

# High School Visual AI Lesson: PoseBlocks from MIT

Day	Lesson
Day One: Intro, Training Images and Poses	Movement and Visual AI, Training Images and Pose Models with Teachable Machine
Day Two: Projects with PoseBlocks	Interactive AI Systems with PoseBlocks
Day Three: Projects with PoseBlocks + Free Projects	Finish up PoseBlocks projects and start making your own!

## Extra Resources:


<https://dancingwithai.media.mit.edu/curriculum> - Curriculum page

<https://mitmedialab.github.io/prg-extension-boilerplate/create/> - PoseBlocks template

<https://www.media.mit.edu/posts/ai-blocks/> - More MIT Scratch systems outside of PoseBlocks

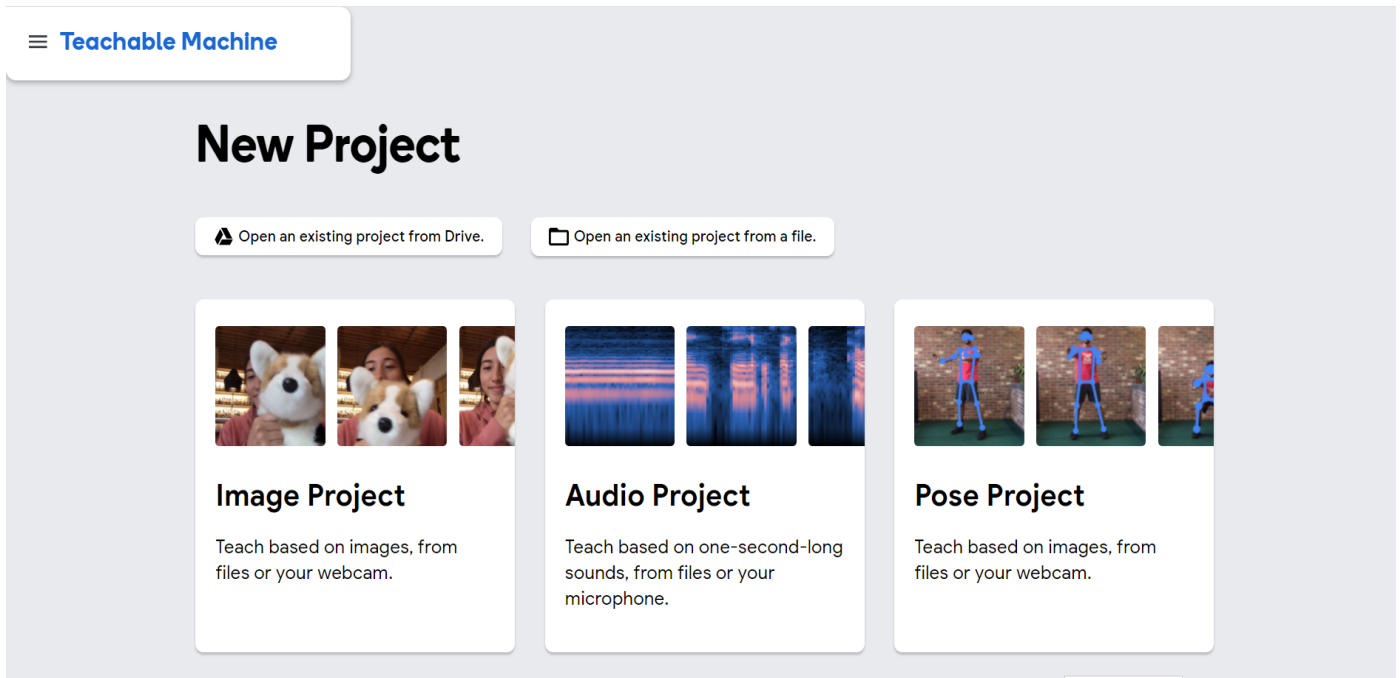
## Day One:

### I. Presentation on Movement and Visual AI:

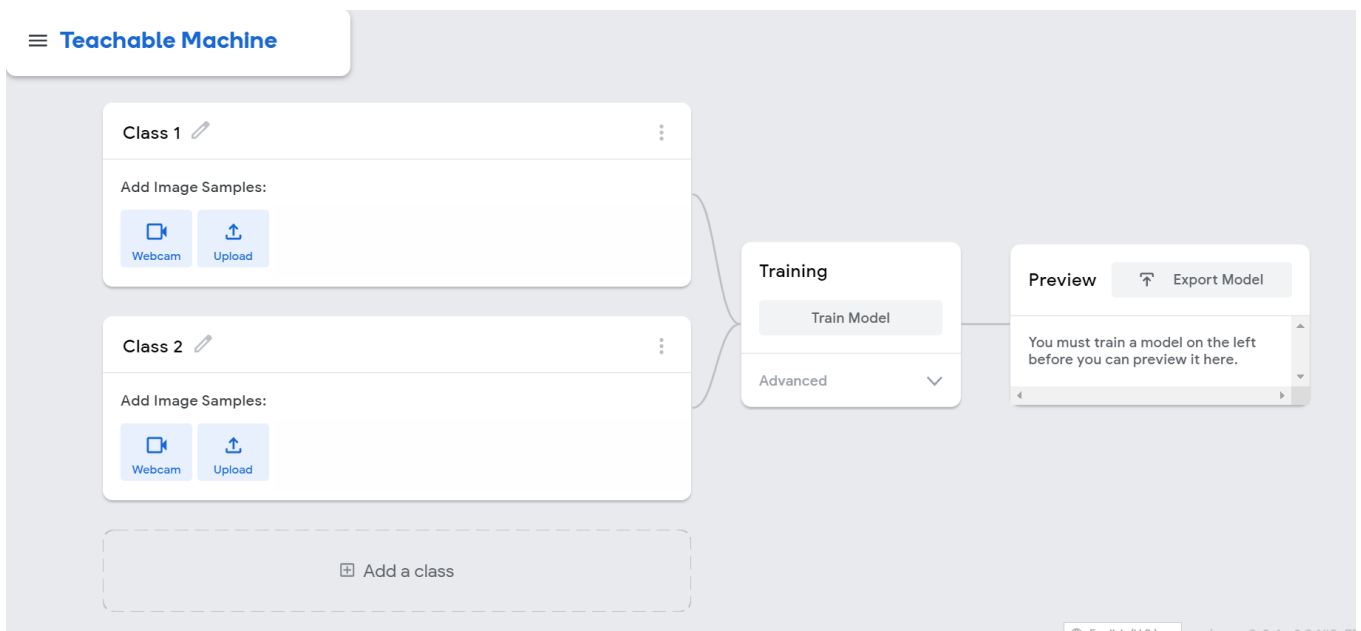
- A. Follow the slideshow link below to reach the presentation. Go through its slides to introduce the concepts of motion, movement, and visual AI/computer vision.
- B. The speaker notes on each slide contain intended talking points for certain parts of the lesson, and examples of what you might say to students to encourage their input or teach the slide concepts in a digestible manner.
- C. The presentation will also cover Teachable Machine with Google! Stop and move to the next section when you reach the Teachable Machine portion of the presentation.
- D.  ModelAI Assignment, Movement and AI - Day 1 (with Quick Draw)

II. Instructions for Teachable Machine:

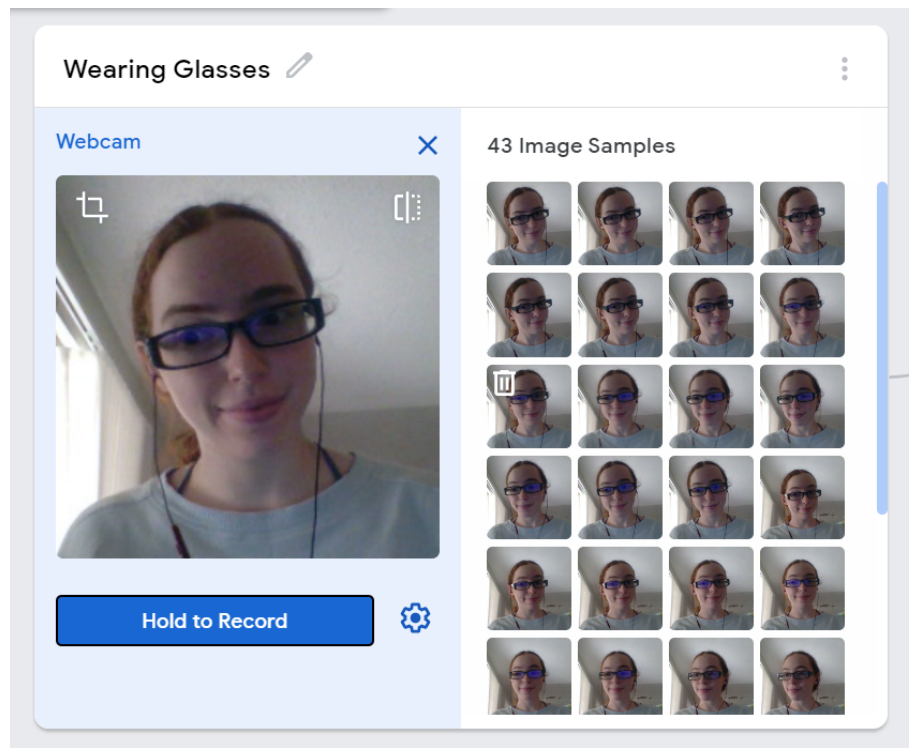
- A. You will demonstrate an image model and a pose model via Teachable Machine. Both are very quick. Follow the link below to reach the training area:  
<https://teachablemachine.withgoogle.com/train>
- B. You will first be brought to this screen that shows you the model options for Teachable Machine.



