Machine Learning Workshop

University of Sunderland

In this activity you will train the computer to recognise images from a webcam.

We will use a web browser application called *Teachable Machine* which is a fun, easy way to create machine learning models - no coding required and by the end of this activity **you** will have trained the computer to recognise different sweets.

WARNING

Allergy statement: During this activity you may come into contact with WHEAT, EGGS, TREE NUTS, and MILK. For more information, please speak with a member of staff.

Let’s get going!

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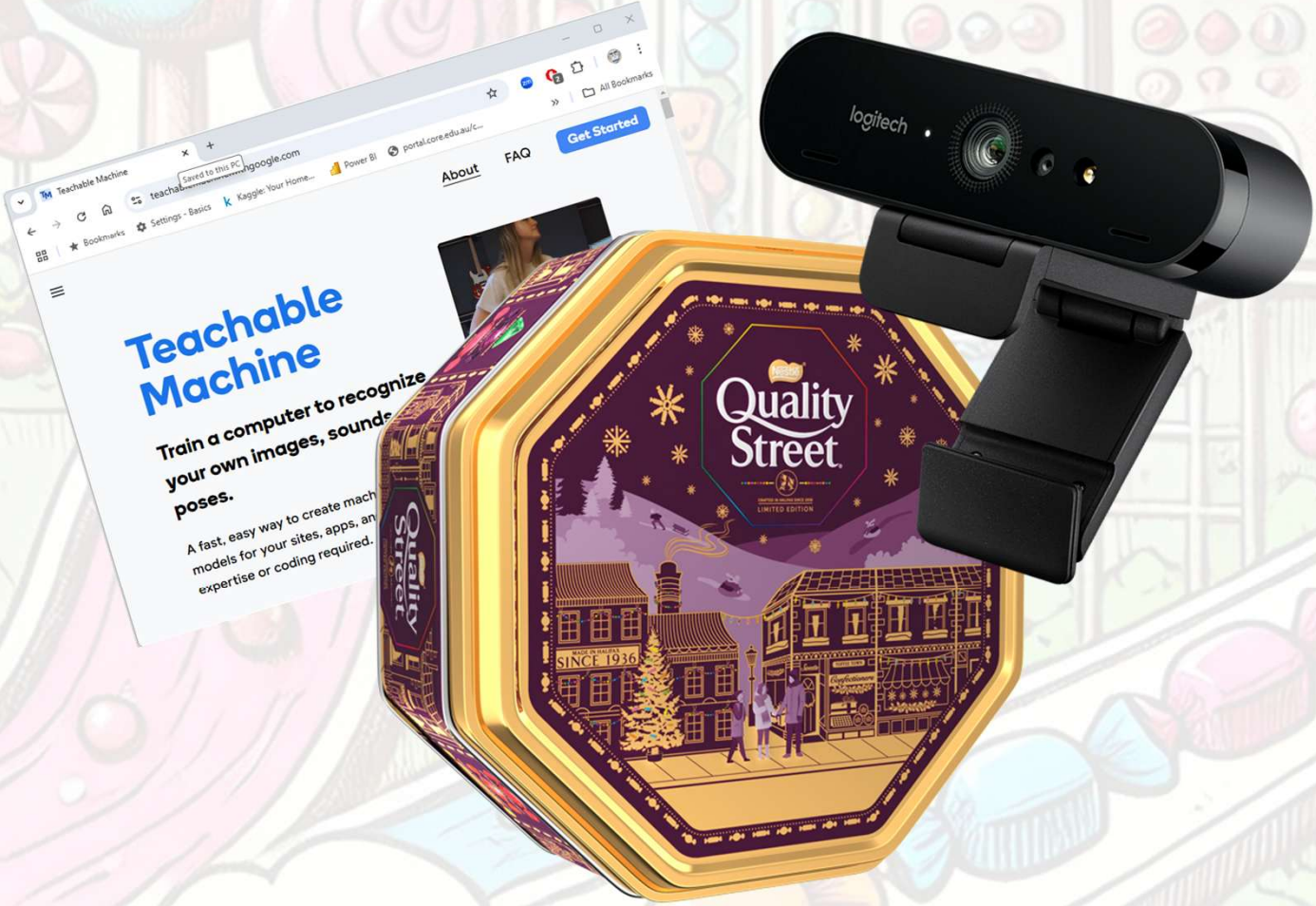
What do we need!

For this activity we need the following:

- A **web browser** (we recommend you use Chrome).
- A **webcam** connected to the computer.
- Some **sweets.** 😋

The lab computers should already be setup, but if you get stuck at any point, ask for help. We are here to help you and don't worry if you don't get everything finished in this session.

Source files: https://github.com/neliot/sweeties



Let’s get going!

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Gather your items

Gather up the sweets that you're using - you'll need one of each type of sweet. This is what we are going to use AI to carry out some classification!

In this guide we use Quality Street chocolates, but yours might be different.

Resist the temptation! You can have some later!

Let's get going!

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Gather your items

Identify each sweet and allocate an appropriate class/label. You might need to look at the key on the side of the box.

No Really! - resist the temptation! You can have some later!

Build the model!

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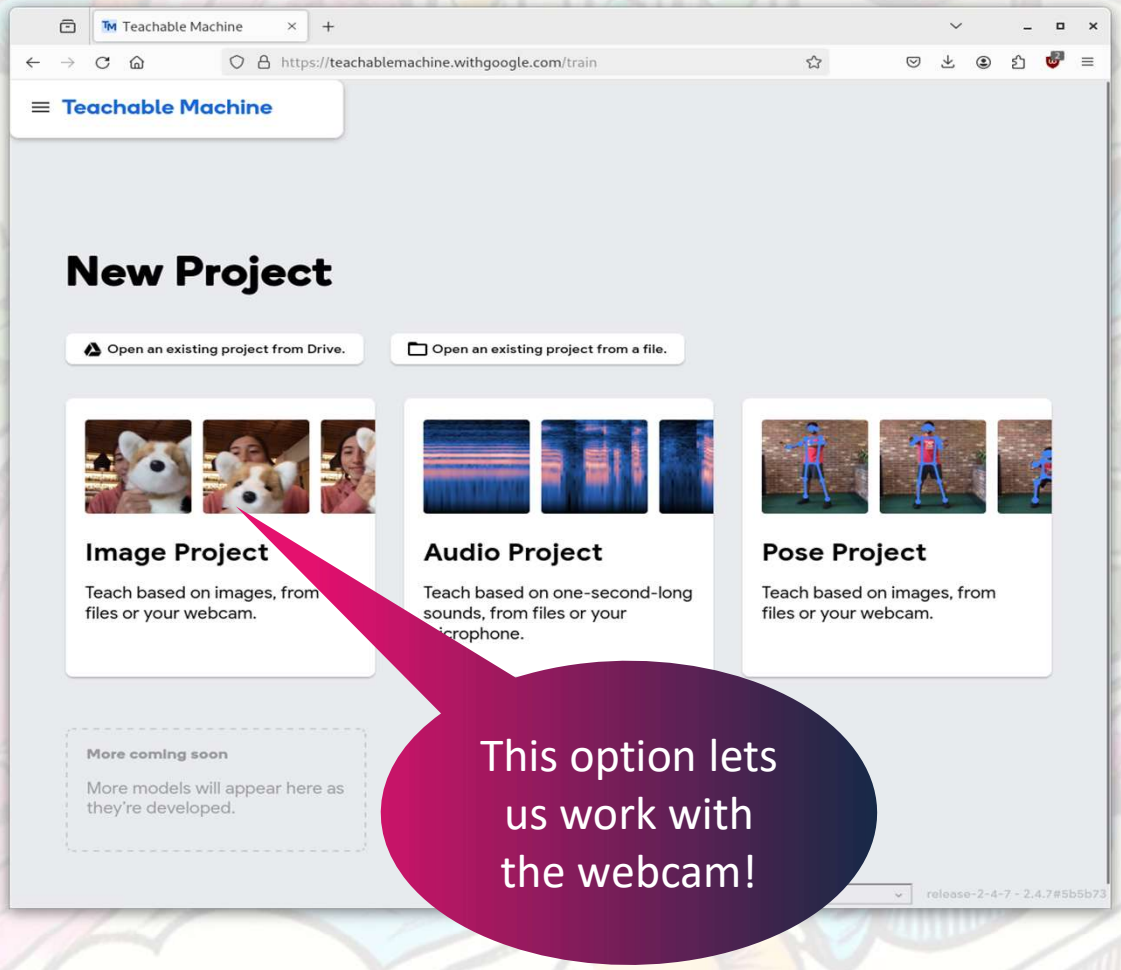
Let’s get classifying

Time to show the computer the sweets and train a model. We're going to use a website called Teachable Machine which has been developed by Google. It makes it easy to create models.

Open Teachable Machine in another window by right clicking on the following link below and selecting open a new window.

https://teachablemachine.withgoogle.com/

You should see a screen that looks like this:



Build the model!

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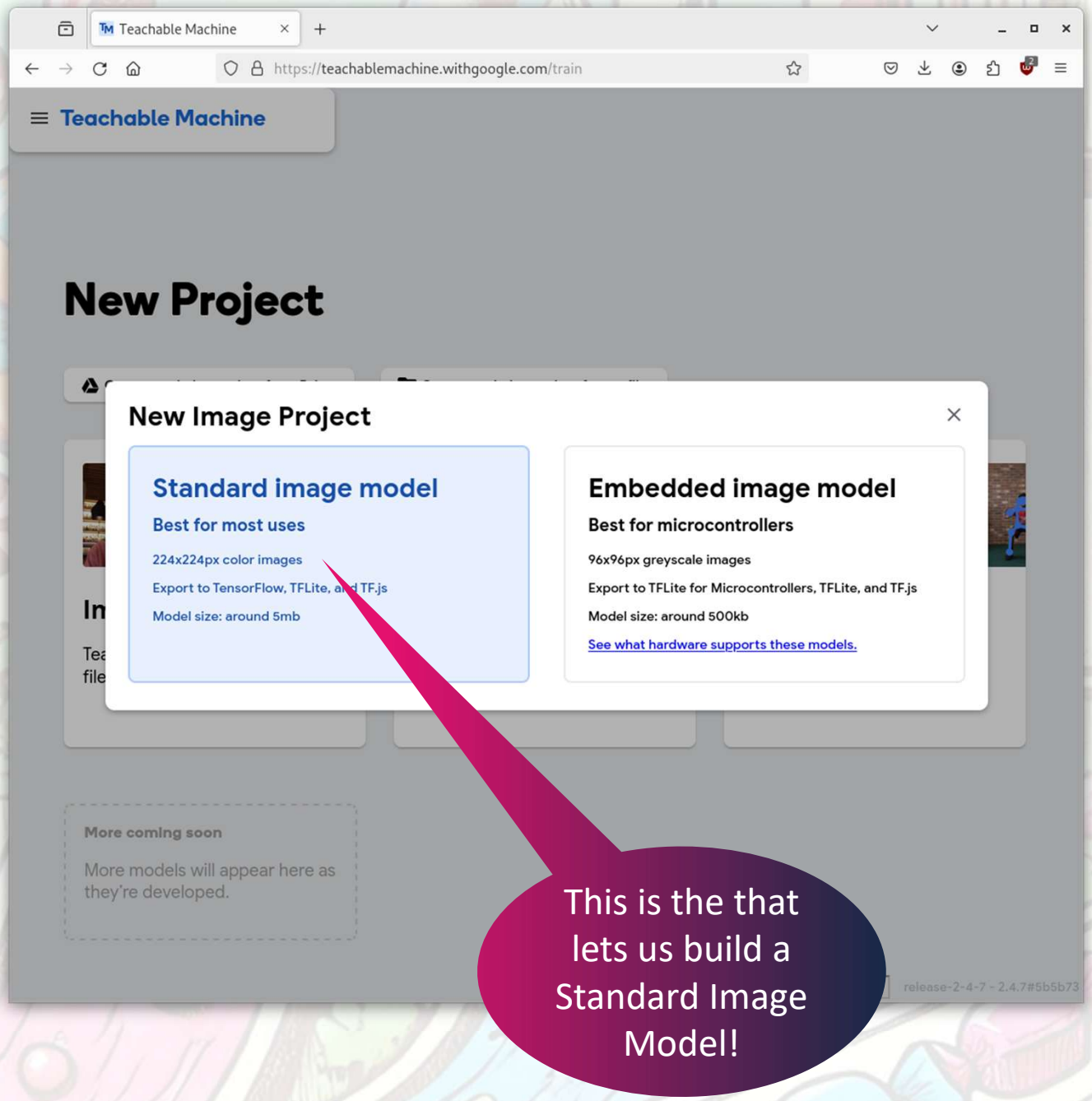
Let’s get classifying

Hopefully you are now seeing a screen like this!



