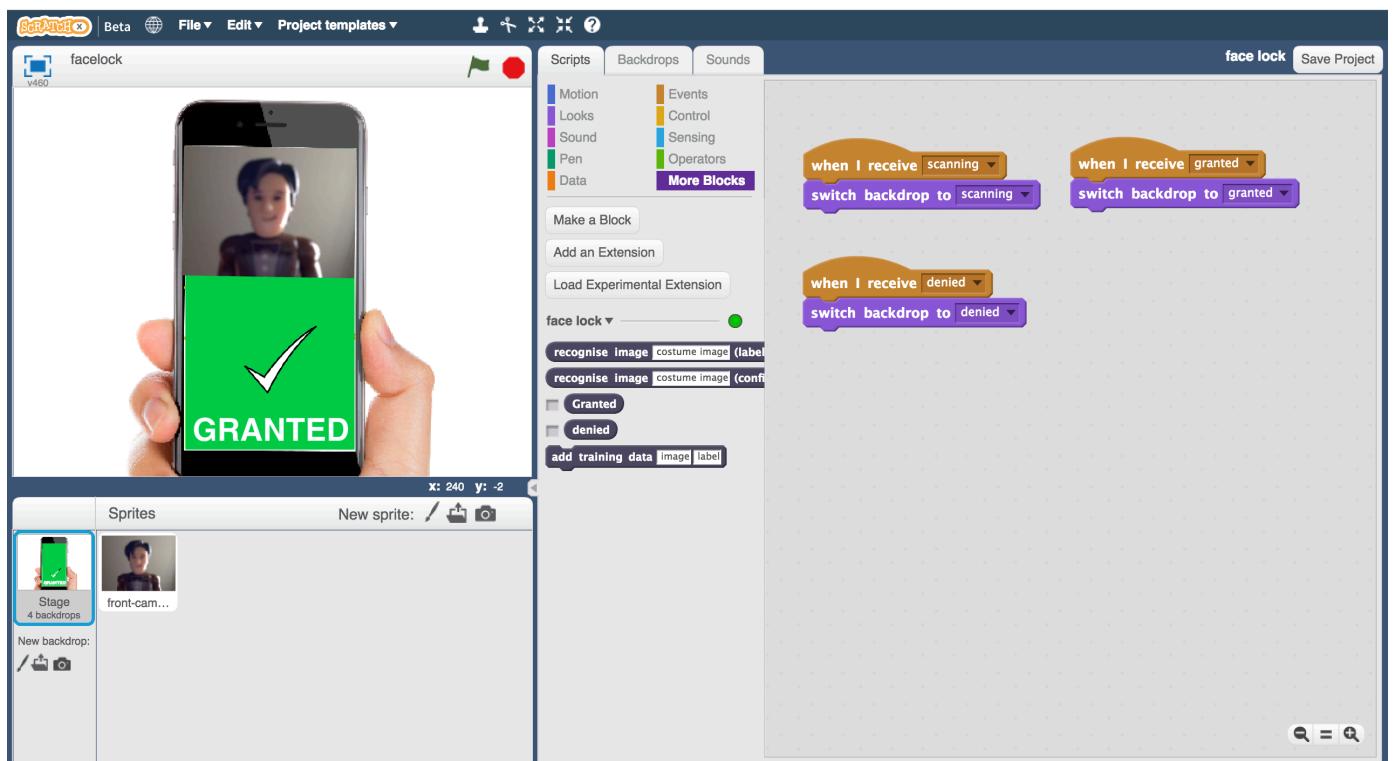


Face Lock

In this project you will make a Scratch project that can unlock a virtual phone using your face.

