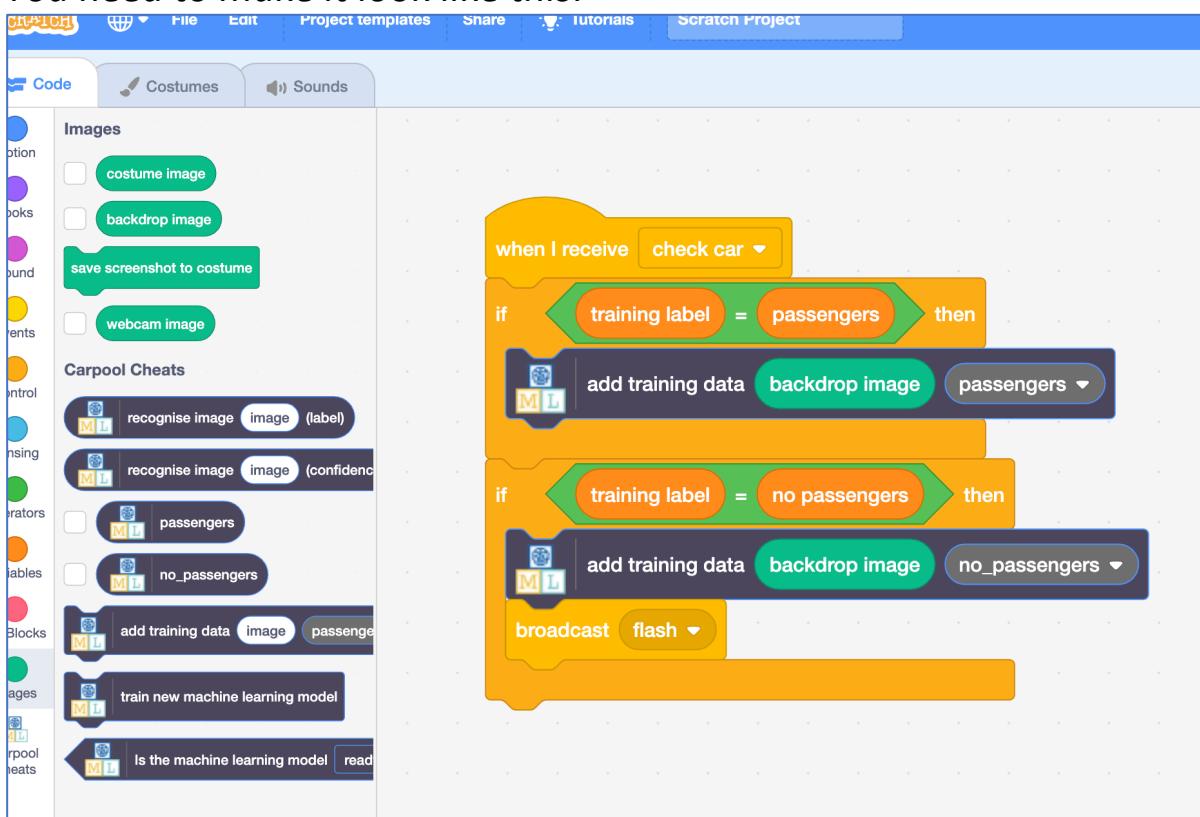
*You need to make it look like this:*



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



## 25. 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.*

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

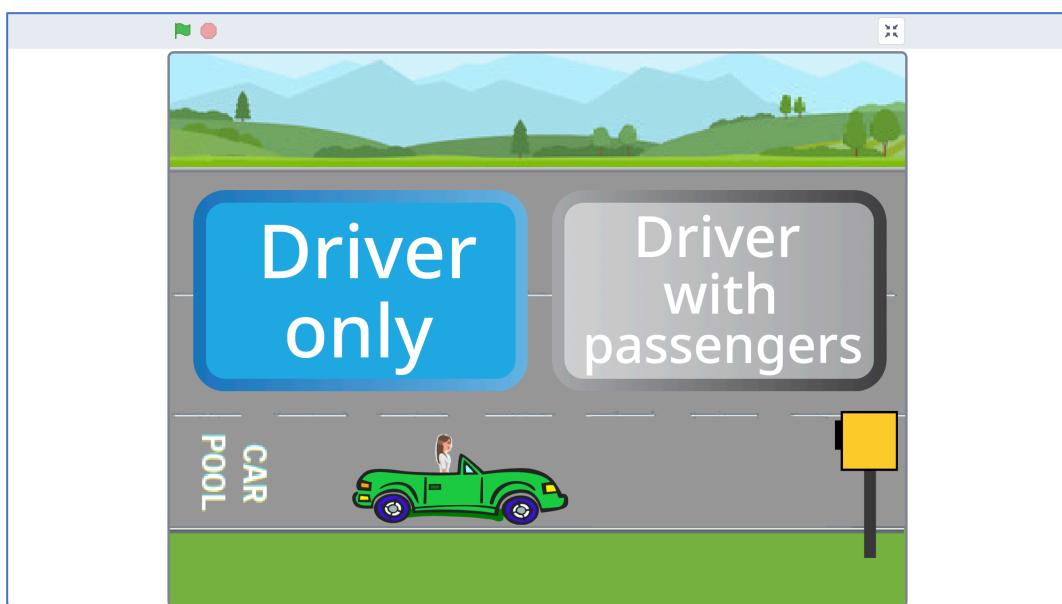
**27.** Click on the **Green flag**

*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*



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

The screenshot shows the Scratch 3 interface with a "Language" dropdown at the top right. Below it is a banner for "Using machine learning in Scratch 3". A blue arrow points to the "[< Back to project](#)" link. A message box below the banner says "You haven't trained a machine learning model yet." and provides instructions: "You can [train one now](#) and then come back to open Scratch. Or you can go [straight into Scratch](#) now."

**29.** Click the **Train** button

## 30. Review the training pictures that you've collected

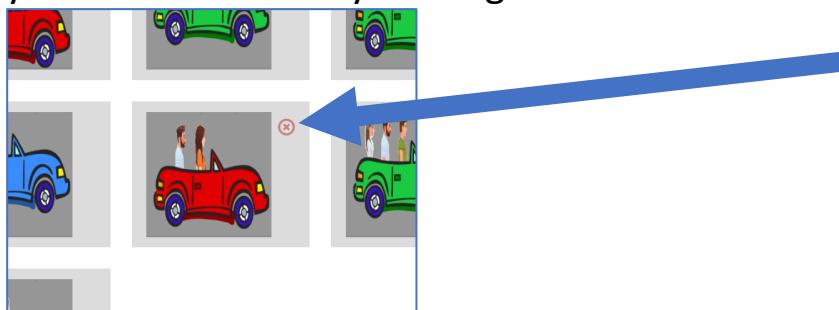
The screenshot shows a web-based machine learning project interface. At the top, there are navigation links: About, Projects, Worksheets, Pretrained, Stories, Book, News, Help, Log Out, and Language. Below the navigation, the title "Recognising **images** as **passengers or no\_passenger**s" is displayed. A link "[< Back to project](#)" is located above the main content area. On the right side, there is a button "+ Add new label".