Build the model!

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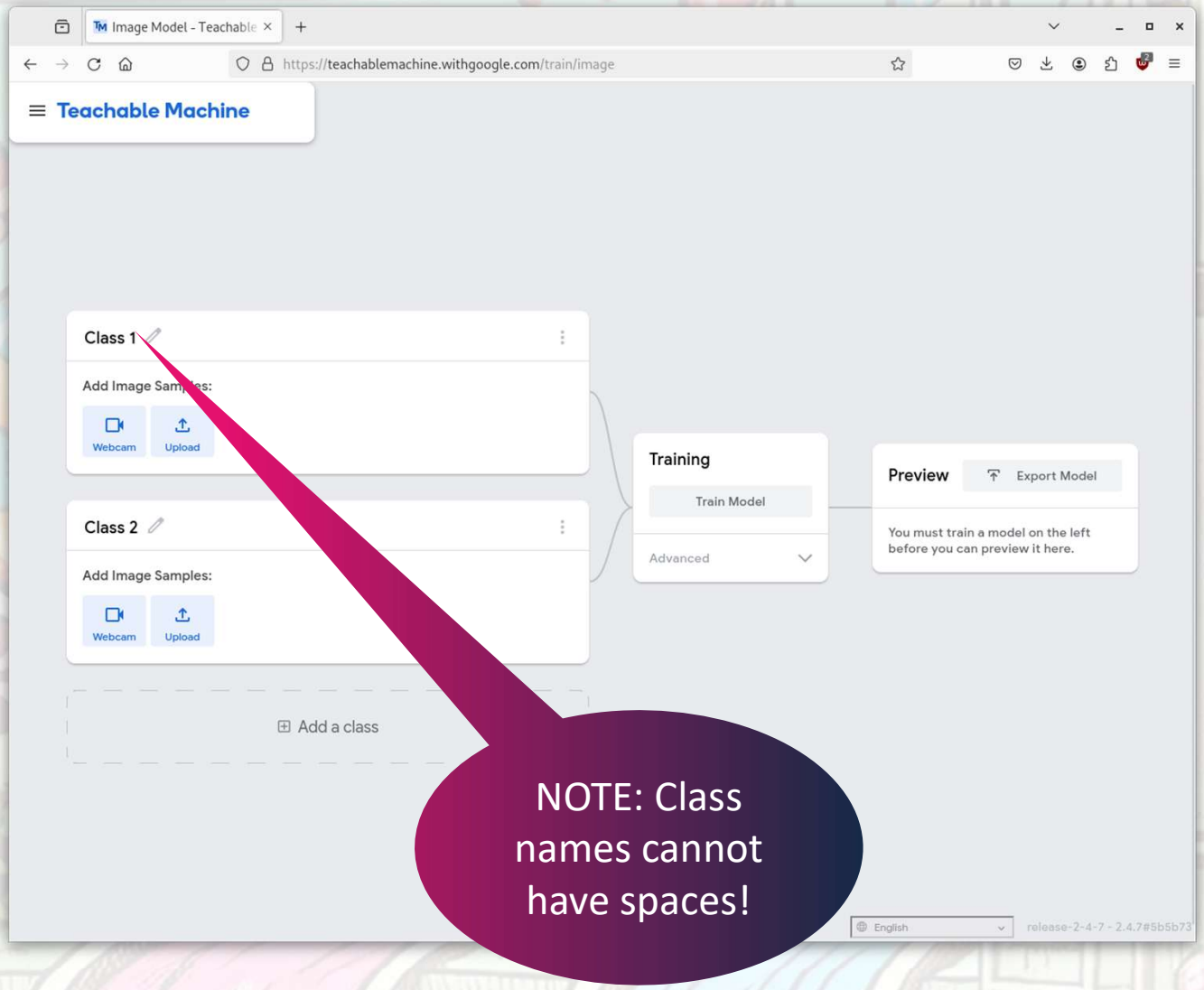
Let’s get classifying

Your screen should look something like below:



Rename **Class 1** by clicking the edit icon and name it to your first sweet. In our example its the Quality Street Green Triangle.

Build the model!

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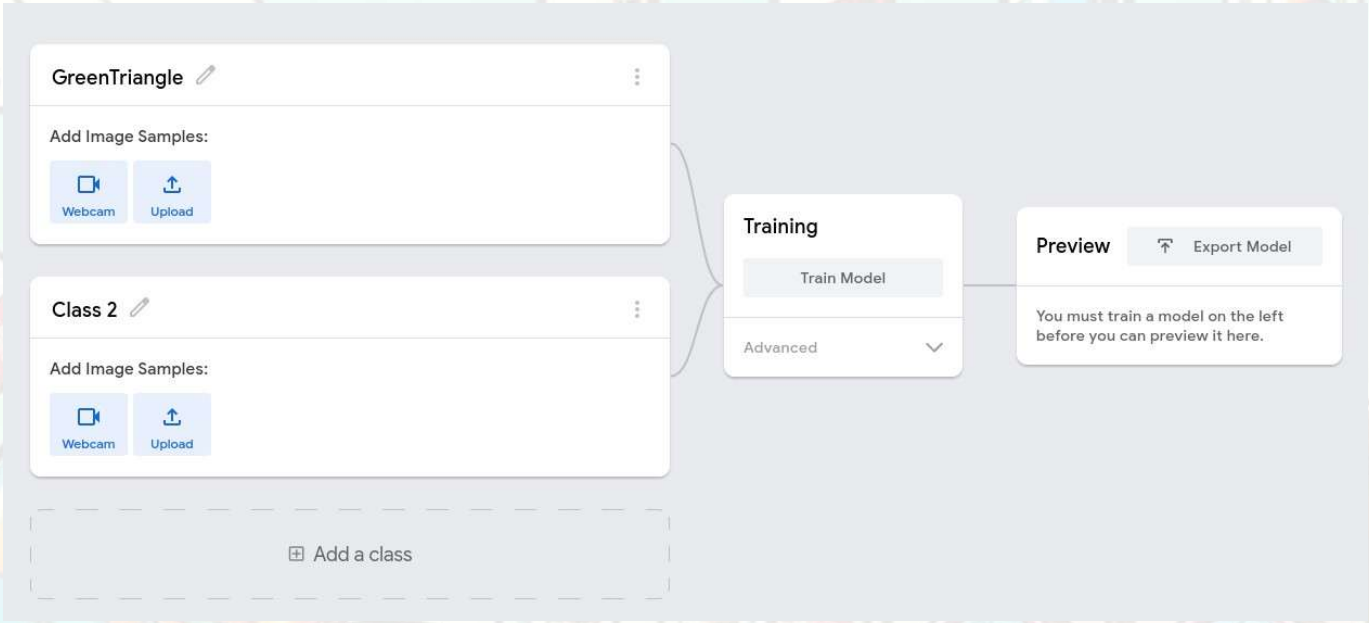
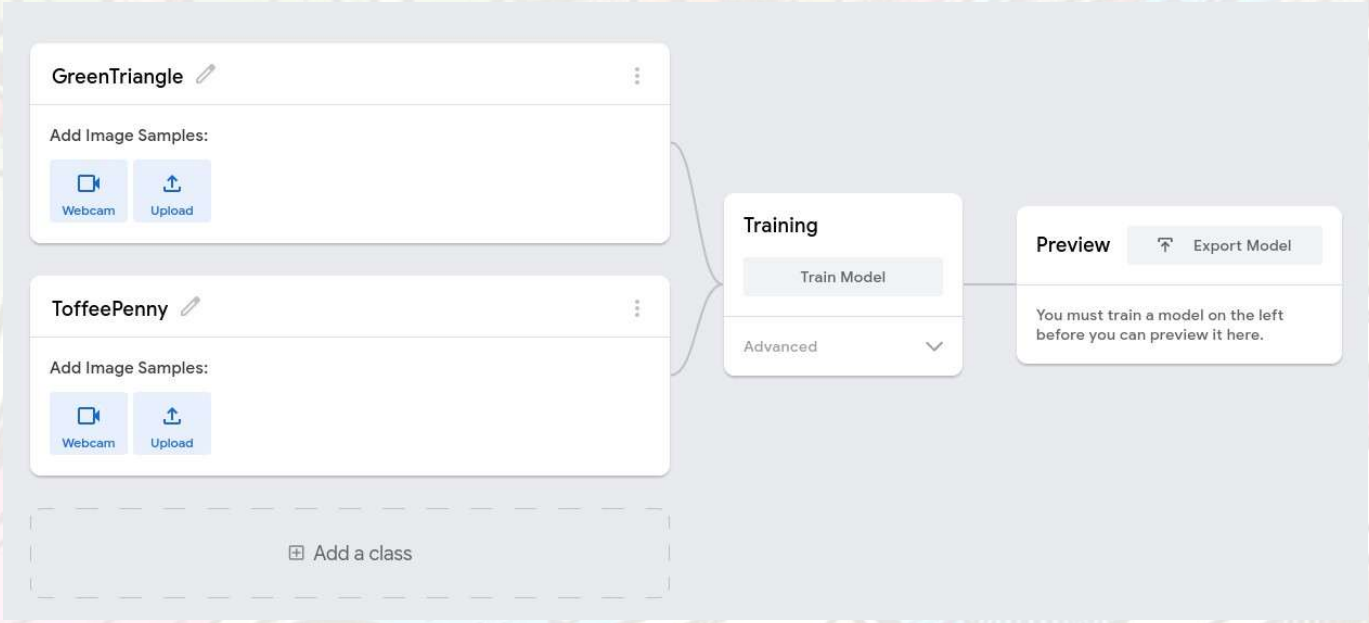
Let’s get classifying



Do the same for **Class 2** and rename it to your next sweet. In our example it’s the classic toffee penny (ToffeePenny)



Build the model!