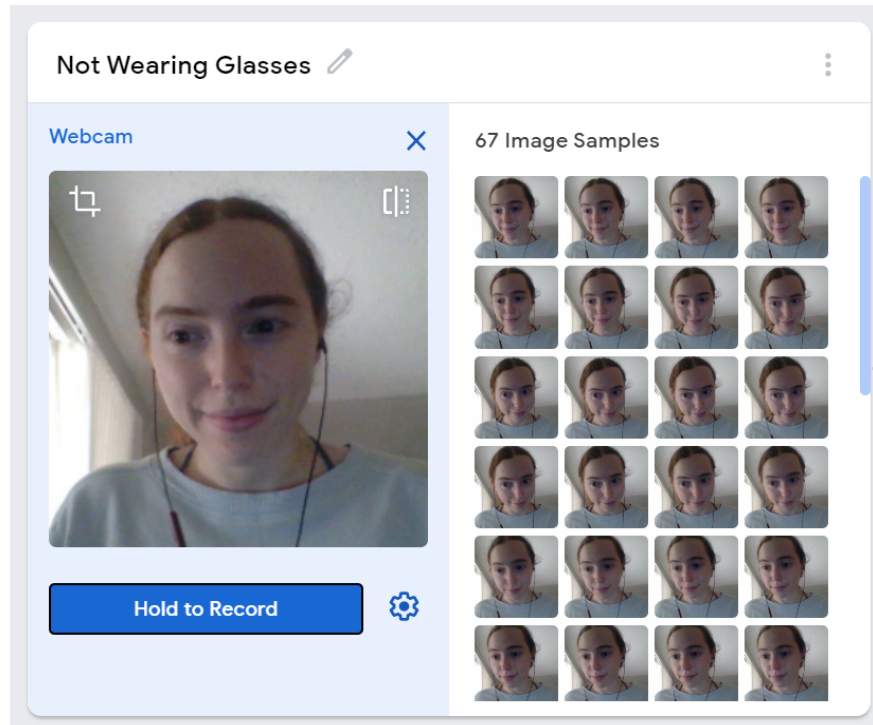
- C. Select Image Project for an Image Model first, and then select Standard Image model from the small pop-up that appears. You will see this screen:



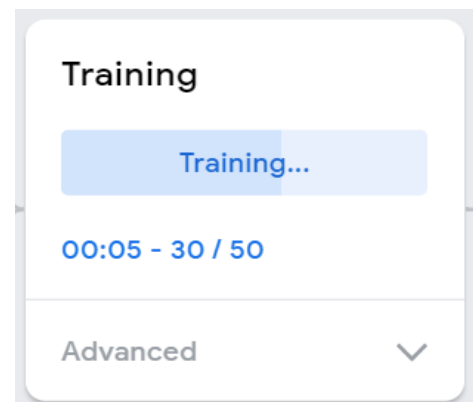
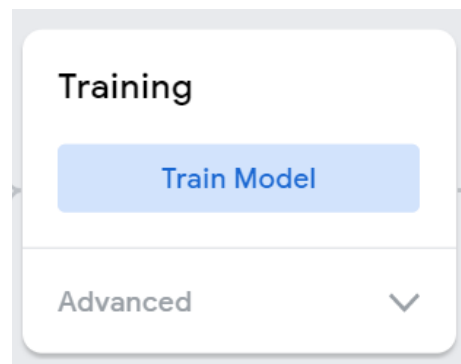
- D. Rename “Class 1” to “Wearing Glasses” and Class 2 to “Not Wearing Glasses” by clicking on the small pencil icon by each of their names.
- E. If you or your students don’t have glasses, you can do an alternate version of the project with the classes “Covering Mouth” and “Not Covering Mouth”. In this case, instead of putting on and taking off glasses, you will cover your mouth with one hand or take it off. All following steps will be the same for this project, except you will be gathering different images and will have different class names.
- F. Under “Wearing Glasses”, turn on your Webcam and click “Hold to Record” to capture images of yourself while glasses are on your face. It captures images very quickly, so move your head around to get different angles. **Get at least 30 image samples for both classes!**



