



**TITLE:** Programing object detection in Scratch

**LEARNING SCENARIO**

|                 |                            |       |
|-----------------|----------------------------|-------|
| <b>School:</b>  | <b>Duration (minutes):</b> | 90    |
| <b>Teacher:</b> | <b>Students' age:</b>      | 13-14 |

**Essential Question:**

How to program object detection in Scratch

**Topics:**

- Programing object detection in Scratch

**Aims:**

- To learn to program object detection with uploaded examples

**Outcomes:**

- Knowing how to write a program for object detection using Scratch

**Work forms:**

- *work in pairs, group work*

**Methods:**

- *presentation, talk, discussion, interactive exercise*

**ARTICULATION**

**Course of action (duration in minutes)**

**INTRODUCTION**

In order to understand object detection, let's review what we have learned so far.

*What is object detection?*

*How does object detection work?*

Object detection is a computer vision technique whose purpose is to identify and locate objects within an image or video. Specifically, object detection draws bounding boxes around these detected objects, which allow us to locate where said objects are in (or how they move through) a given scene. Before we start





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programming object detection, we must collect the photos of specific faces and train the model. We will use an application called Teachable Machine. Teachable Machine is a web-based tool that makes creating machine learning models fast, easy, and accessible to everyone.

**Defining the goal of the lesson:**

Understanding of object detection program and its usage through examples.

**MAIN PART**

**TASK: Is it a cat or a dog?**

Create a model and program that will detect whether a cat or a dog is in the camera stream.

**WEB BASED APPLICATION (no software installation)**

Step 1: Open your web browser, select, and download images from: <https://bit.ly/cats-image-dataset>

It will be used to train Class 1

Step 2: Open your web browser, select, and download images from: <https://bit.ly/dogs-image-dataset>

It will be used to train Class 2

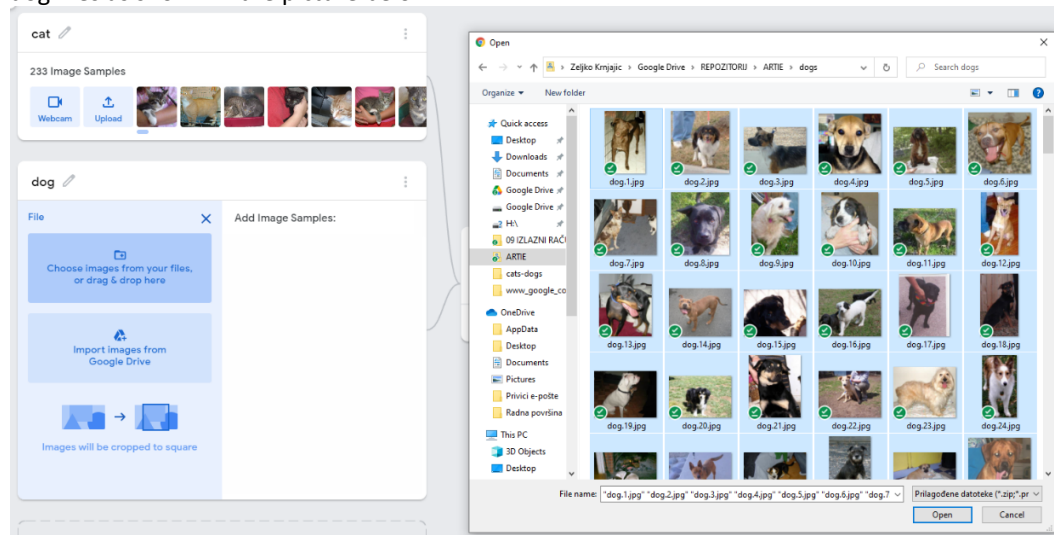
Step 3: Open your web browser and go to: <https://teachablemachine.withgoogle.com/>

Step 4: Click on Get started.