The main area contains two sections:

- passengers**: This section contains 7 images of cars with passengers. The images are arranged in three rows: the first row has 3 images, the second row has 3 images, and the third row has 1 image.
- no\_passenger**: This section contains 8 images of cars without passengers. The images are arranged in three rows: the first row has 3 images, the second row has 3 images, and the third row has 2 images.

At the bottom of each section, there are three buttons: "www", "webcam", and "draw". The number "7" is in a green circle at the bottom center of the "passenger" section, and the number "8" is in a green circle at the bottom center of the "no\_passenger" section.

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



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

33. Click on the “[< Back to project](#)” link

34. Click on the “**Make**” button.

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

**36.** Click on the “straight into Scratch” button

*This will open another, different, Scratch window.*

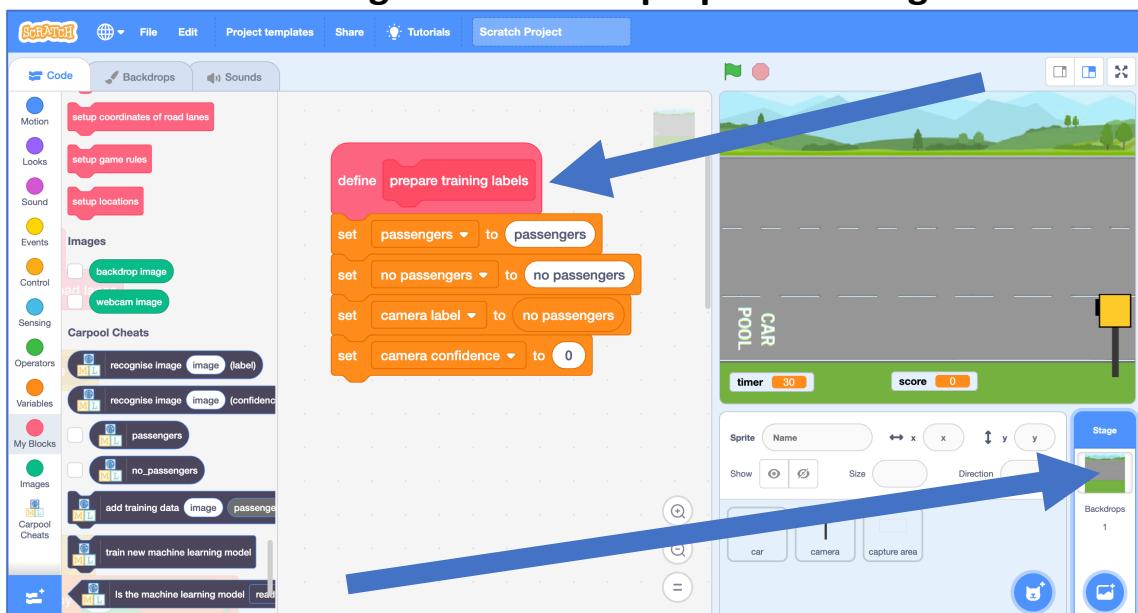
*Having two Scratch windows means you can use one for training, and one for testing.*