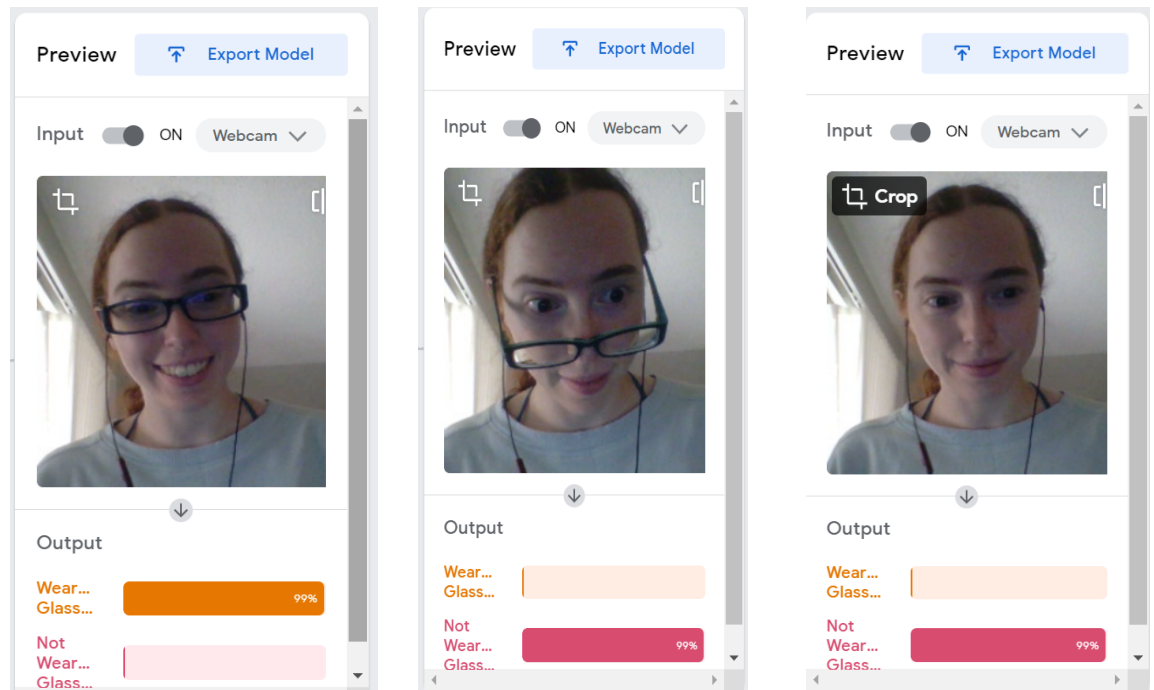
- G. Under “Not Wearing Glasses”, repeat the process, but this time when you have no glasses on your face AND while you’re taking them off. In the case of the alternate project, record when you have no hand on your mouth AND while you’re removing it.



- H. Hit "Train Model" to let Teachable Machine's algorithm begin training the model. It won't take very long for it to run through your images if you didn't record a huge amount.
  
- I. If you want to introduce more advanced concepts of the machine learning process here, you can discuss how one or two common AI algorithms work, and how they might be working in the context of the project the students are training. For example, discuss genetic algorithms used to train neural networks, and the concept of picking the "strongest" candidates to move on to the next level. You can also even just discuss the differences between training and testing data, and how the AI algorithm will utilize both to come up with its best model.



- J. There will be a Preview of your model on the side of the webpage when training is done. It will show a live confidence score and prediction of the model.




- K. The process will be the same for the Pose Model, just with the “Pose Project” option. The model should have a much tougher time distinguishing with glasses or no glasses in the Pose version because the facial/head pose is the same. It should also have difficulties distinguishing “Covering Mouth” and “Not Covering Mouth” for the same reason, although it may do slightly better if it can catch the hand mesh over your face each time.
- L. Return to the presentation and lead the AI weaknesses and ethics activity at its end. You will first help the students brainstorm weaknesses involving their Teachable Machine models, then lead them through a hypothetical AI situation called “Crazy Cake Caper”. When the activity is finished, discuss adversarial data and malicious intent with AI to wrap up the day.