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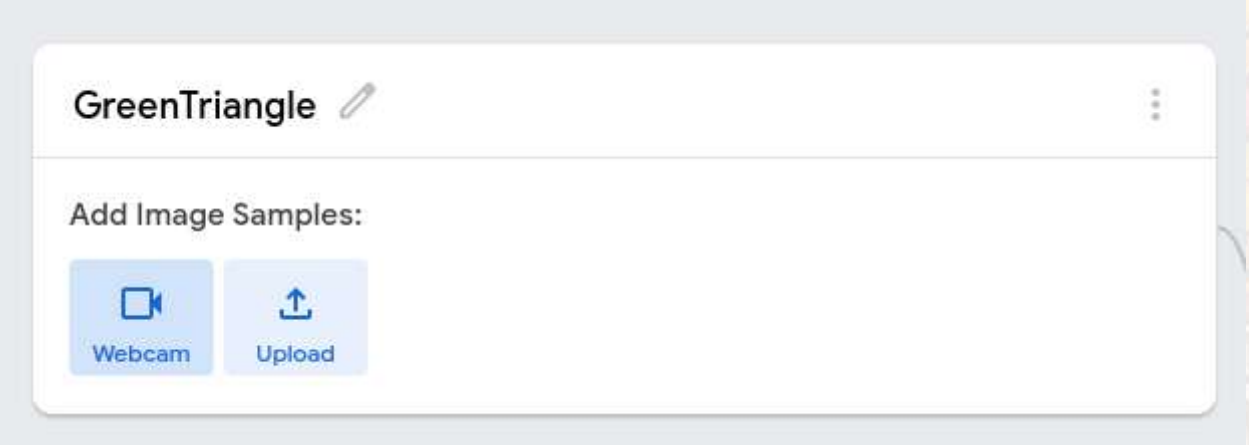
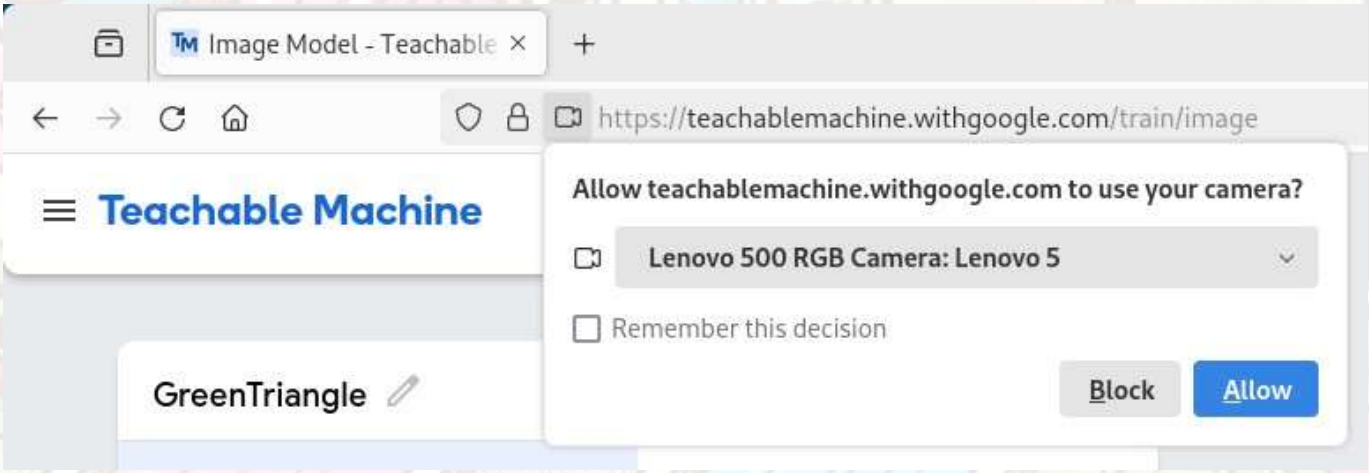
Time to add the photos (webcam)

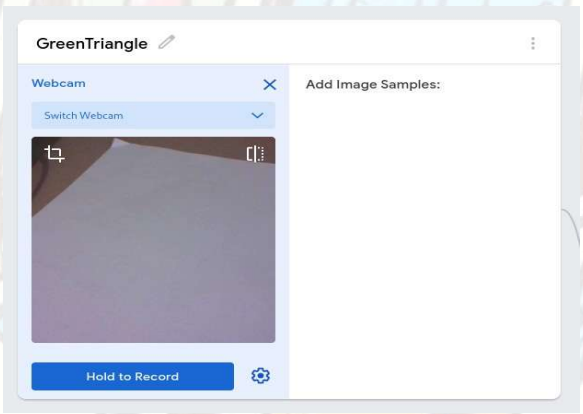
Click the Webcam for the first Class (GreenTriangle)



Your browser may ask for permission to use the Webcam. Check the **Remember this decision** checkbox and click **Allow.**



If all goes well, the webcam will start and you'll see a preview



Build the model!

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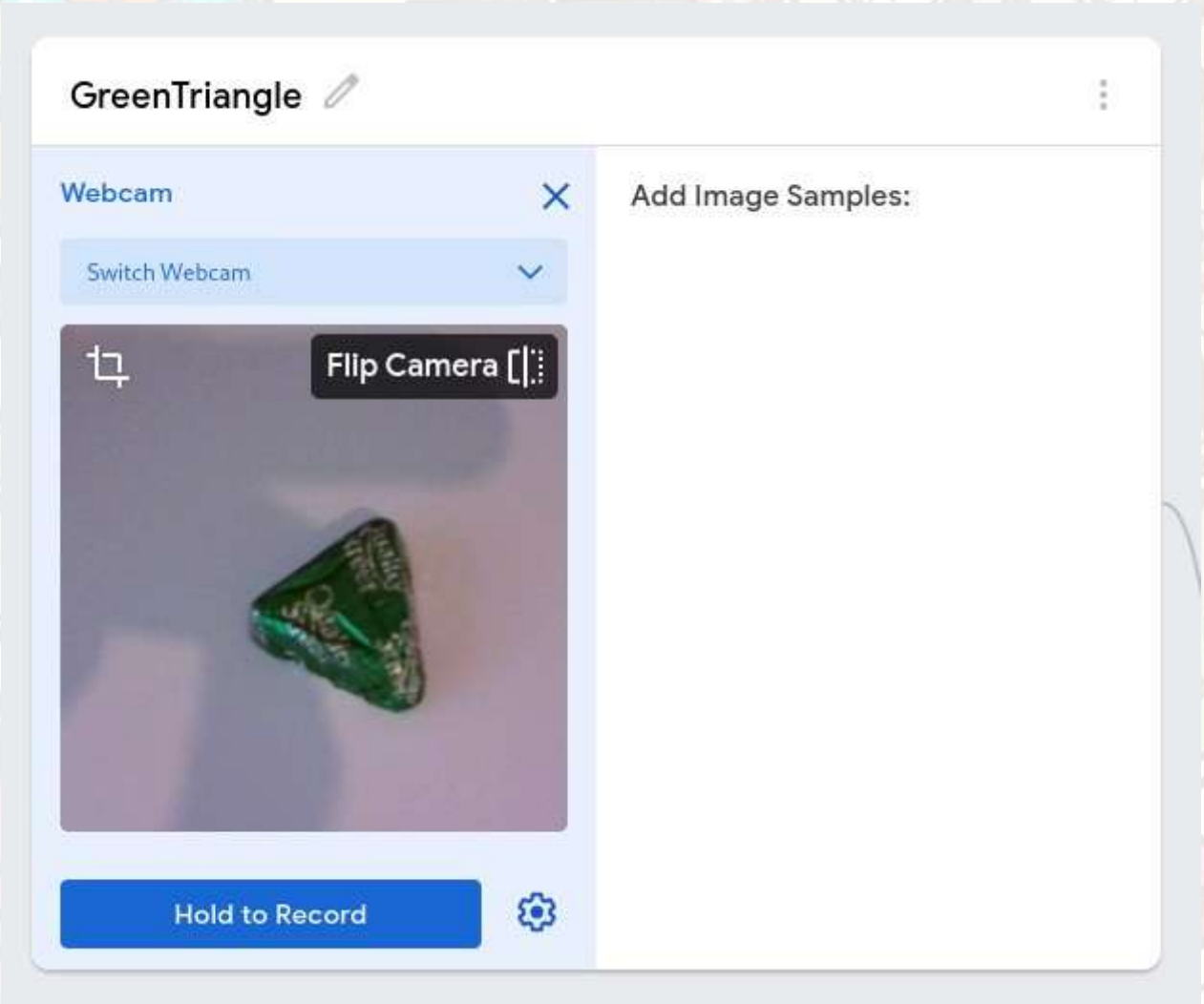
Time to add the photos (webcam)

Before you begin the next part works best if you have a plain background. Also, you can hold the webcam to get a better photo of the sweets.

To record images, press the **Hold to Record** button



Build the model!

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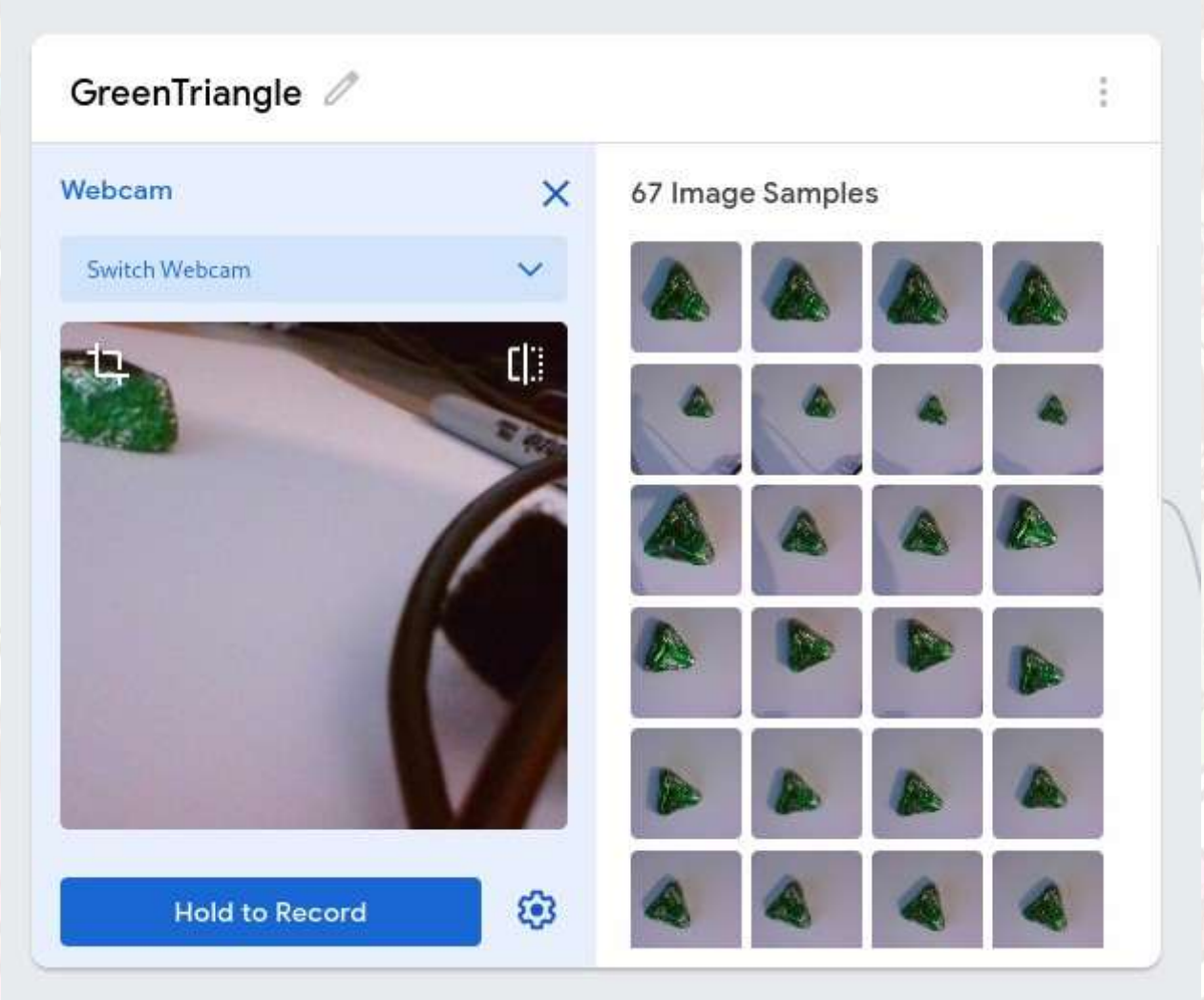
Time to add the photos (webcam)

The webcam will start taking photos at regular intervals. Make sure you move the webcam around a little to get the sweet in different positions. This will improve the effectiveness of the model.