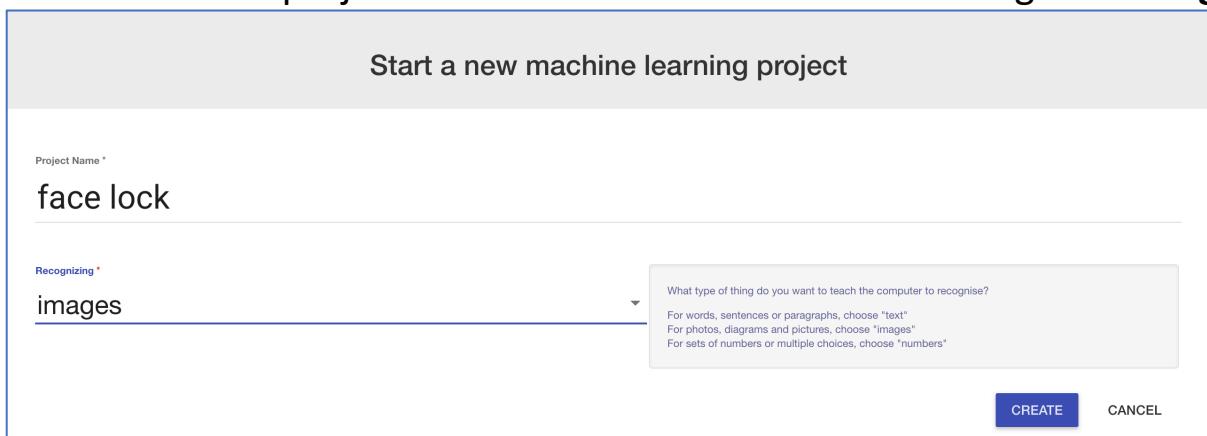
You'll train a machine learning model to be able to recognise a face so that it only unlocks the phone for the right person.



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<http://creativecommons.org/licenses/by-nc-sa/4.0/>

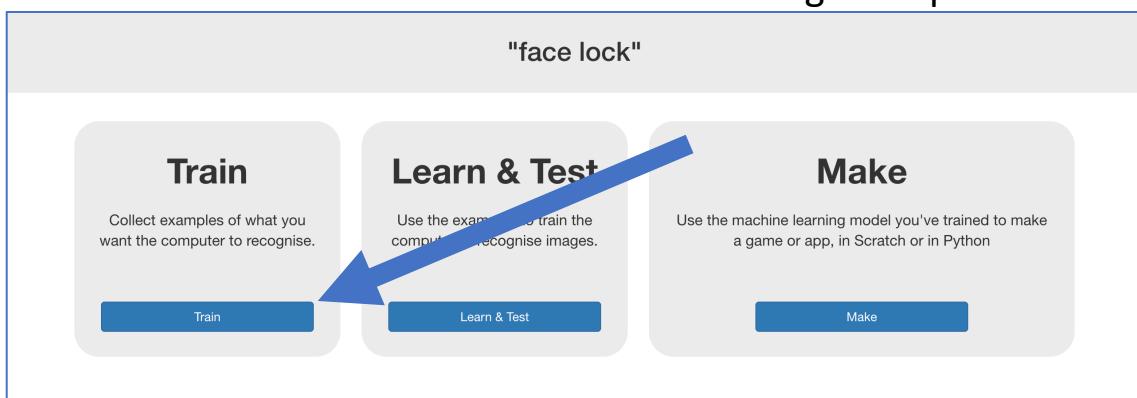
This worksheet was contributed by Jasmine Crisp and Daniel May, from Mountbatten School.

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 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. Click on the “**+ Add a new project**” button.
6. Name the project “face lock” & set it to learn to recognise “images”