## Day Two:

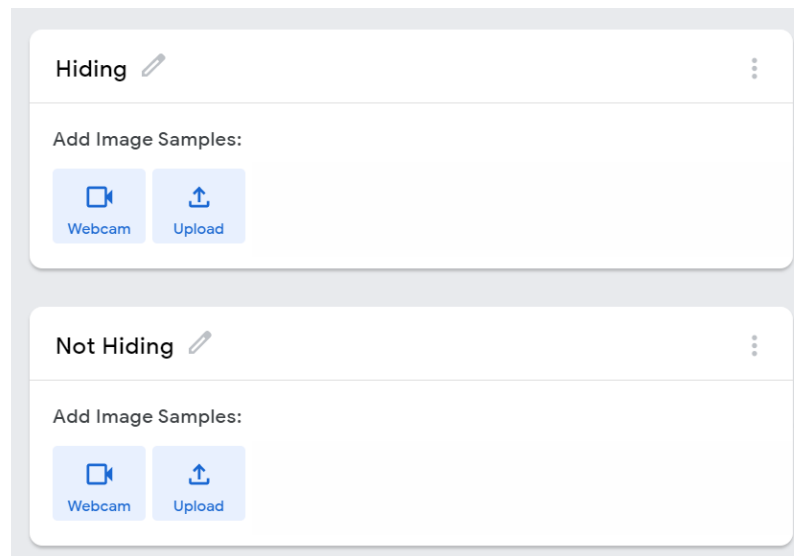
High schoolers will use exported models from Teachable Machine to train their own Scratch projects.

I. Presentation on Movement and Visual AI:

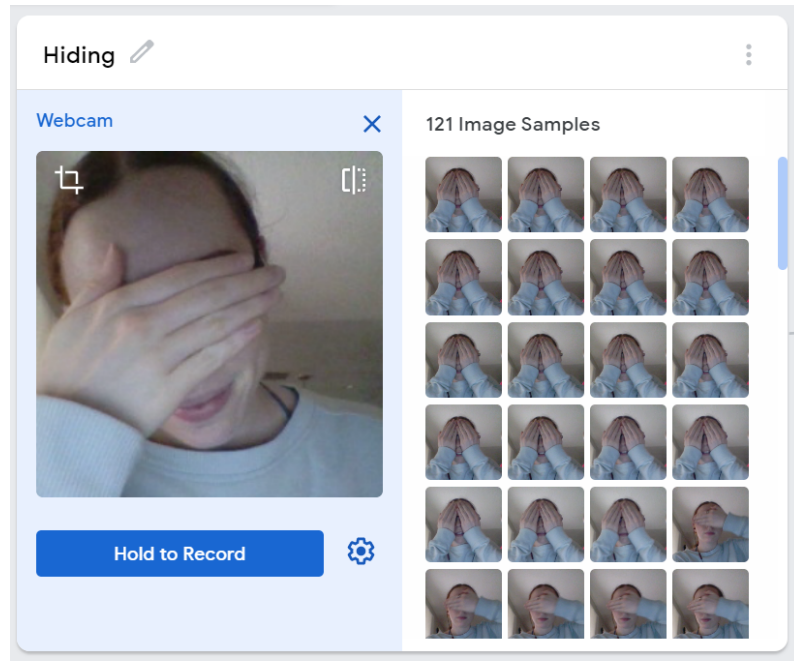
- A. Follow the link below to reach the presentation. Go through its slides to further discuss motion, introduce Scratch, the pre-trained models Scratch has, and the concept of introducing their own models into Scratch.
- B. Stop and move to the next section when you reach the Shake Break portion.
- C.  ModelAI Assignment, Movement and AI - Day 2 (HS)

II. Building Teachable Machine Model for Shy Dog and Exporting as a Link

- A. Follow the link below to reach the Teachable Machine website again. Choose an Image Model for the Shy Dog (ask the students which model they think would work best first - the answer is Image).
- B. <https://teachablemachine.withgoogle.com/train>
- C. Name your two classes “Hiding” and “Not Hiding”.