NOTE: If you make a mistake, you can always remove an image.



Build the model!

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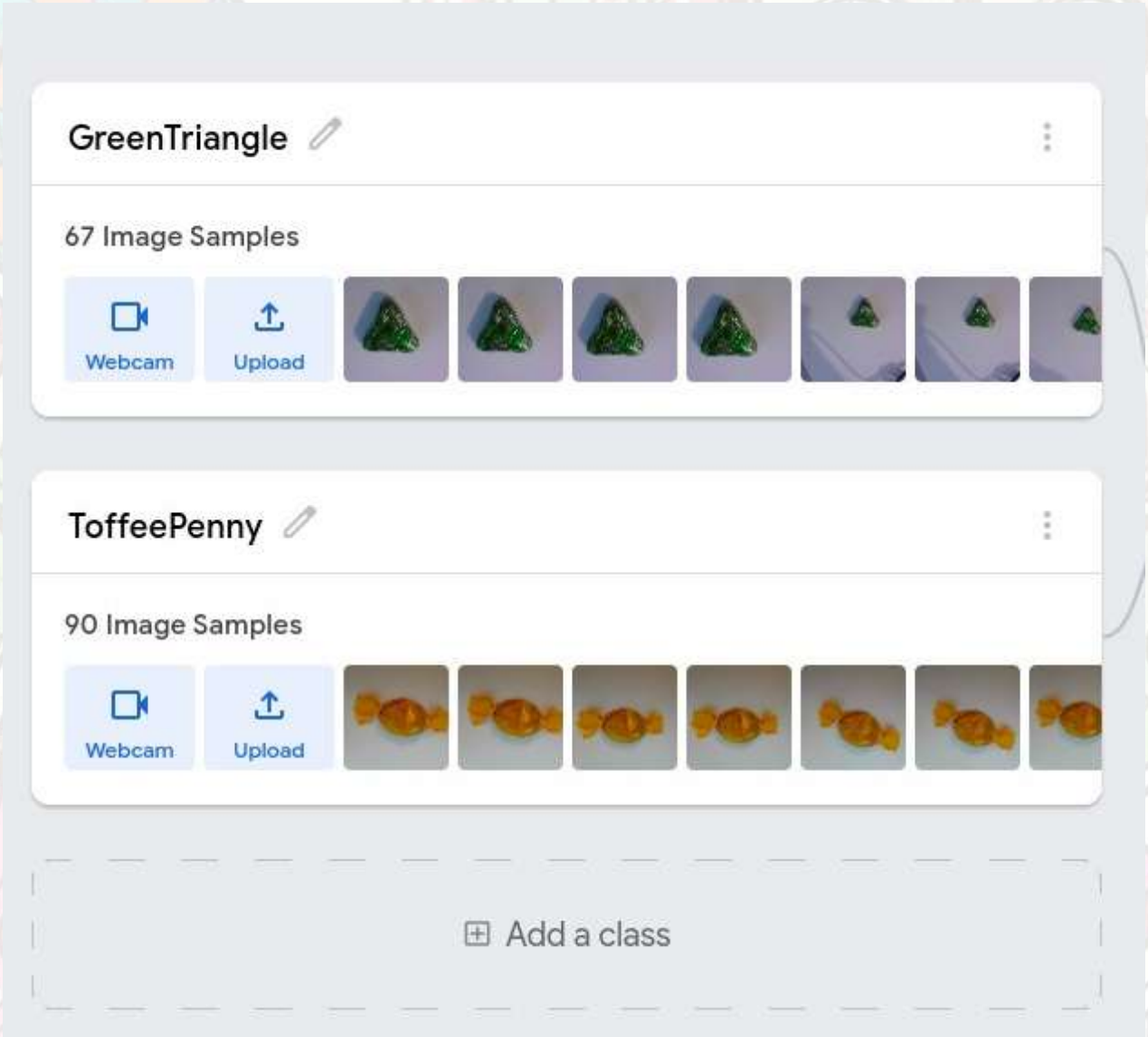
Time to add another class

Once you have the images from the webcam for the sweet you can move on.

When you started the process teachable machine added two class, there's no point in just having one! So, add your next sweet.



Build the model!

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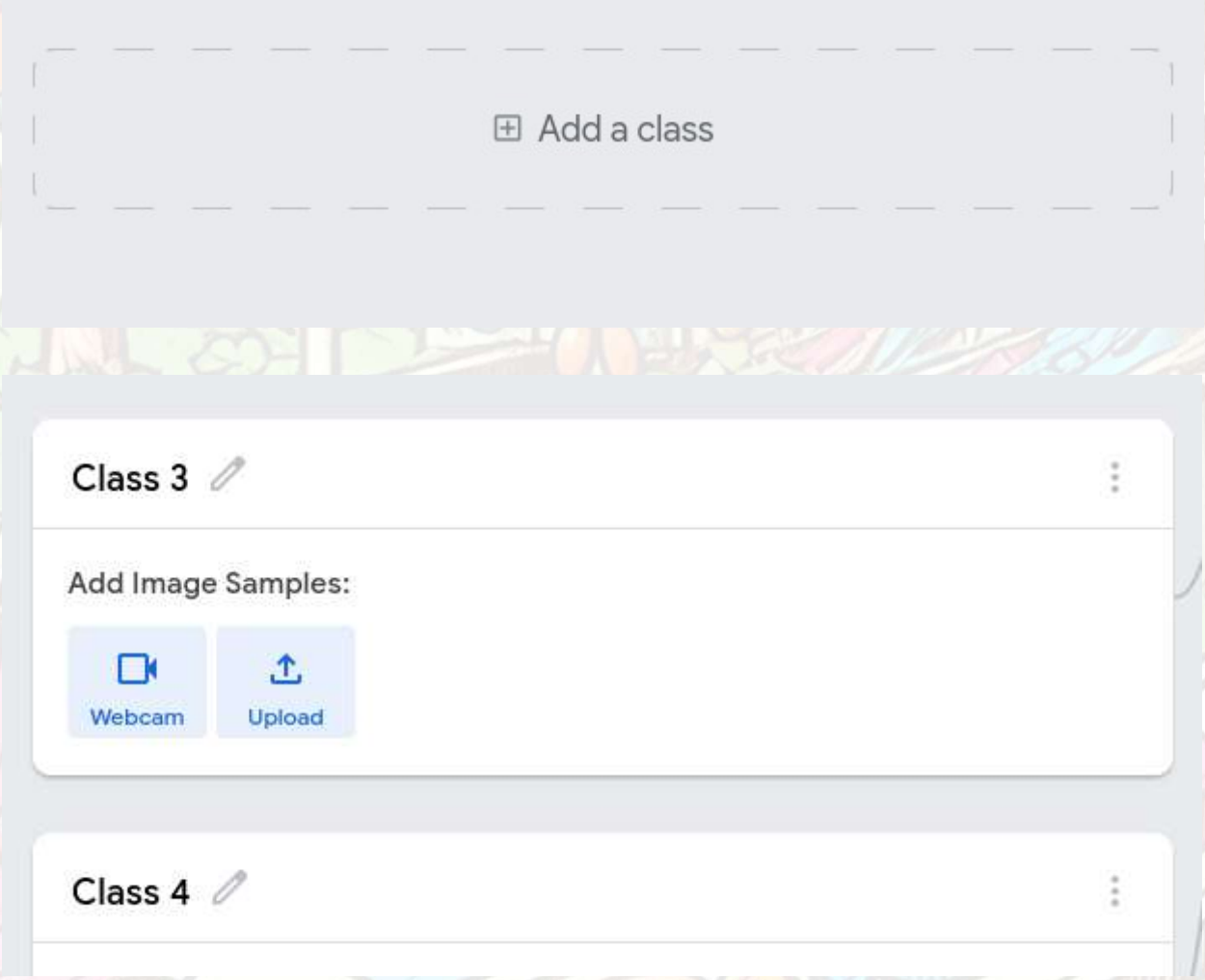
Add the rest of the classes

There are 11 sweet varieties in the Quality Street box. To add the rest, select the “Add a class” and repeat the process.

When you have finished there is one more class to add.

What about when there’s no sweet. Add an additional class called “**None**” and using the webcam make a class based on the “background” of where you took the sweet photos.



Build the model!

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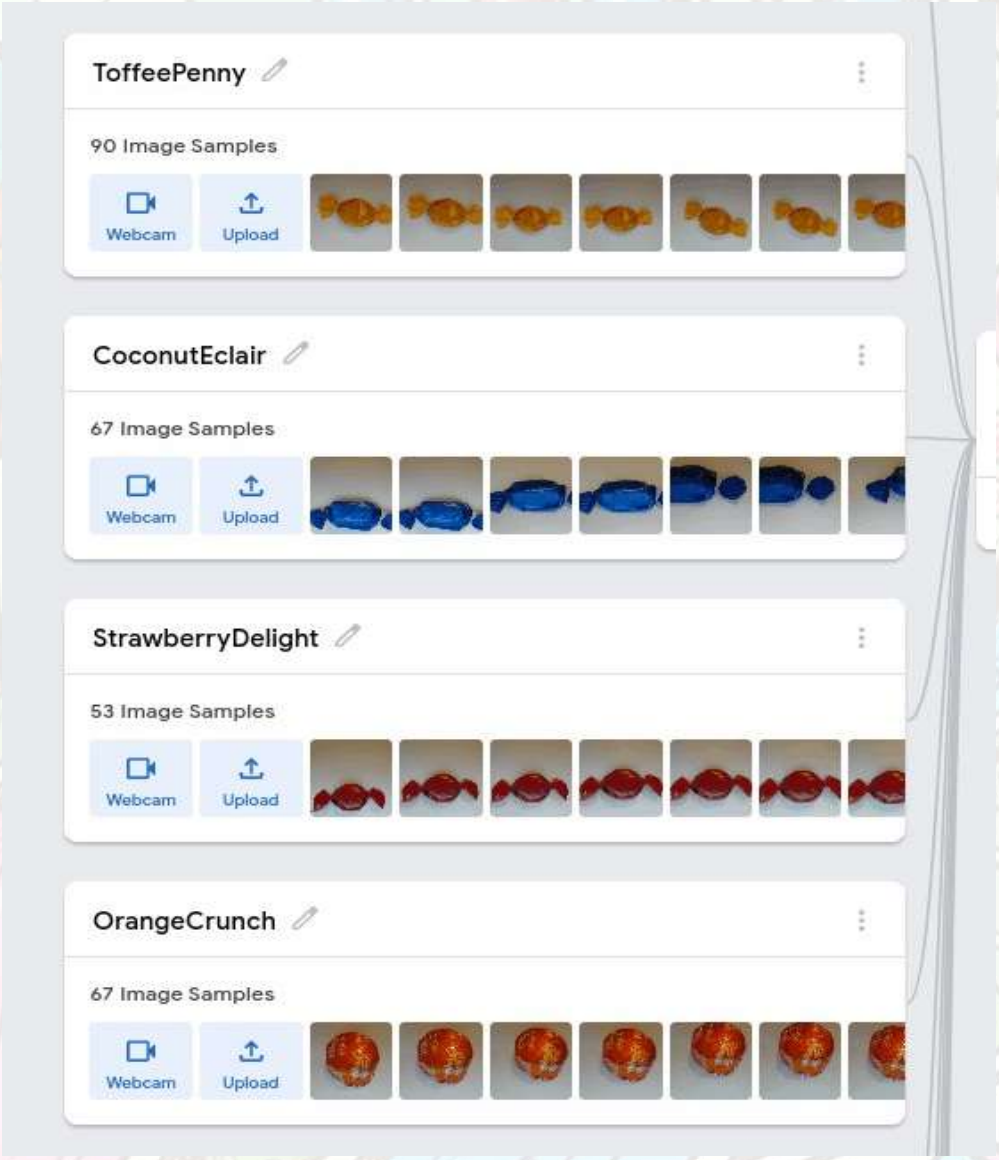
All classes added

If all went well, you'll have something that looks something like the picture below.