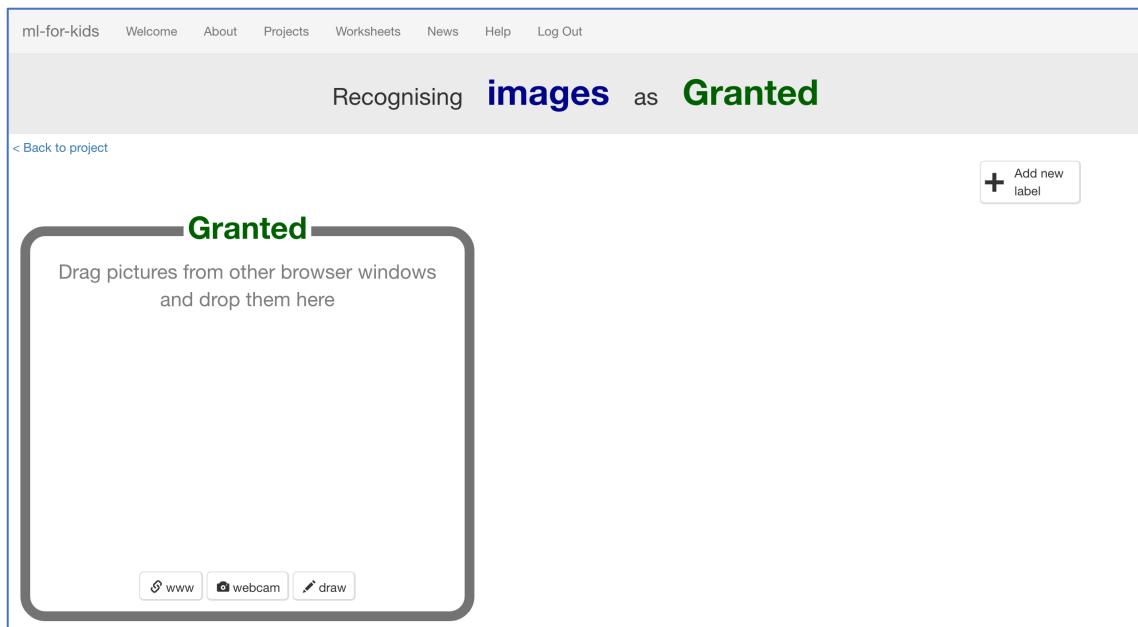


The screenshot shows a dialog box titled "Start a new machine learning project". It has fields for "Project Name" (set to "face lock") and "Recognizing" (set to "images"). A dropdown menu next to "Recognizing" provides options: "What type of thing do you want to teach the computer to recognise?", with choices "text", "images", and "numbers". At the bottom are "CREATE" and "CANCEL" buttons.

7. You should see “face lock” in your list of projects. Click on it.
8. Click the “**Train**” button to start collecting examples



9. Click on “+ Add new label”. Create a bucket called “Granted”

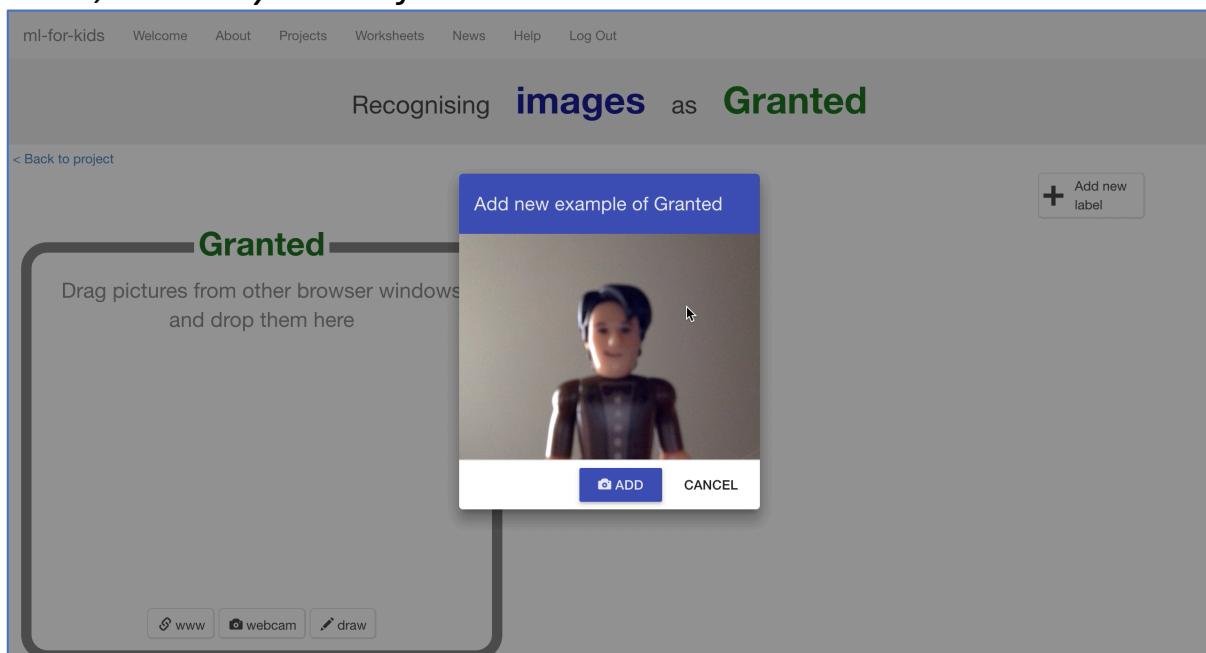


10. Click “webcam”.

A preview window will show the current view from your webcam.
You will need to click “Approve” or “Allow” if your web browser asks permission to use your webcam.

11. Put your face in front of the webcam, and click “Add” to take a picture of it.

Make sure you have permission to upload photos of your face. If you don’t, use a toy with a face like we’ve done here.