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

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

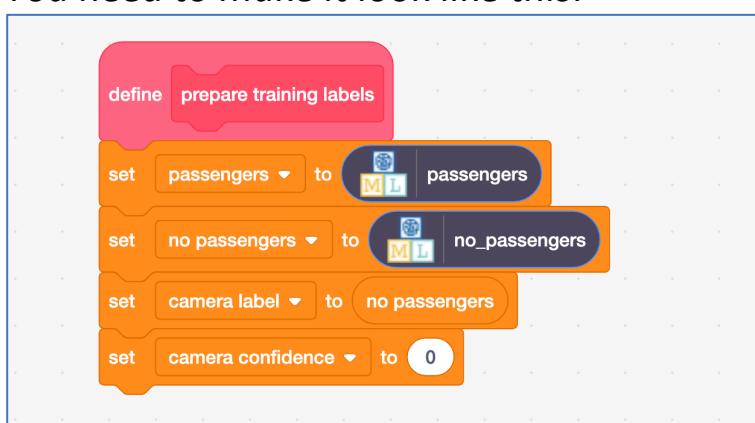
You will update it to get the traffic camera to use your machine learning model.

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

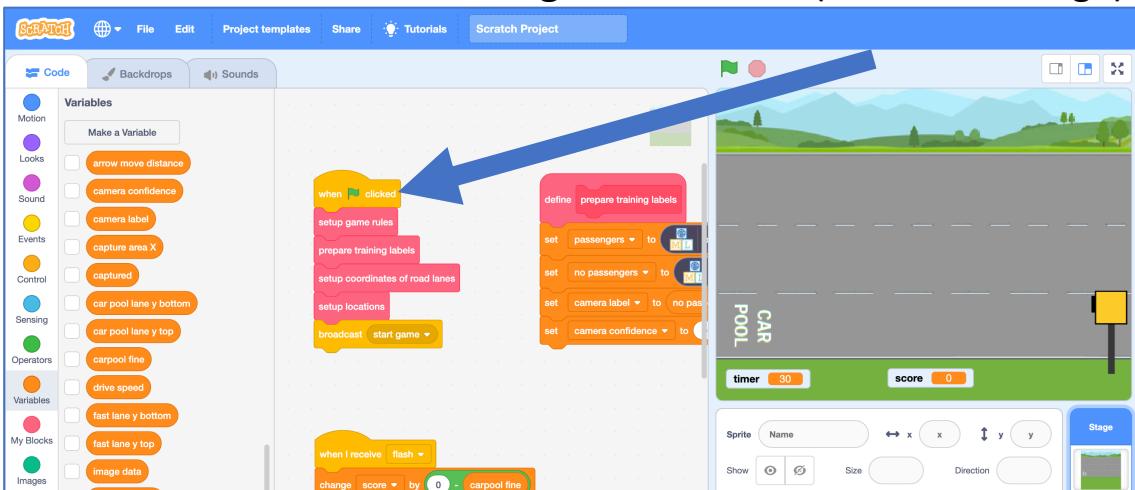


**40.** Add blocks from your machine learning project to this code

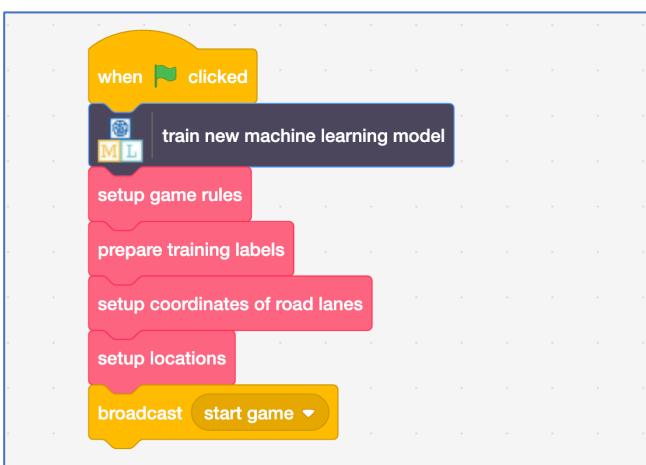