That's your dataset created for the sweety sorter. Now we need to convert the dataset into an AI model.



Build the model!

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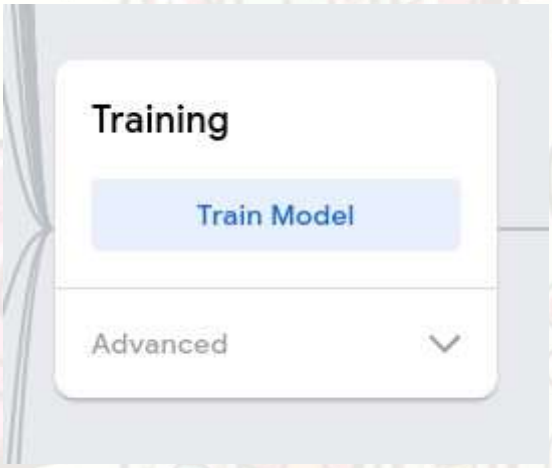
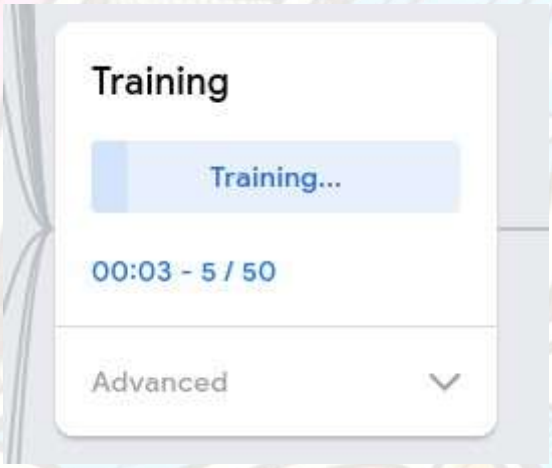
Let’s build the model!

To train the model each photo from each class is converted into a set of numbers that are then passed through a neural network to produce a model.

To start the training process, select the “Train Model” option. Be patient it does take a while; there’s a lot of photos!



You can see the progress of the model training. Once you select the “Train Model” button it becomes a progress bar.



Build the model!

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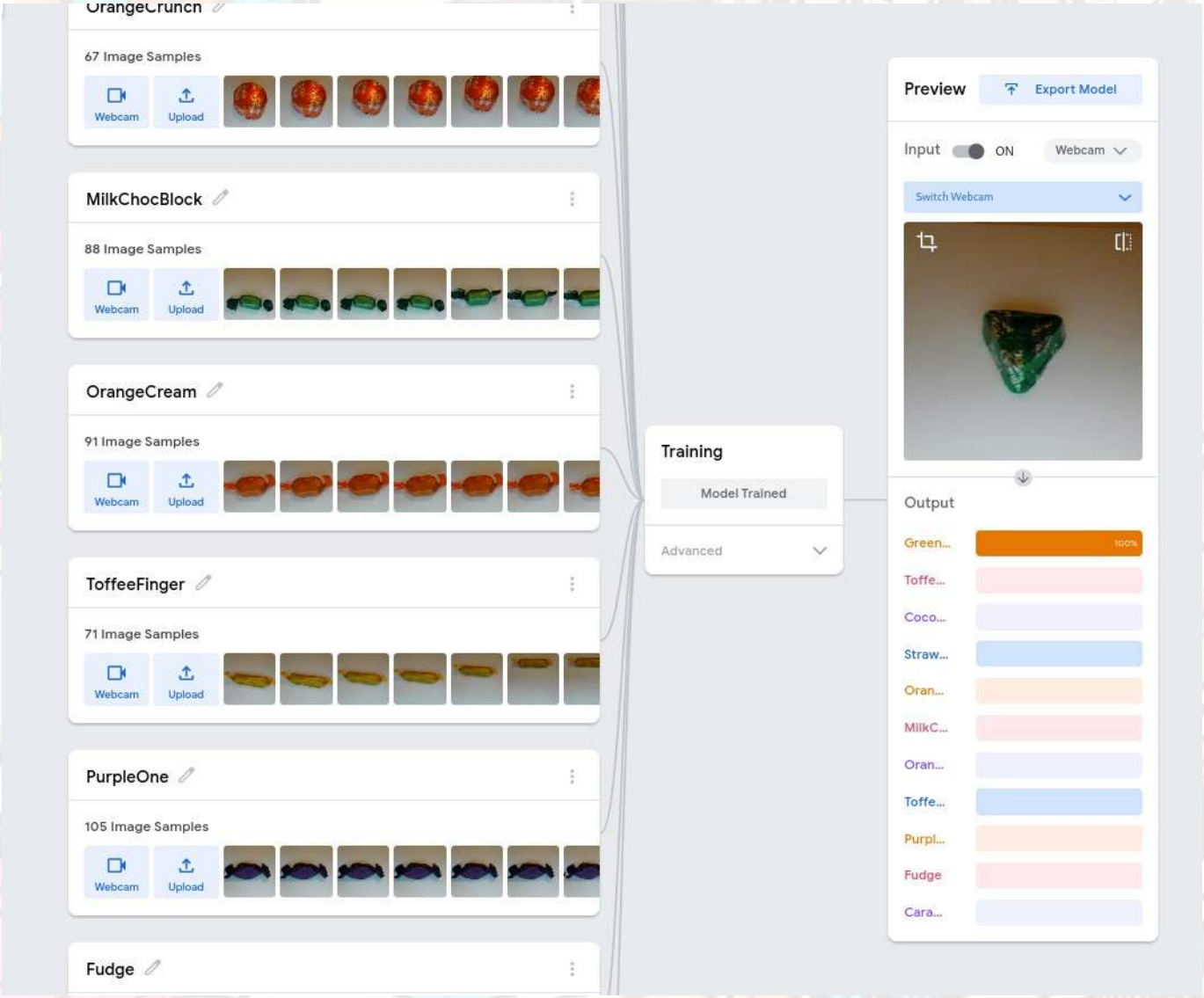
Check the model!

Once the training is complete “Teachable Machine” provides you with a very basic testing facility. You can point the webcam at the sweets, and it will try and identify them.

The bars show you how confident the model is when predicting the match.



Build the model!

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Before you move on

- Did it work as expected?
- What happens when you present a sweet at an angle, or only show part of the sweet to the webcam?
- What happens when you don't present a sweet to the webcam? Has your “None” class worked?
- What's happens if you present a different sweet that wasn’t in your training set (put something in front of the webcam)?
- How do you think you could improve the training data?

Have a chat with other students to see what they think.

Use the model!

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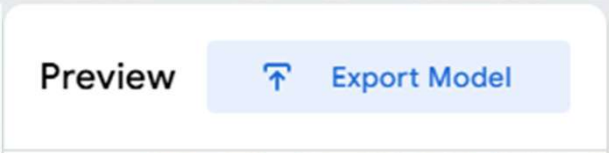
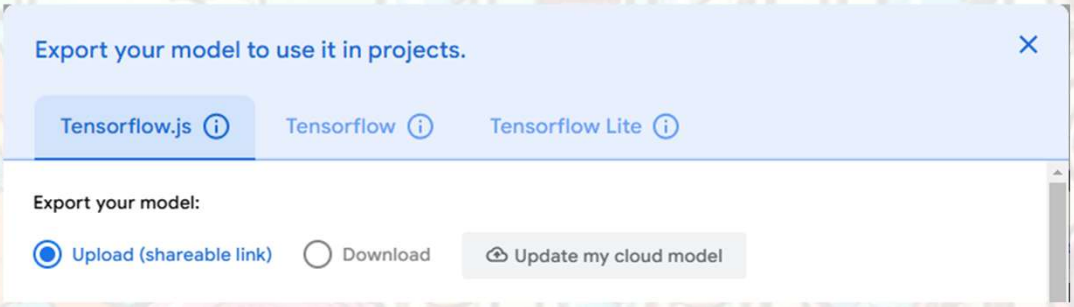
Let's upload the project so we can use it.

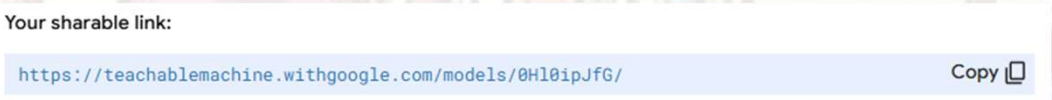
Click **Export Model**



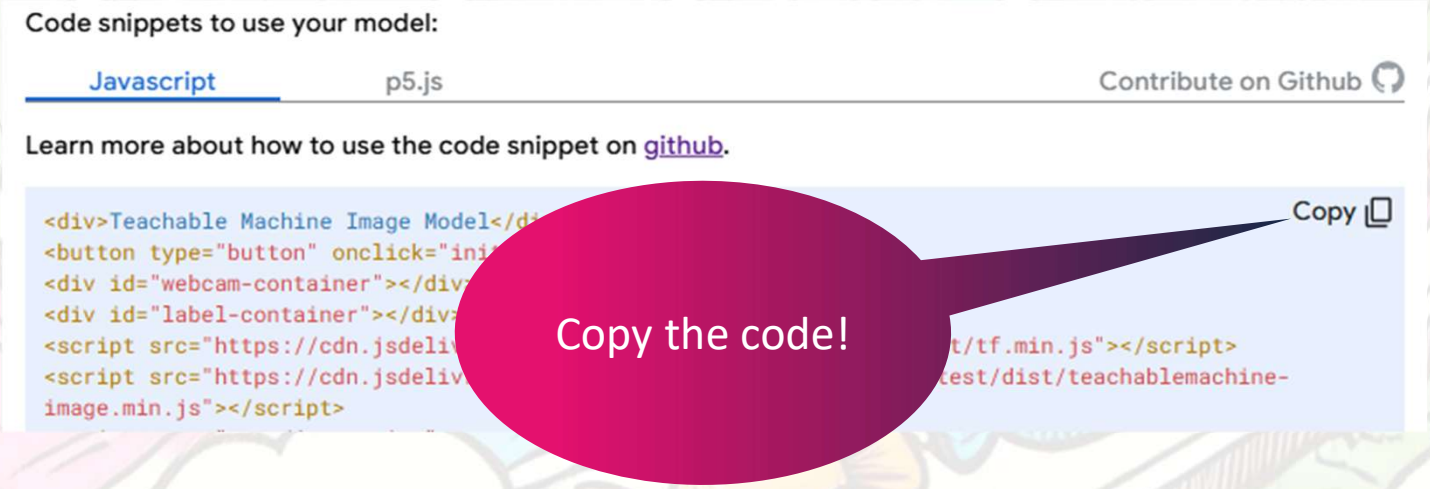
Click **Upload (shareable link)** radio button



You'll also see two important things now. The Sharable link.