12. Repeat until you've got at least 10 examples of your face.

Take pictures with different backgrounds, angles, focuses, and distances from the webcam. The more variation the computer has to learn from, the better.

The screenshot shows a web interface for labeling images. At the top, there is a navigation bar with links: ml-for-kids, Welcome, About, Projects, Worksheets, News, Help, and Log Out. Below the navigation bar, the title "Recognising images as Granted" is displayed. A "Back to project" link is located above a "Granted" folder containing 10 small thumbnail images of a person's face. To the right of the folder is a button labeled "+ Add new label". At the bottom of the page are three buttons: "www", "webcam", and "draw".

13. Click “+ Add new label” and create one called “denied”

14. Use the “**webcam**” button in the “denied” bucket to take 10 photos of other people’s faces

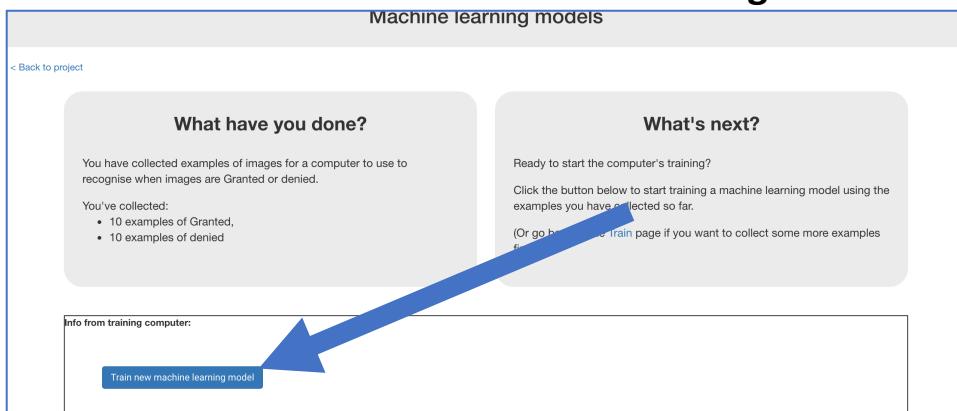
Try to vary these pictures in the same way that you varied your first set.

The screenshot shows the same web interface as the previous one, but now with two labeled buckets: "Granted" and "denied". The "Granted" bucket contains 10 images of a single person's face, while the "denied" bucket contains 10 images of various other people's faces. Each bucket has its own "www", "webcam", and "draw" buttons at the bottom. The overall title is "Recognising images as Granted or denied".

- 15.** Click on the “< Back to project” link

- 16.** Click the “Learn & Test” button

- 17.** Click the “Train new machine learning model” button



- 18.** Wait for the training to complete.
This might take a few minutes. You'll know when it's done when it gives you the opportunity to test the model. Why not try doing the quiz?

- 19.** Click on the “< Back to project” link

What have you done so far?

You're started to train a computer to recognise pictures of you.

Instead of trying to write rules to be able to do this, you are doing it by collecting pictures of yourself.

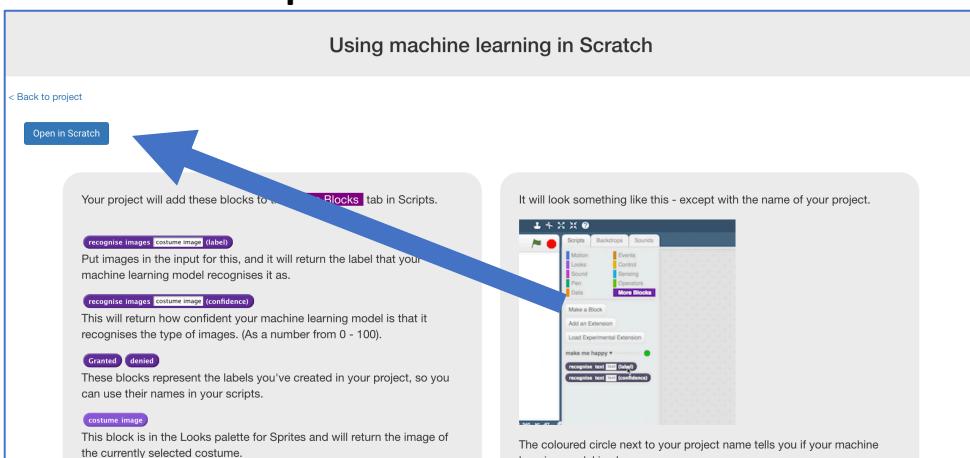
These examples are being used to train a machine learning “model”. This is called “supervised learning” because of the way that you are supervising the computer’s training.