Step 5: Choose the Image project

Step 6: Choose the Standard image model

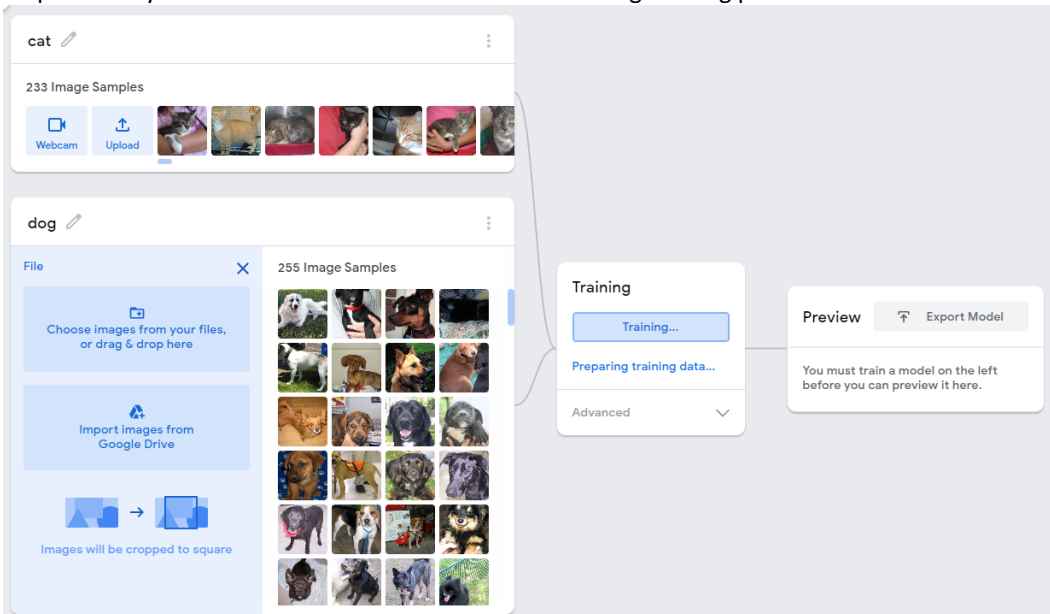
Step 7: Change Class 1 name to cat and Class 2 to dog. Upload cats' images to cat files and dogs' images to dog files as shown in the picture below



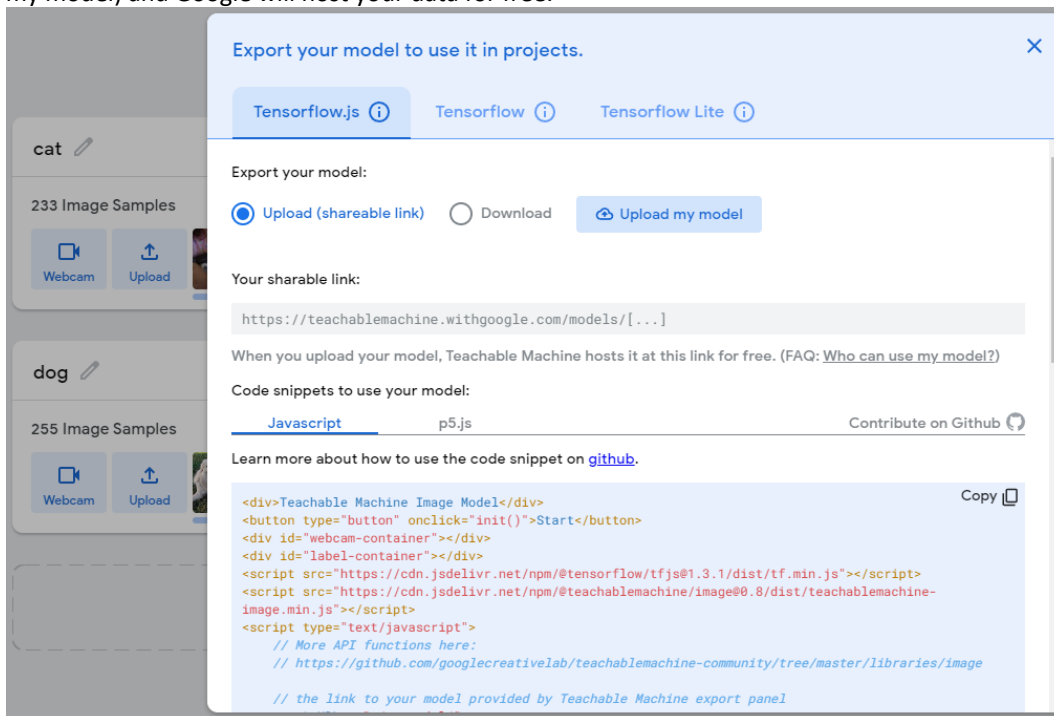


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**Step 8: Train your model. Don't switch browser tabs during training process.**



**Step 9: Export your model. On the pop-up window choose to upload it to the cloud (third option - Upload my model) and Google will host your data for free.**

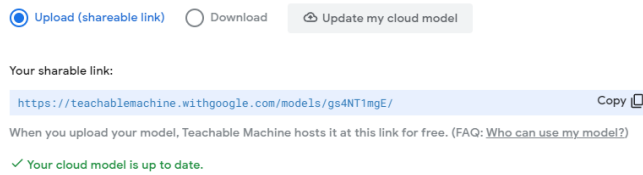




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Step 10: Copy the link given in the text field below - this is the URL of your model.