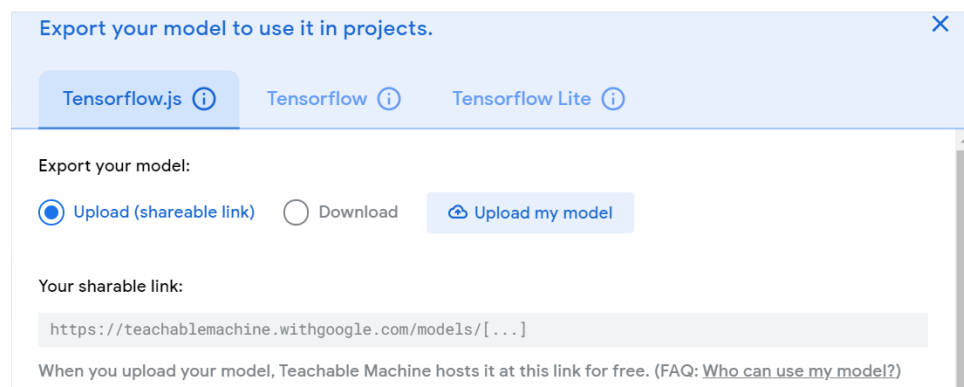


- D. Use the webcam to capture images of you with your hand(s) in front of your eyes for “Hiding”. Capture images of your face exposed for “Not Hiding”. **Remember to get at least 30 images for each.** You might end up with a lot more, though, depending on how many positions with your hands over your eyes that you try.

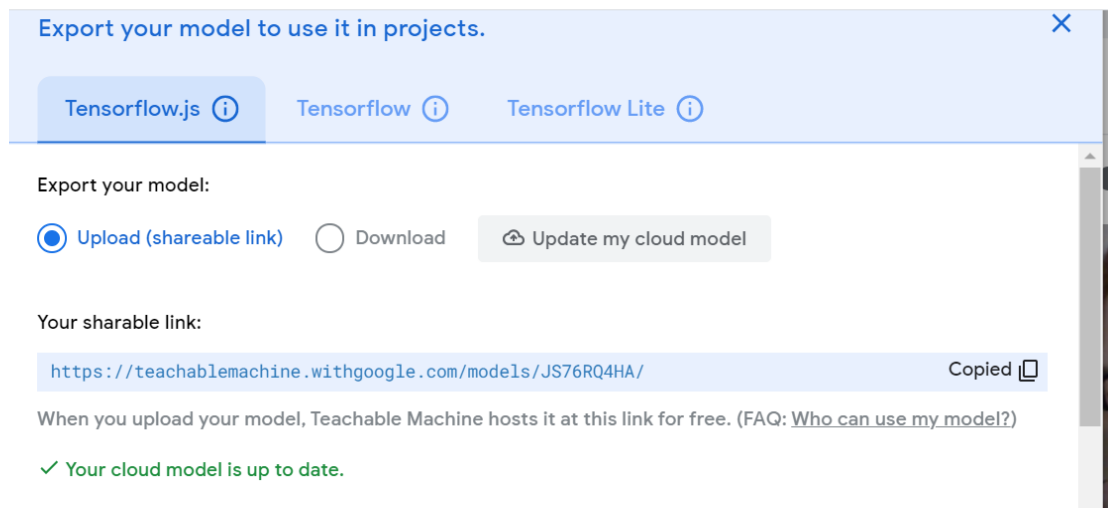


E. Train the model on the data you've collected by clicking the "Train Model" button. If you want to introduce more advanced concepts of the machine learning process here, you can discuss how one or two common AI algorithms work, and how they might be working in the context of the project the students are training. For example, discuss genetic algorithms used to train neural networks, and the concept of picking the "strongest" candidates to move on to the next level. You can also even just discuss the differences between training and testing data, and how the AI algorithm will utilize both to come up with its best model.

F. When the Preview comes up this time, click "Export Model". Upload it as a shareable link under the TensorFlow.js tab (darkened tab at the top of the image).



- G. Click “Upload my model” once your features are selected, then copy the link that is generated.