The computer will learn from the patterns in the photos you’ve taken. Hopefully this will mostly be the facial features and hair, but beware that it might also include the clothes and background!

20. Click the “**Make**” button

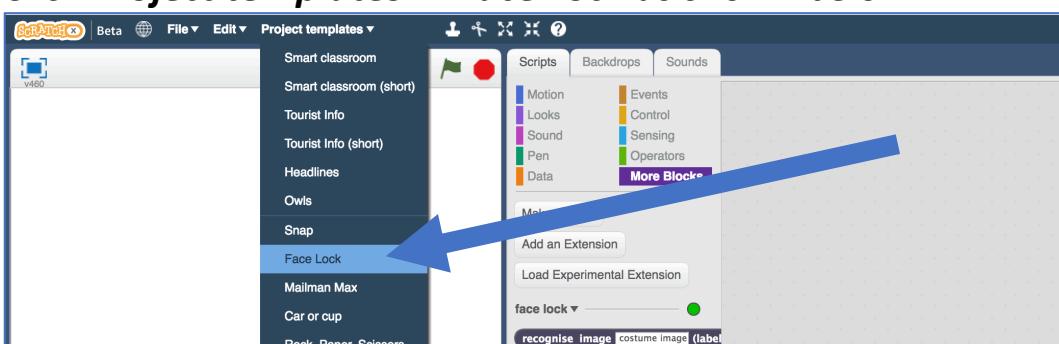
21. Click the **Scratch** button.

22. Click the **Open in Scratch** button.



23. Load the Face Lock template project

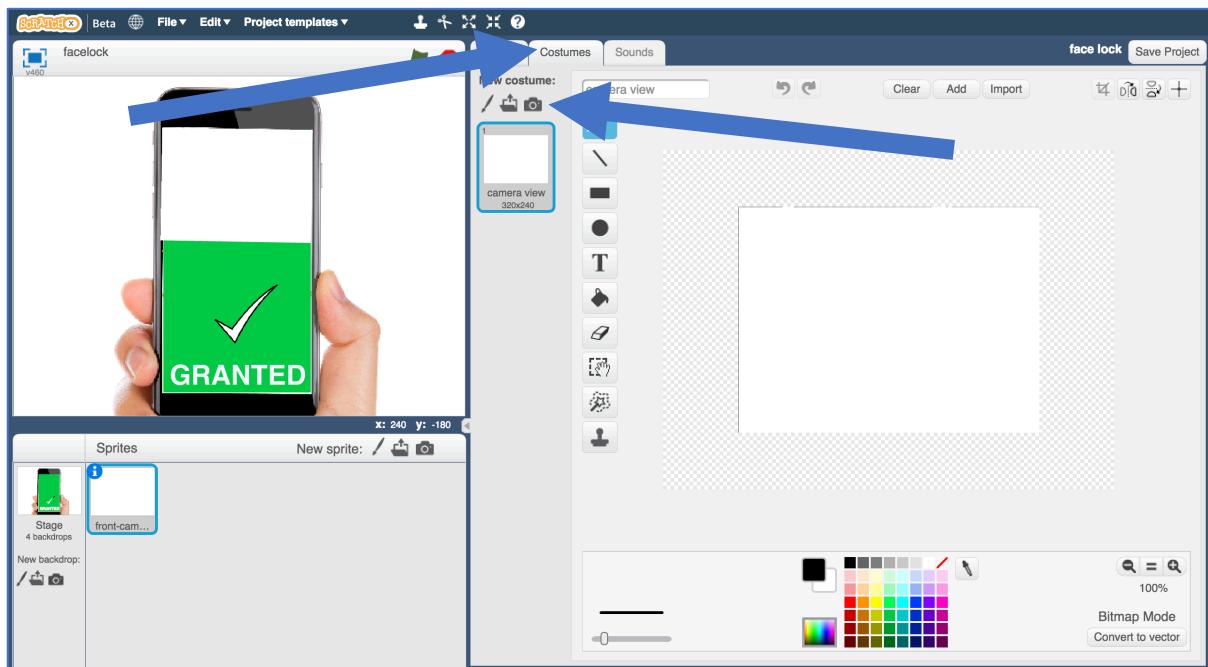
*Click **Project templates** -> **Face Lock** as shown below*