In my case it was <https://teachablemachine.withgoogle.com/models/gS4NT1mgE/>



Step 11: Your model is ready to use

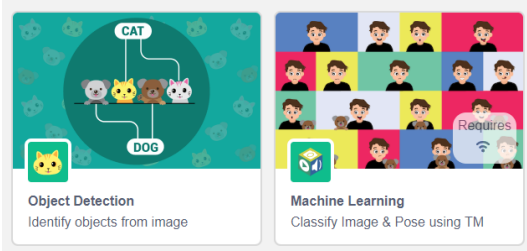
PICTOBLOX (Desktop application):

Step 1a: Download and install **PictoBlox** since it's currently the only one with object detection capability.

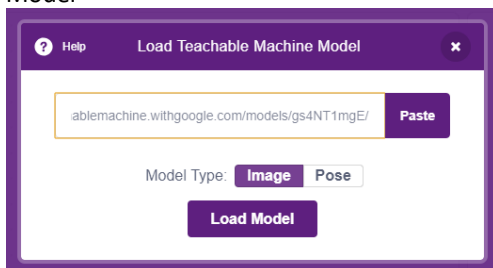
It's desktop type application and you must install it first from

<https://thetempedia.com/product/pictoblox/download-pictoblox/> (427 Mb)

Step 2a: Load extensions Object Detection and Machine Learning.



Step 3a: Select Machine Learning group and choose Load a Model. Paste the model link from teachable machine (below): <https://teachablemachine.withgoogle.com/models/gS4NT1mgE/> and click on Load Model

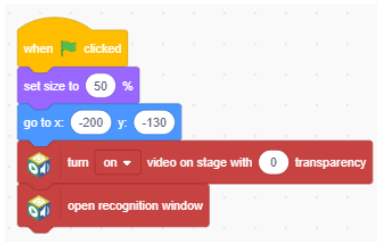


Step 4a: We will perform an object classification and object detection simultaneously. First, we must start the program, resize, and move the Tobi sprite in lower left corner. The next few blocks from Machine Learning extension are used to turn on the video and open recognition window. Use turn on flipped video on stage with 0 transparency if your video is flipped.

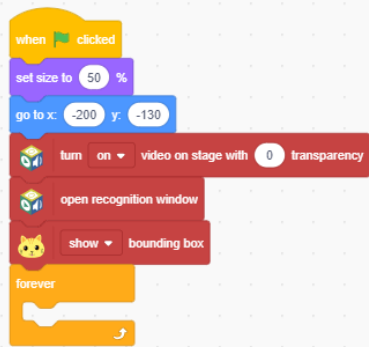




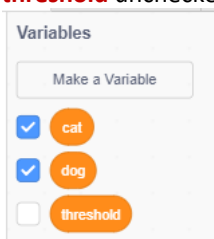
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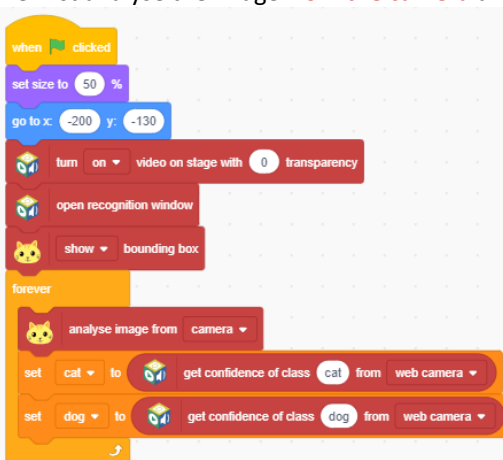
Step 5a: From Object Detection extension use **show bounding box** block to display the position of an object in the video stream and add a forever loop block.



Step 6a: Make 3 variables **cat**, **dog** and **threshold**. Display **cat** and **dog** on stage by checking it. Leave the **threshold** unchecked.