And the sample code which will already have the shared link in the code for you.



Use the model!

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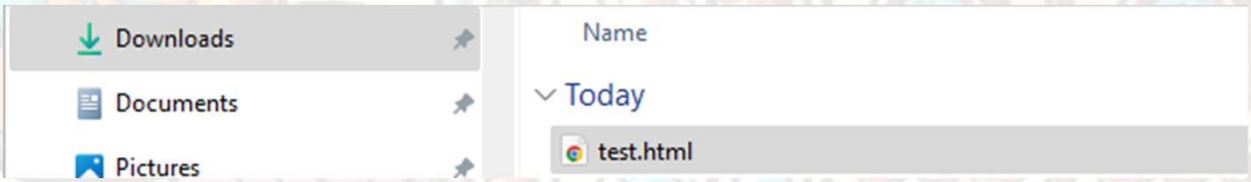
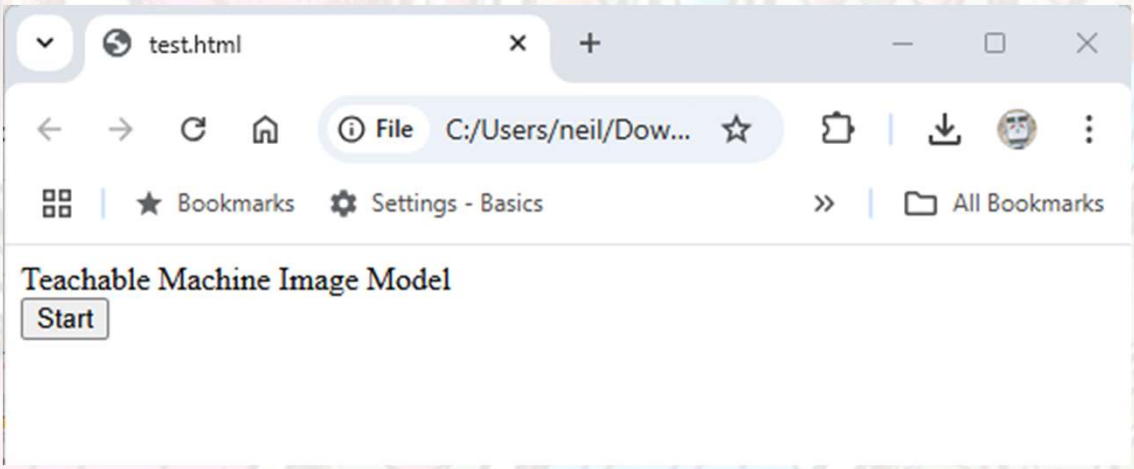
Let's use the sample code.

Open a text editor (Notepad or VS Code) and paste the code into the file.

Save the code into a file as **test.html**. You can save it to the in your **Downloads** folder for ease.

Browse to the **Downloads** folder and double click the file.





Click the **Start** button and wave some sweets in front of the webcam!

Use the model!

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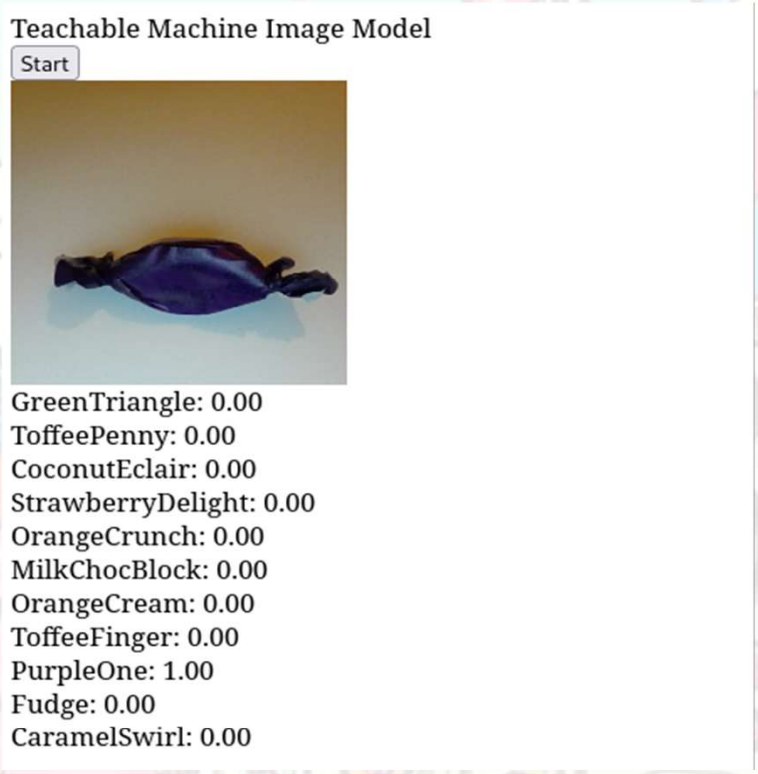
Let's use the sample code.

You are now running your own AI model in a browser!



It's all down to your imagination now. What could you use this technology for?

What about record faces with the class name as an ID to create a login facility? Is that better than a password?

Let's get going!

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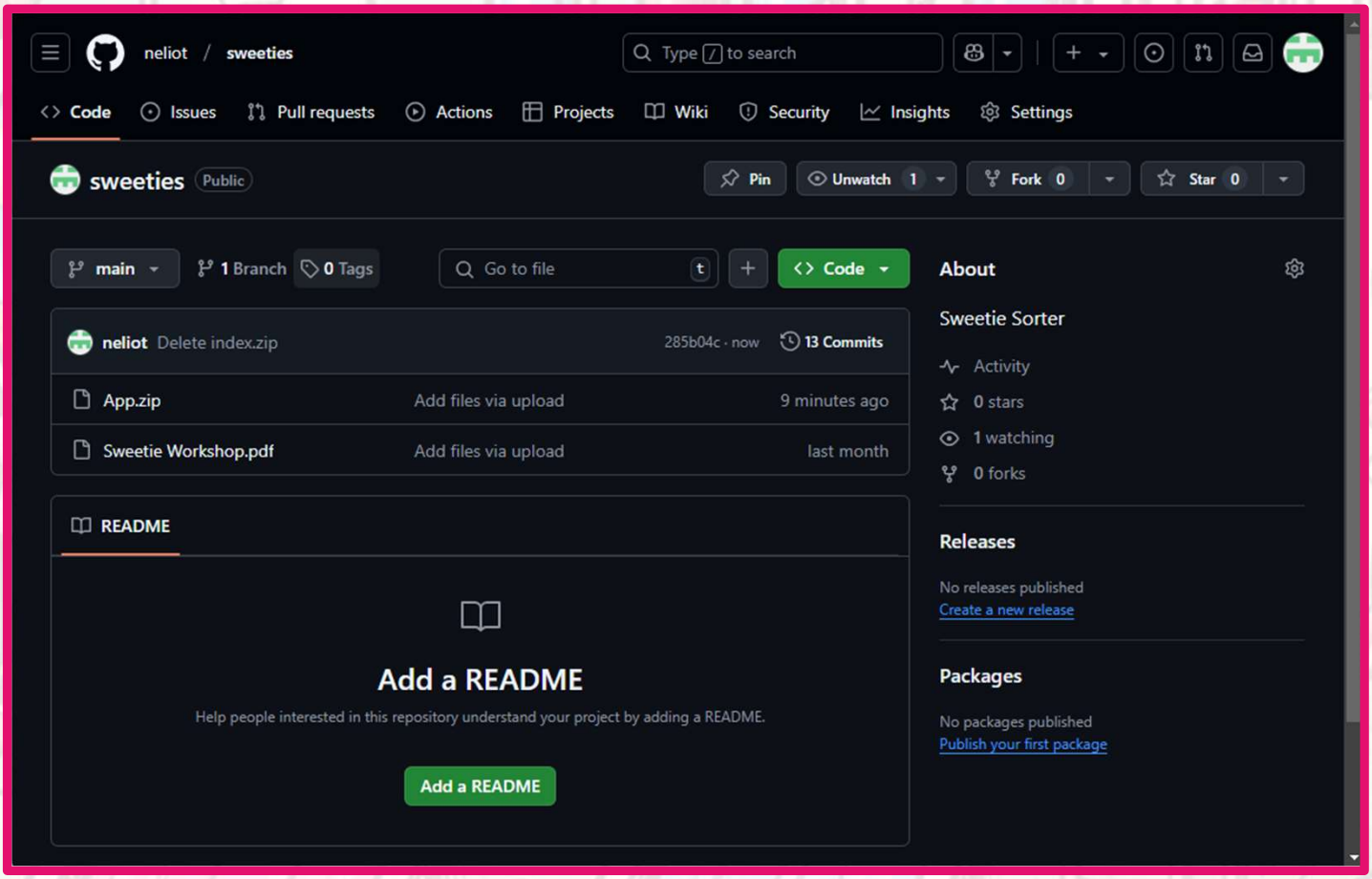
Download the application!

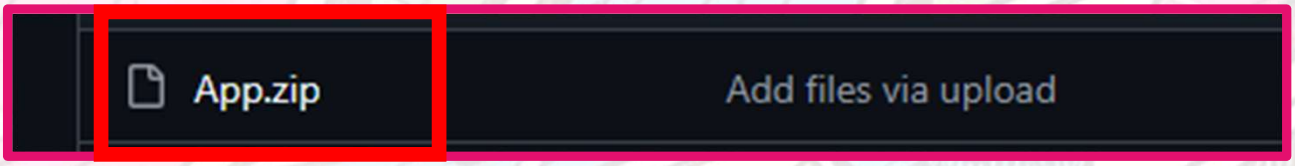
In your browser enter the URL below:

https://github.com/neliot/sweeties

You should see a page similar to the one below:



Click on the App.zip file:



Let's get going!