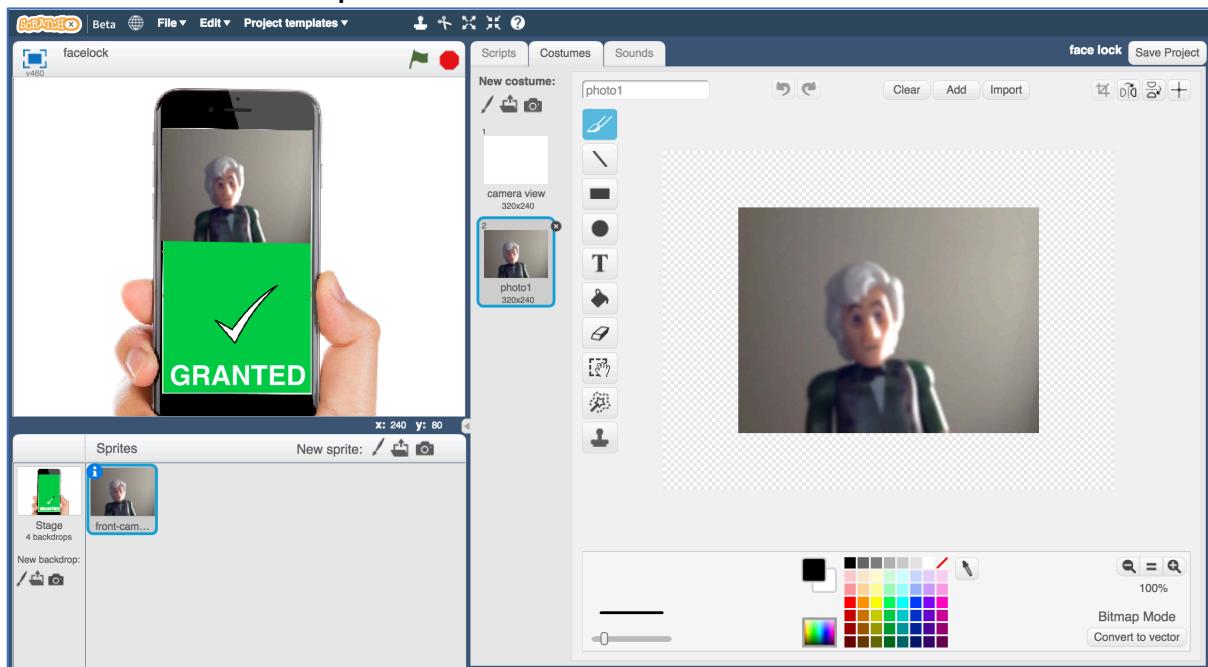
24. Create this script



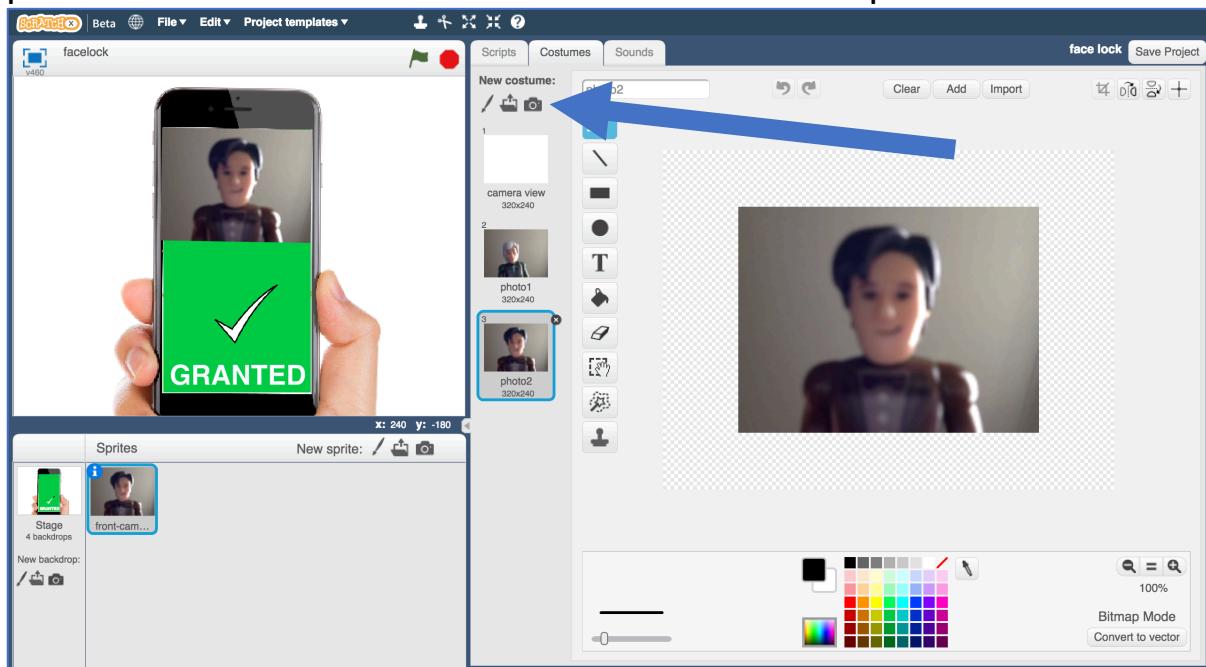
25. Click on the “Costumes” tab,
then click on the “New costume from camera” button