Step 7a: First, insert **set threshold to 0.97** block before forever loop. And now here is the main part in which we first analyse the image **from the camera** and store the confidence **of class** values in variables.



Step 8a: It is followed by a double if-then-else block and 2 class detector blocks followed by say "cat" or "dog". If nothing is detected, the speech balloon text is "Not sure".

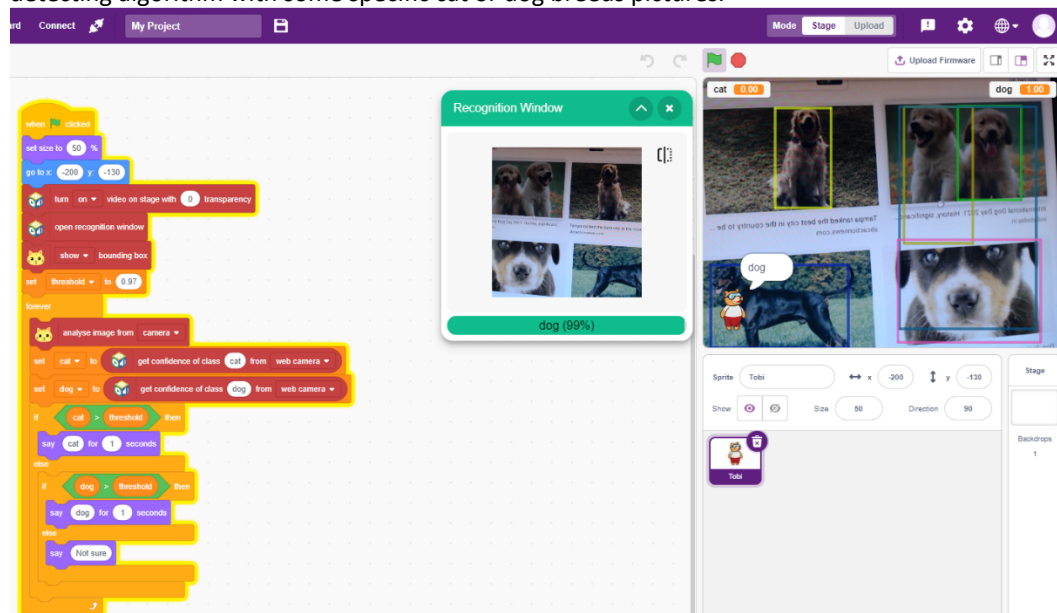




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```
when clicked
  set size to 50 %
  go to x: -200 y: -130
  turn on video on stage with 0 transparency
  open recognition window
  show bounding box
  set threshold to 0.97
  forever
    analyse image from camera
    set cat to get confidence of class cat from web camera
    set dog to get confidence of class dog from web camera
    if cat > threshold then
      say cat for 1 seconds
    else
      if dog > threshold then
        say dog for 1 seconds
      else
        say Not sure
```

Step 9a: Start the program and test it on your cat or dog. If you don't have any near you, Google images are here, just search for dog/cat pictures and point your web camera to screen with results. You will see the bounding boxes around detected objects. Try to lower or increase the threshold value or try to confuse the detecting algorithm with some specific cat or dog breeds pictures.



## CONCLUSION





***So what exactly is object detection?***

To answer that question let's start with image classification. In this task we've got an image and we want to assign it to one of many different categories (e.g. car, dog, cat, human,...), so basically we want to answer the question "What is in this picture?". Note that one image has only one category assigned to it. In simple words, object detection is a type of image classification technique, and besides classifying, this technique also identifies the location of the object instances from a large number of predefined categories in natural images.

Discuss the threshold and precision of the detection.

Do the K.W.L. (**K**now, **W**ant, **L**earned) chart with your students.

| What I <b>K</b> now | What I <b>W</b> ant to Know | What I <b>L</b> earned |
|---------------------|-----------------------------|------------------------|
|                     |                             |                        |

***Methods***

*presentation*  
*interactive exercise / simulation on the computer*

***Work forms***

*work in pairs*  
*group work*

***Material:***

- <https://bit.ly/cats-image-dataset>
- <https://bit.ly/dogs-image-dataset>
- <https://teachablemachine.withgoogle.com/>
- <https://teachablemachine.withgoogle.com/models/gS4NT1mgE/>
- <https://thetempedia.com/product/pictoblox/download-pictoblox/>

***Literature***

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PERSONAL OBSERVATIONS, COMMENTS AND NOTES