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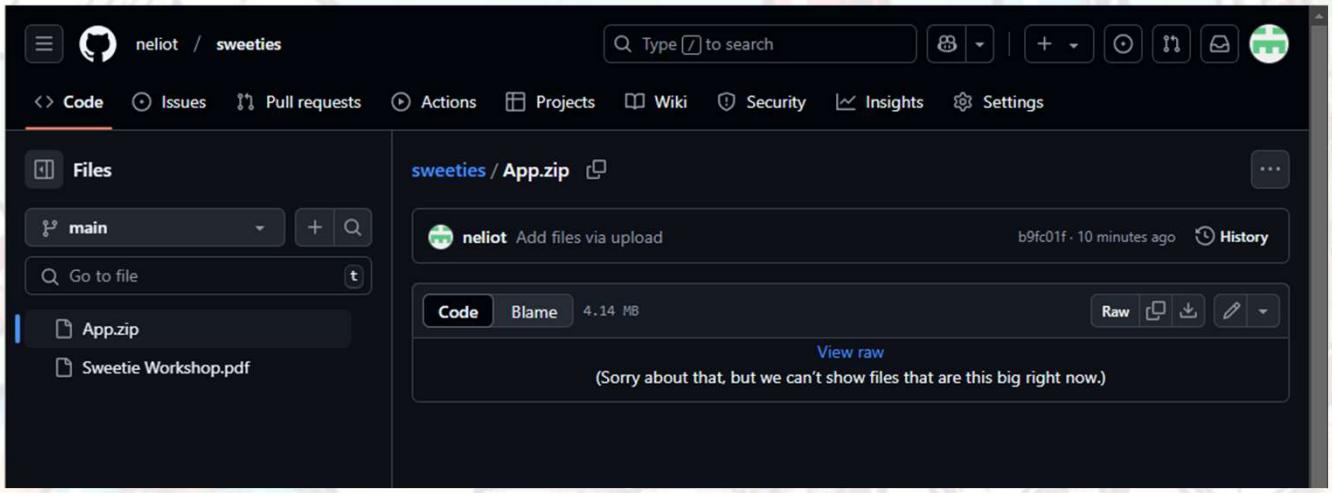
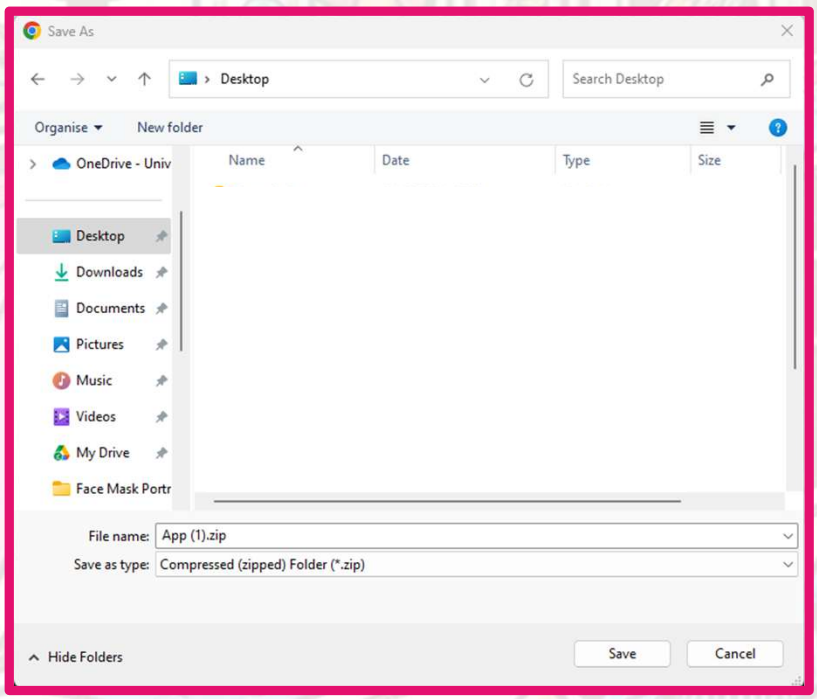
Download the application!

You will now be presented with the following screen:



Click on the download icon and save the file to the Desktop.



Let’s get going!

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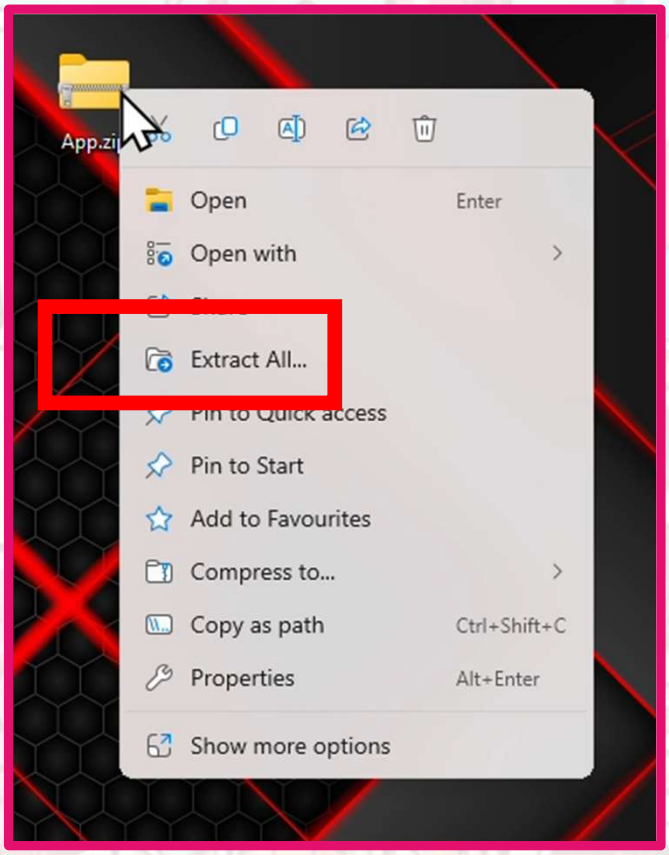
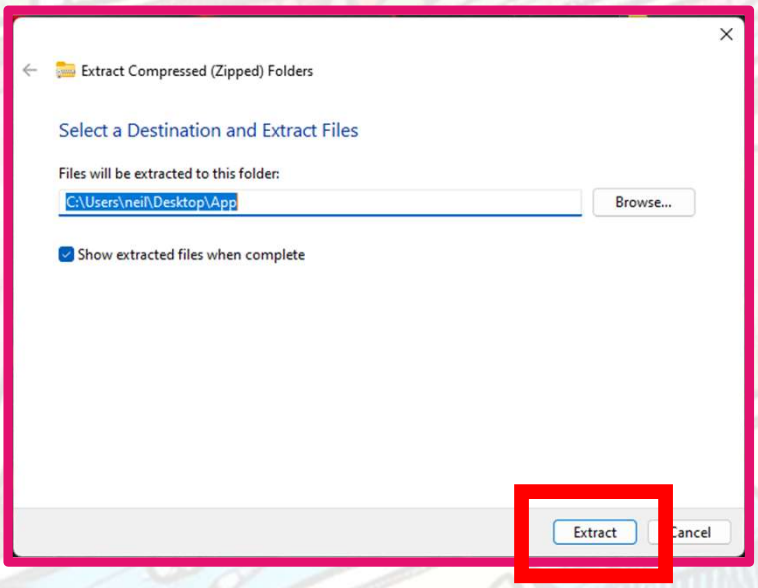
Extract the application!

Go to the desktop and find the file you just downloaded and right click on it.



Select **`Extract All`** and then **`Extract.`**



Let's get going!

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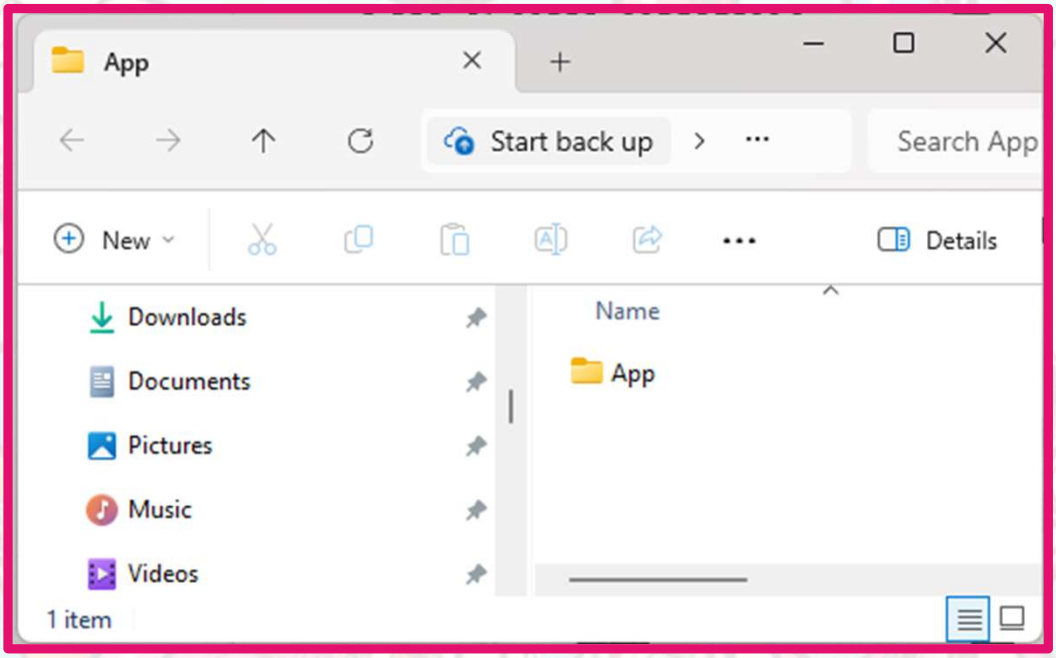
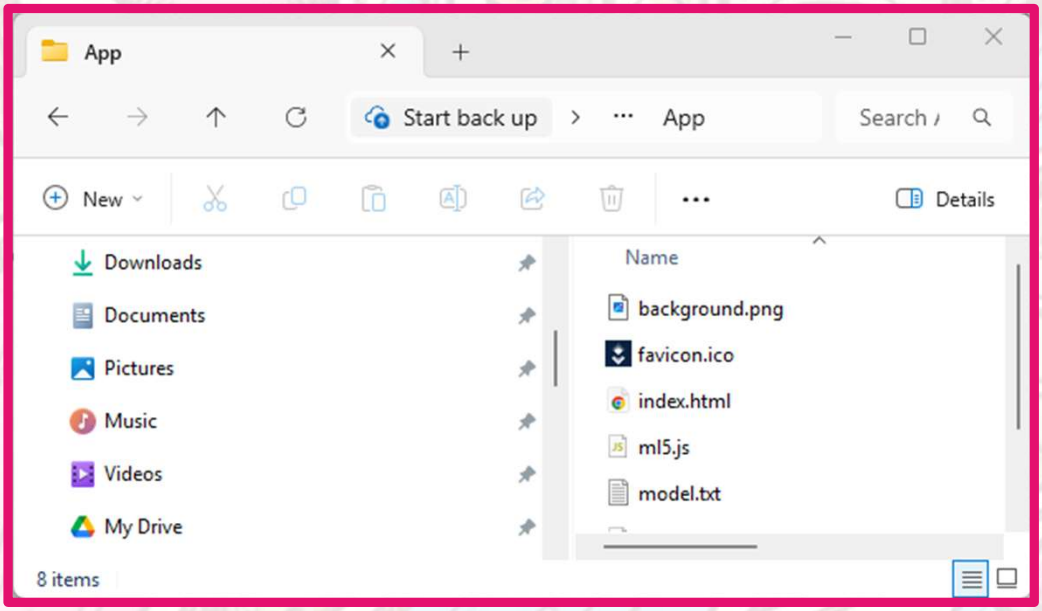
Updating the application model!

You can now see the Extracted application folder.



Go into the **App** folder by double clicking on it.