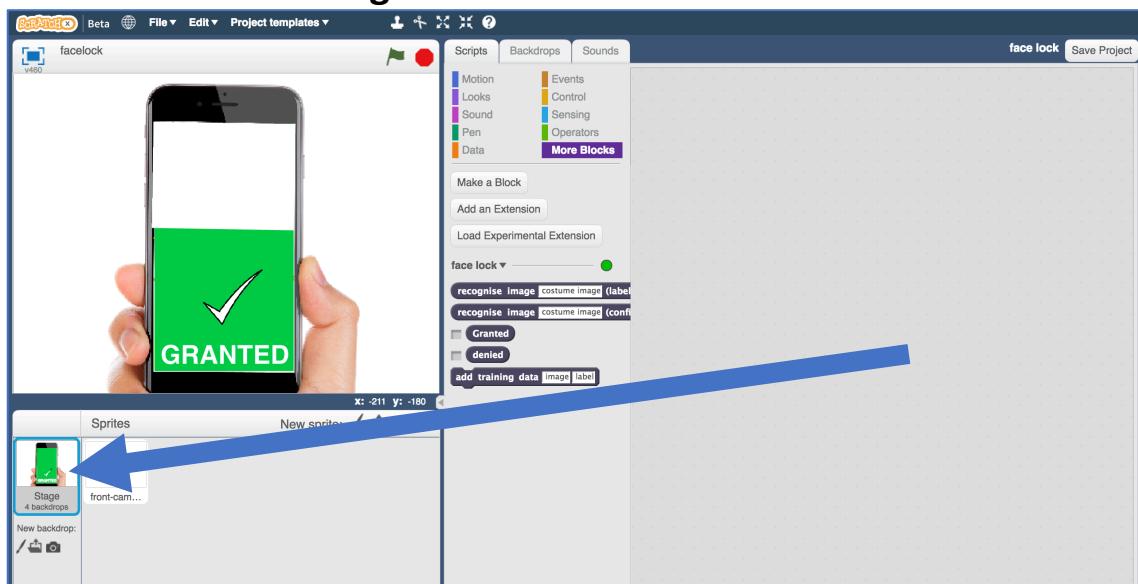
26. Use the webcam to take a photo of a face that should not be allowed to use the phone