*You need to make it look like this:*



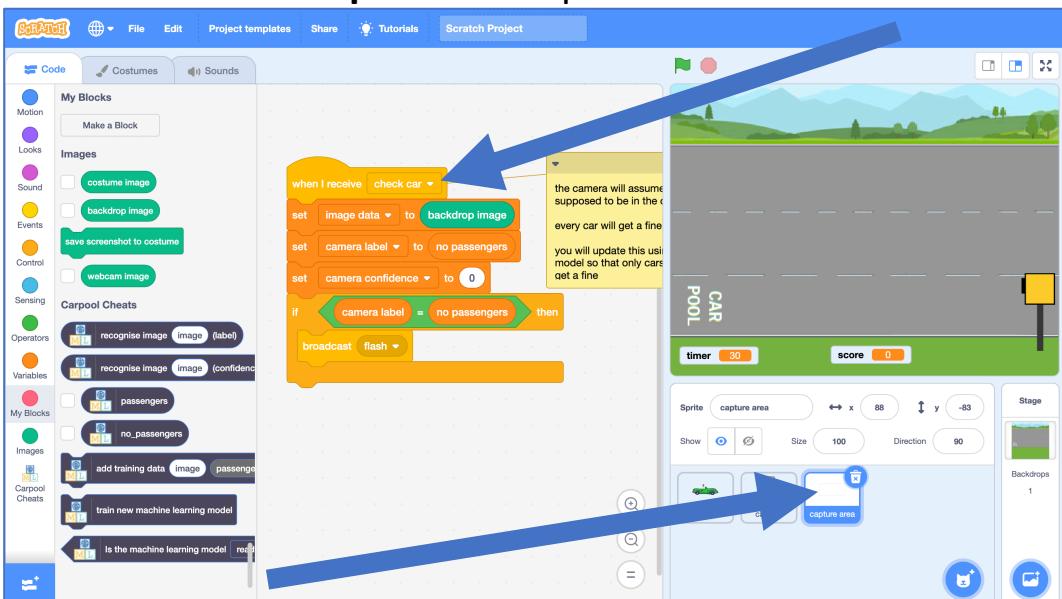
## 41. Find the “when Green flag clicked” code (still on the Stage)



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

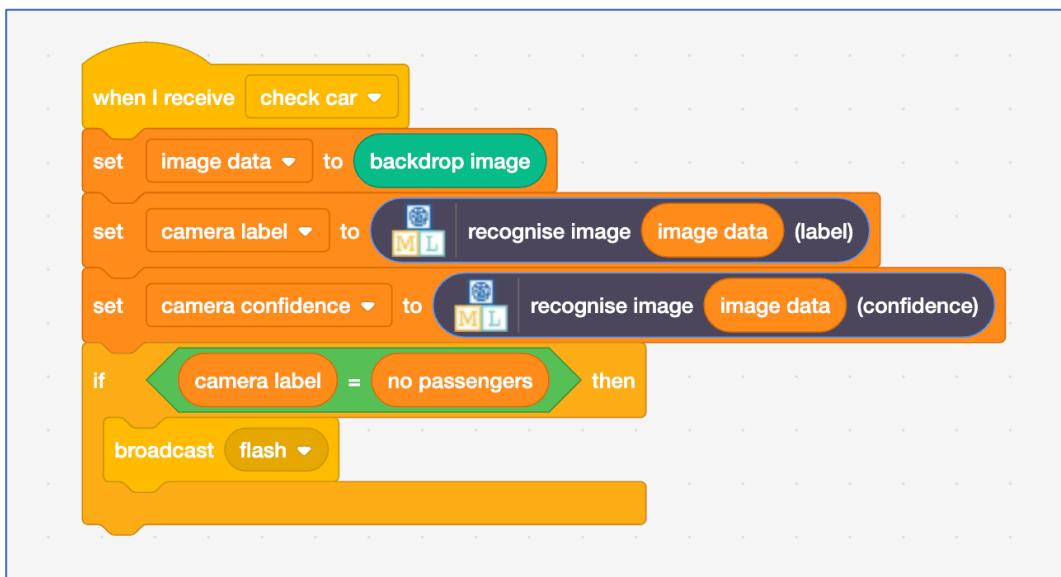


## 43. Click on the capture area sprite and find the “check car” code



## 44. Add blocks from your machine learning project to this code

You need to make it look like this:

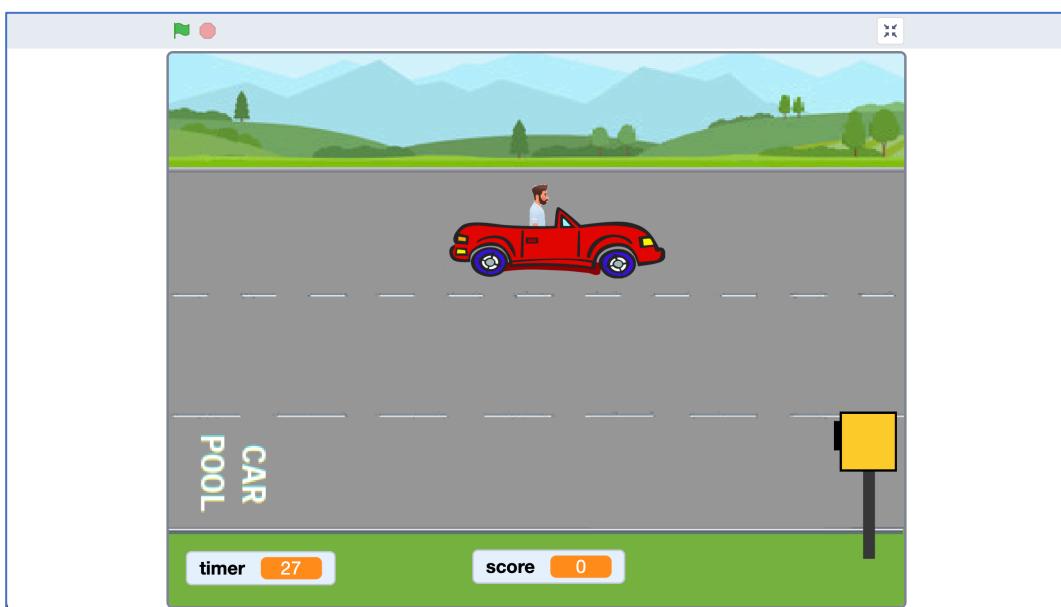


Move or delete the comment if it's in your way while you update the code.

## 45. Click on the **full-screen** button

## 46. Click on the **Green flag**

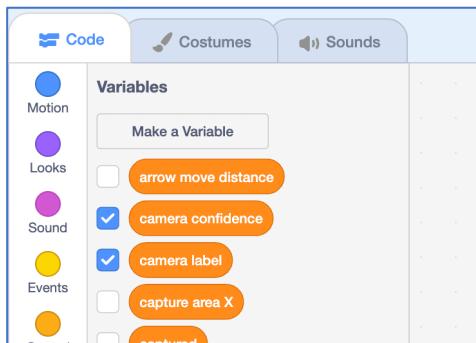
*It's time to test!*



*Play the game as you did.*

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

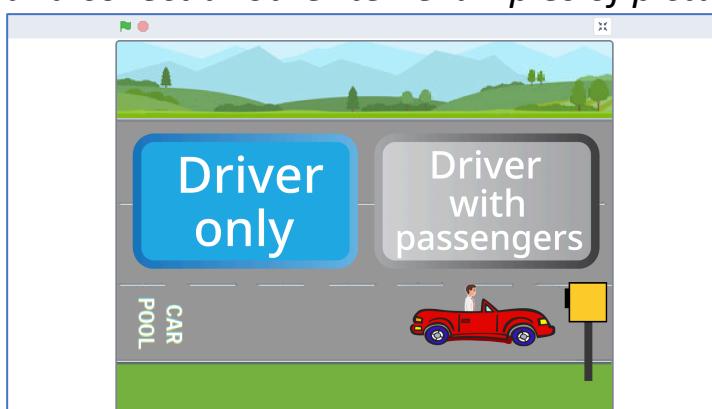
- 47.** If you want to see what your machine learning model is doing, tick the “camera label” and “camera confidence” variables



*This will display the results from your machine learning model every time that a car goes past the traffic camera*



- 48.** If your machine learning model is making mistakes, more training examples may improve how it behaves  
*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.