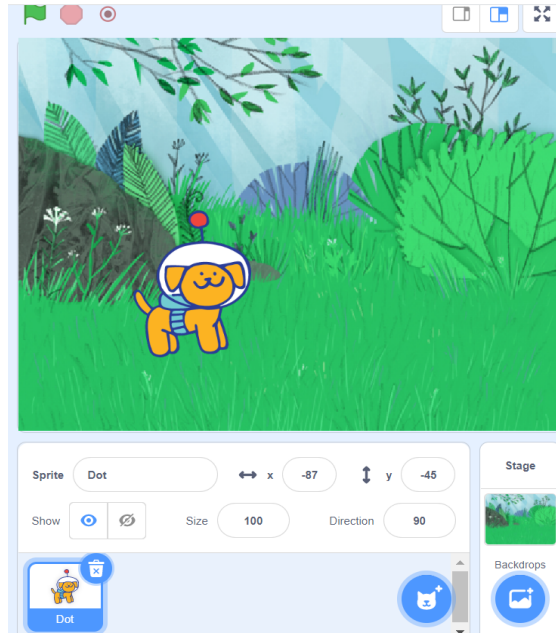
- H. When your model is uploaded, the algorithm that you’ve trained is uploaded to the Google servers, but your pictures and examples are not! Those are kept private!
- I. Here is an example model link:  
<https://teachablemachine.withgoogle.com/models/JS76RQ4HA/>

### III. Using the Model link in Scratch and Building the Shy Dog Project

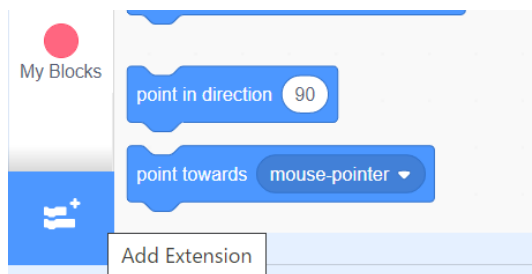
- A. Begin the Shy Dog project in Scratch. Refer to this link for the full project if needed:  
<https://mitmedialab.github.io/prg-extension-boilerplate/create/?project=https://dancingwithai.media.mit.edu/projects/NewShyDog.sb3>



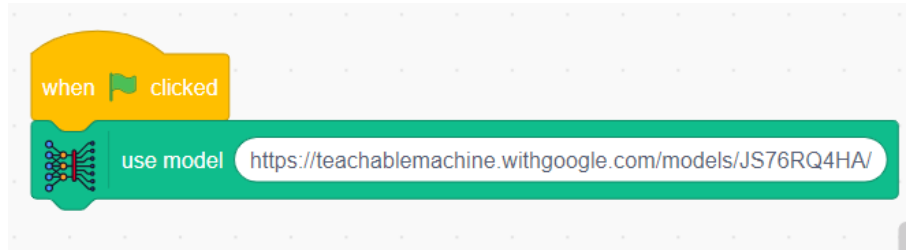
- B. Go to the lower right corner of the Scratch screen and select the Backdrops icon. Pick a good backdrop, like the “Forest” one pictured below.
- C. In the Sprite area, pick Dot the dog as your new Sprite by clicking on the cat-like Sprite icon in the lower right and finding Dot in the gallery.



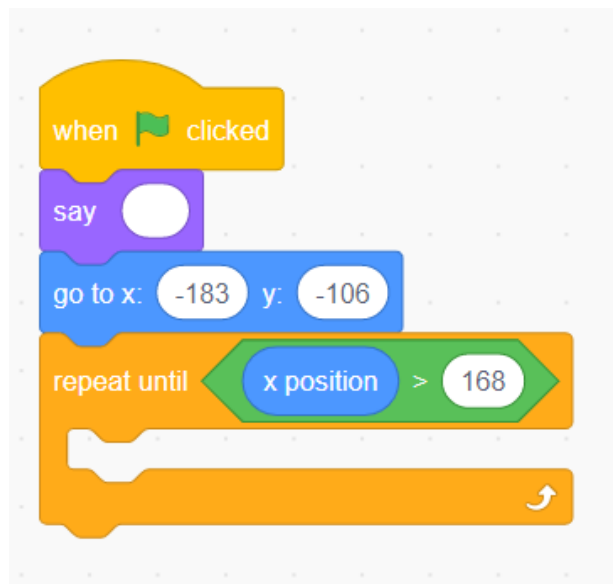
- D. You'll have to add the block options for Teachable Machine in order to follow this activity. Do this by clicking on the “Add Extension” option in the bottom left corner of the screen and selecting “Teachable Machine” from the options that pop up.



- E. Create the following code to import your Teachable Machine model. Paste your model URL in the blank space. Remember, this URL is retrieved from the shareable link that you copied from the Teachable Machine page.



- F. Add the following set of blocks to your code under a new Green Flag clicked event.