And now the Editor

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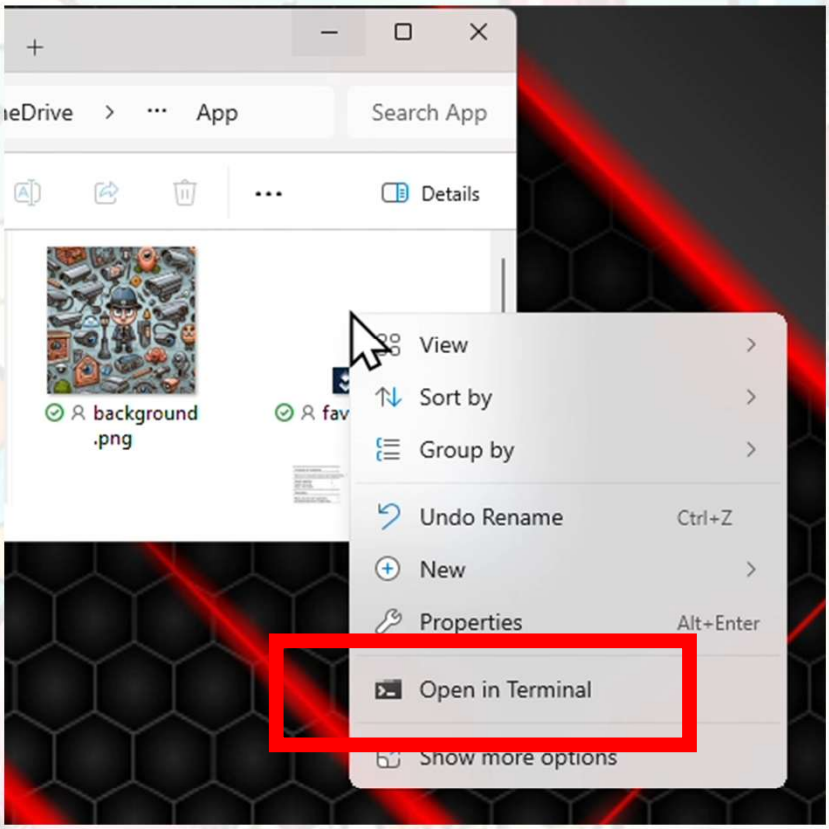
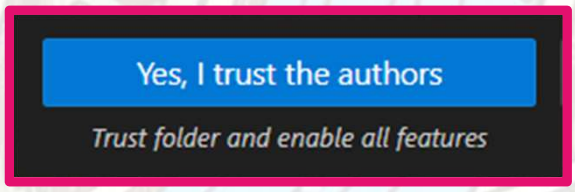
Updating the application model!

`Right Click` in the folder to bring up the **`action menu`** as below:



Select the **`Open in Terminal`** option. When the terminal window opens go to it and type in "**`code .`**" (without the quotes, yes, a dot is required after **`code`**!). Press the **`RETURN`** key. You should now have **`VS Code`** running with the **`App`** folder showing the files. If you get a message asking if you Trust this folder select **`Yes.`**



Use the model!

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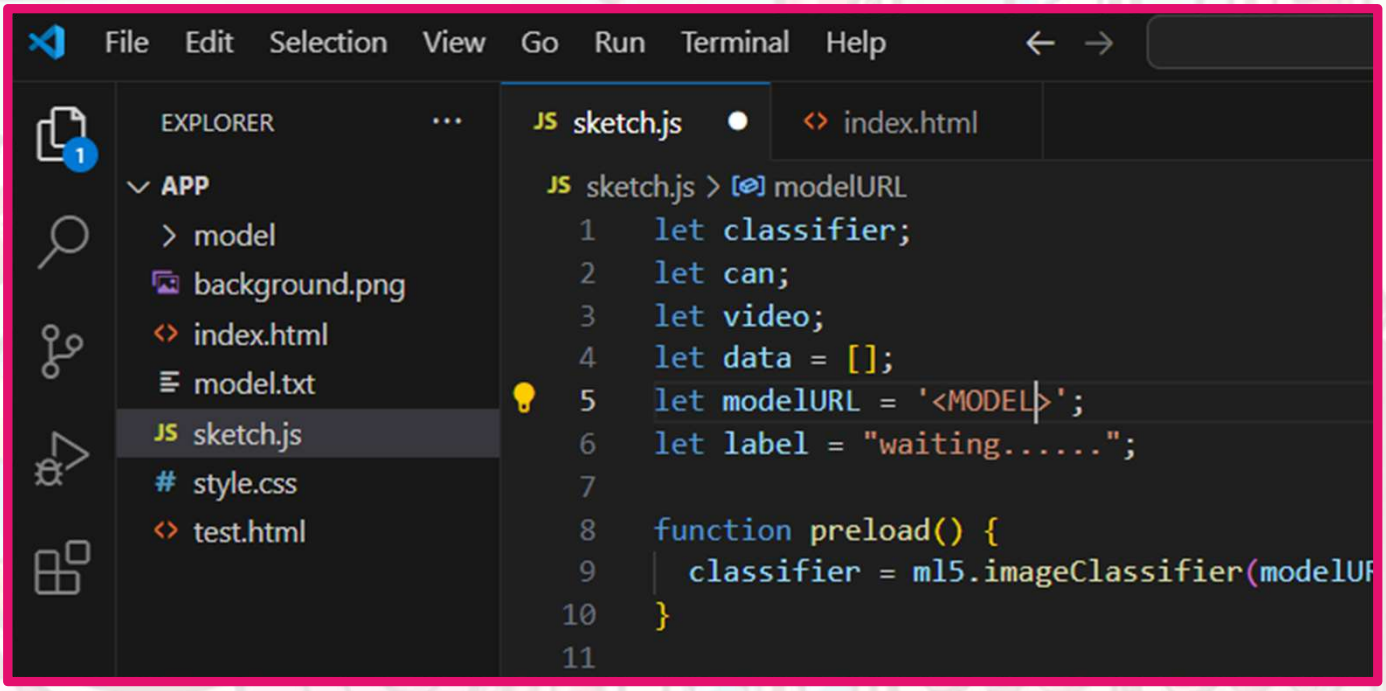
Updating the application model!

Select the **`sketch.js`** file



Replace the **`<MODEL>`** placeholder with the `URL` for the model you create in Teachable Machine.

```
let modelURL = '<MODEL>';
```

```
//let modelURL = '<MODEL>';
let modelURL = 'https://teachablemachine.withgoogle.com/models/hi-QIF4Ck/';
```

And now the Editor

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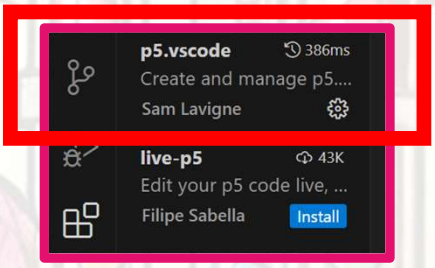
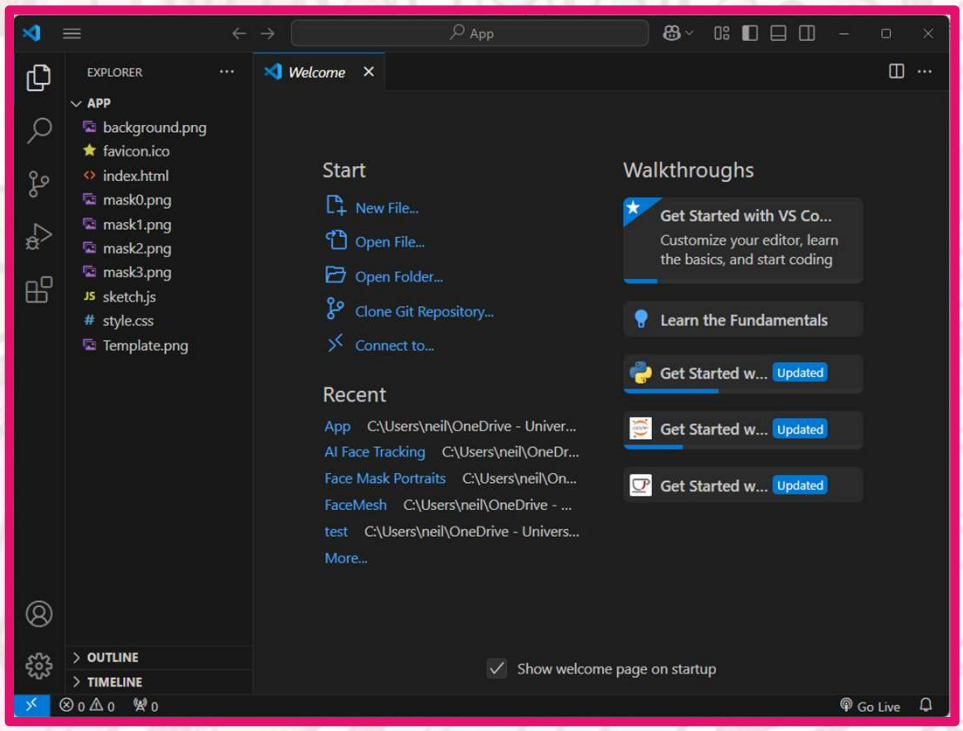
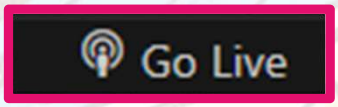
Running the application!

Now you can launch the application. At the bottom of the screen is an option "`Go Live`". This is the built in `Live Server` which is a local web server which runs the application.

If the "Go Live" option isn't displayed call the academic over, they may need to install the `p5.vscode` extension for you!







Use the model!

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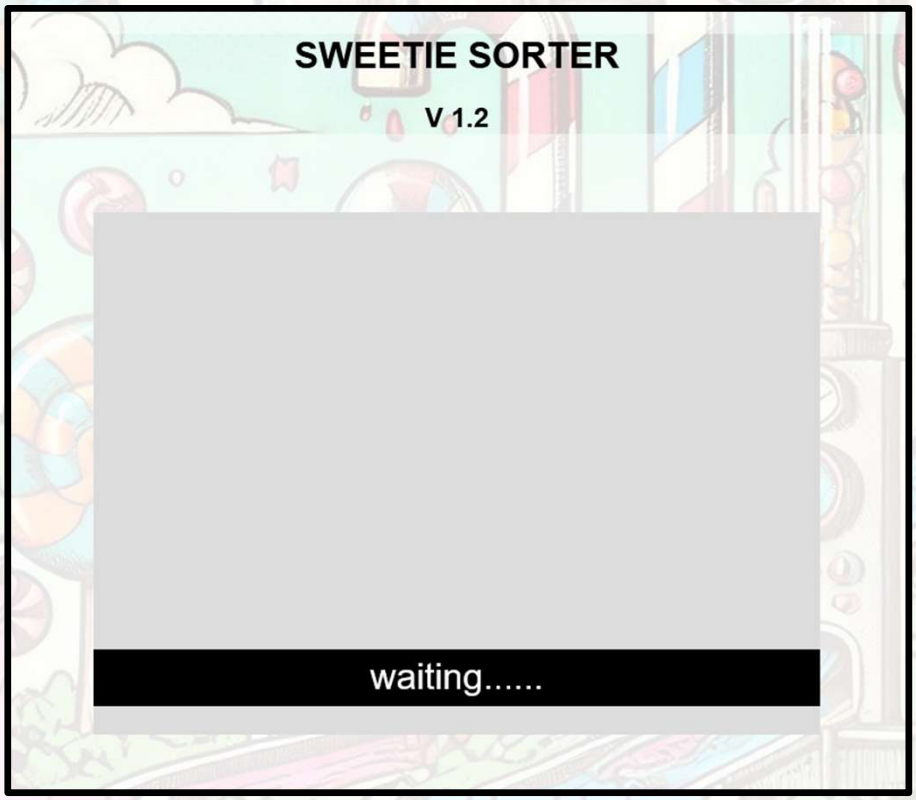
Running the application!

If you didn't manage to create your own model for this. Go back to the folder and there is a text file called "model.txt". It contains a `URL` to a pre-trained sweety model for you.
Each sweet has been scanned on a white background for the model.



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Fancy a Challenge?

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Build a new model of the faces of all the people in your "team" (and other attendees if they are willing) and using the sample application check that the system can identify each of you.

Don't forget to update the model `URL` in the `sketch.js` file.

Don't forget to add the "**None**" class. The model will always try and match to at least one **Class**, so you need a fall back!

Remember no spaces in the **Class** names!