27. Click the “New costume from camera” button again, and take a photo of a face that should be allowed to use the phone



28. Click on the Stage

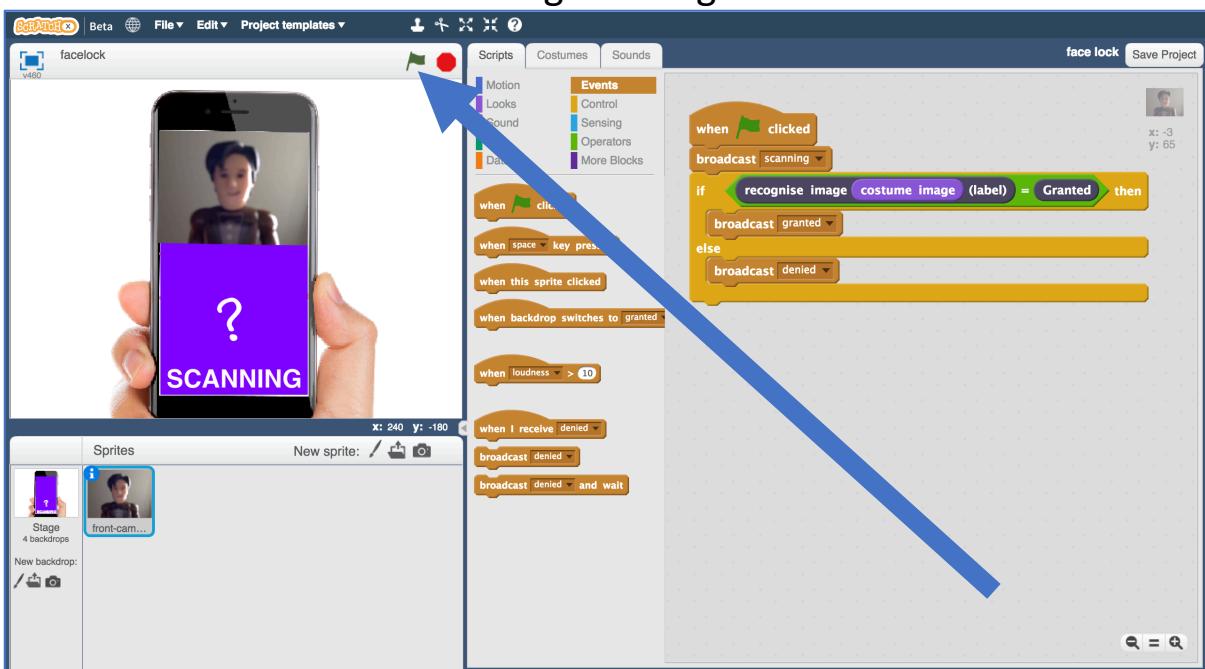


29. Create the following scripts

These will make the phone screen update based on whether it is locked.



30. It's time to test! Click the green flag



What have you done?

You've trained a facial recognition system. You've done this by collecting examples of pictures of faces, and used this to train a machine learning model that is able to recognise faces.

You've used this model to create an app, using the model as an authentication method (a way of proving that someone is who they say they are).

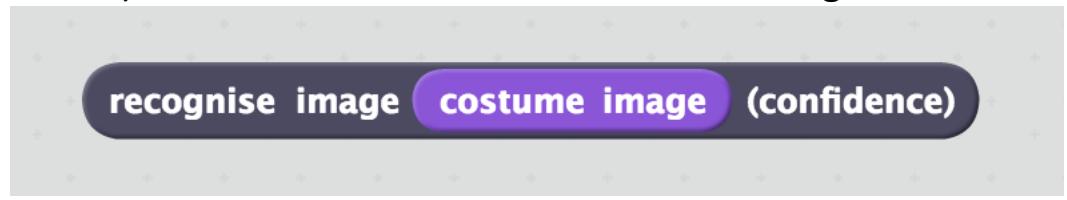
It's a very simple system so far.

Can you think of ways that you could fool it?

Ideas and Extensions

What if the computer isn't sure?

The confidence block returns a percentage (a number from 0 to 100) with how confident it is that it has recognised the face.



```
recognise image [costume image (confidence)]
```

How could you update your script to use this?

Should the phone still unlock if the computer is only 10% sure that it has correctly recognised the owner's face?

Add more people for the computer to accept

Can you get the phone to recognise two different people's faces that it should let through?

Try confusing the computer

If you train the computer to recognise you while you're in one place only, can it still recognise you if you are somewhere else? What if you change your clothes?

Is the computer recognising your face, or something else?

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

Did you know?

The first known attempt at facial recognition was in 1965 by Woodrow Wilson Bledsoe. He manually inputted measurements of a person's face and stored them, along with measurements of other people's faces.

When presented with a new photograph, the system could be used to work out which person most closely resembled the picture.

He found a number of issues with getting his system to cope with differences in "head rotation, tilt, light intensity, the angle of the light, aging, facial expression" and a number of other factors. These were impossible to avoid at the time.

Recently, Apple introduced facial recognition into their phones, by using software known as Face ID. Instead of relying on pictures, this makes a detailed map of over 30,000 specific points on your face. This helps it to handle small changes in the look of your face, such as wearing makeup or a different hairstyle. Other companies, such as Samsung, have also introduced similar technology to their phones.