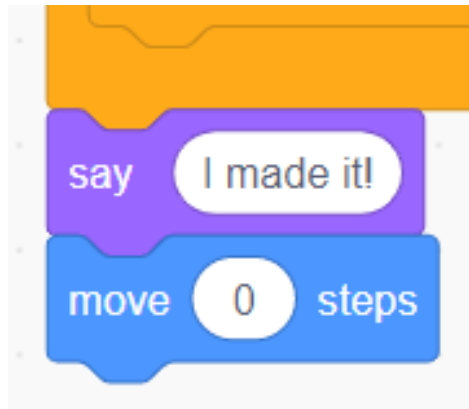
- G. Add this code within the repeat until section from the previous image. **The first time you work with the code, you'll also need to click the Green Flag once to import your model so that the code can then find your class names from the Teachable Machine model.**

```
repeat until (x position > 168)
  switch costume to dot-a
  if (prediction is Not Hiding) then
  else
```

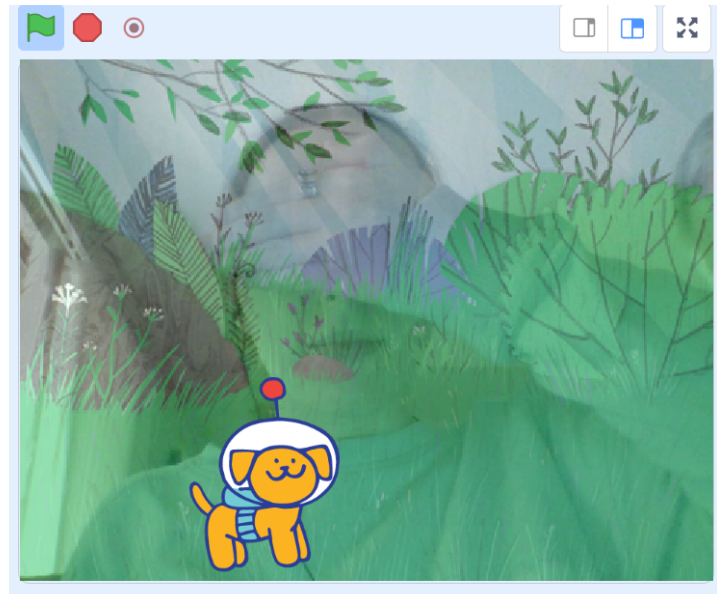
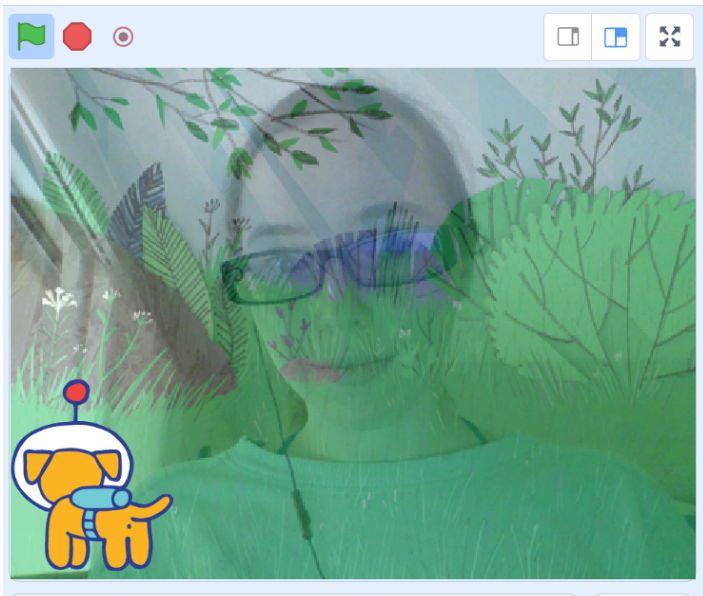
H. Finish filling out the code for the conditional statements.

```
repeat until (x position > 168)
  switch costume to dot-a
  if (prediction is Not Hiding) then
    switch costume to dot-d
    move 0 steps
  else
    switch costume to dot-a
    move 2 steps
```

- I. Add the final two blocks to the bottom of your code.



- J. Click the Green Flag to test it out.



- K. If there is free time after the project, introduce the high schoolers to the Pre-Trained Models (see the Middle School curriculum for example projects with these) and lead them through a complicated pre-trained model project like this one:

<https://mitmedialab.github.io/prg-extension-boilerplate/create/?project=https://dancingwithai.media.mit.edu/projects/FingerFoodNinja.sb3>

### **Day Three:**

Help students who haven't finished projects from previous days finish, and allow time for free builds of their own projects.