



TITLE: Object detection and classification for beginners in Scratch

LEARNING SCENARIO

School:	Duration (minutes):	90
Teacher:	Students' age:	13-14

Essential Question:

What is object detection and classification?

Topics:

- Object detection and classification for beginners in Scratch

Aims:

- To learn what is object detection and classification for beginners in Scratch

Outcomes:

- Understanding what object detection and classification is with the help of simple example in Scratch
- Understanding the difference between Object detection and Object classification

Work forms:

- *work in pairs, group work*

Methods:

- *presentation, talk, discussion, interactive exercise*

ARTICULATION

Course of action (duration in minutes)

INTRODUCTION

What do your students think the difference between Object detection and Object classification is?

Object detection and classification have attracted much attention in the past decades. In the computer vision field, one of the most common questions has to do with the difference between image classification, object detection and image segmentation.





Let's start with understanding of what image classification is:
Consider the image below:





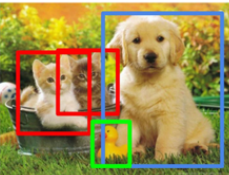
You recognize it instantly. It's a dog. Take a step back and analyse how you came to this conclusion. You were shown an image and you classified the class it belonged to (a dog, in this instance). And that, in a nutshell, is what Image Classification is all about.

As you saw it, there's only one object here: a dog. We can easily use an image classification model and predict that there's a dog in the given image. But what if we have both a cat and a dog in a single image?



We can train a multi-label classifier in that instance. But we won't know the location of either animal/object in the image. That's where Image Localization comes into the picture. It helps us to identify the location of a single object in the given image. In case we have multiple objects present, we then rely on the concept of **Object Detection**.

We can predict the location along with the class for each object using OD.

Classification	Classification + Localization	Object Detection
		
CAT	CAT	CAT, DOG, DUCK

Defining the goal of the lesson:

Introduction in object detection and classification for beginners through examples of different applications.

MAIN PART





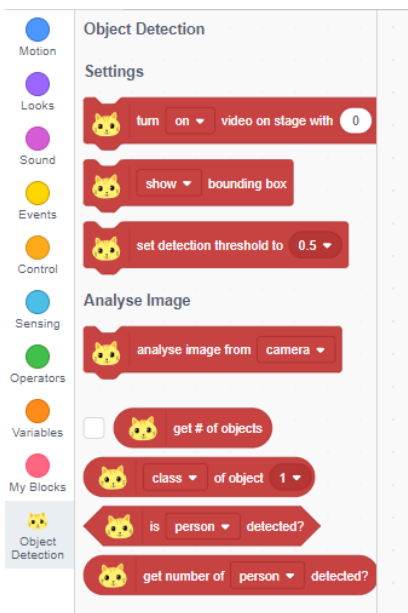
Application with object detection

PictoBlox is currently the only application with object detection capability. It's a desktop type application and you must install it first from <https://thestempedia.com/product/pictoblox/download-pictoblox/> (427 Mb)

Step 1: After installation load Object detection extension



Step 2: These are the blocks available for coding.

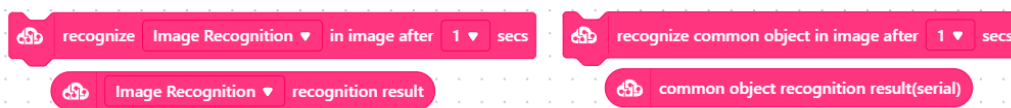


First 3 blocks are camera stream settings, and the others are used for analysing and reporting

Situation with object classification is much better since we have few more applications to use (beside PictoBlox)

Makeblock (mBlock) - <https://ide.mblock.cc/>

Load Cognitive services extension and you will find 4 blocks to use for object recognition (classification).



Makeblock also provides Teachable machine extension (not to be confused with Google's) where you can train up to 3 classes and use it for object classification.





ARTIE: Artificial Intelligence in Education - challenges and opportunities of the new era:
development of a new curriculum, guide for educators and online course for students
Project co-funded by European Union under Erasmus+ Programme, 2020-1-HR01-KA201-077800

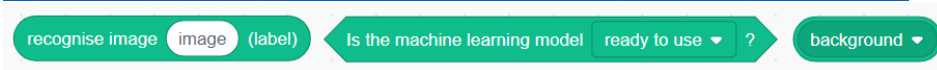
Scratch (ML4KIDS) - <https://machinelearningforkids.co.uk/scratch3/>

Load Imagenet extension.



3 blocks are available. Use it in combination with Video sensing extension to turn camera video on/off and set transparency. It has been trained to recognize photos of one-thousand common objects. The machine learning model is based on MobileNet (a ML model designed for mobile devices, so it doesn't need much computing power). Complete list of objects is available here:

<https://storage.googleapis.com/download.tensorflow.org/data/ImageNetLabels.txt>

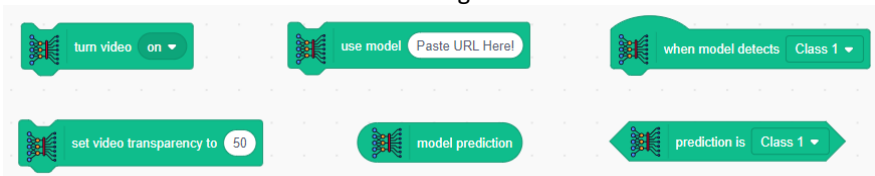


Scratch (MITMEDIALAB) - <https://mitmedialab.github.io/prg-extension-boilerplate/create/>

Load Teachable machine extension



Use these blocks in combination with Google Teachable machine.



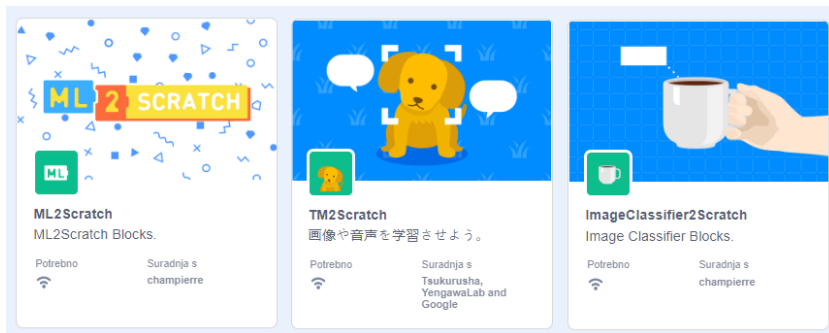
Stretch3 (github.io) - <https://stretch3.github.io/>

Load ML2Scratch, TM2Scratch and ImageClassifier2Scratch extensions to use plenty blocks for object classification and training

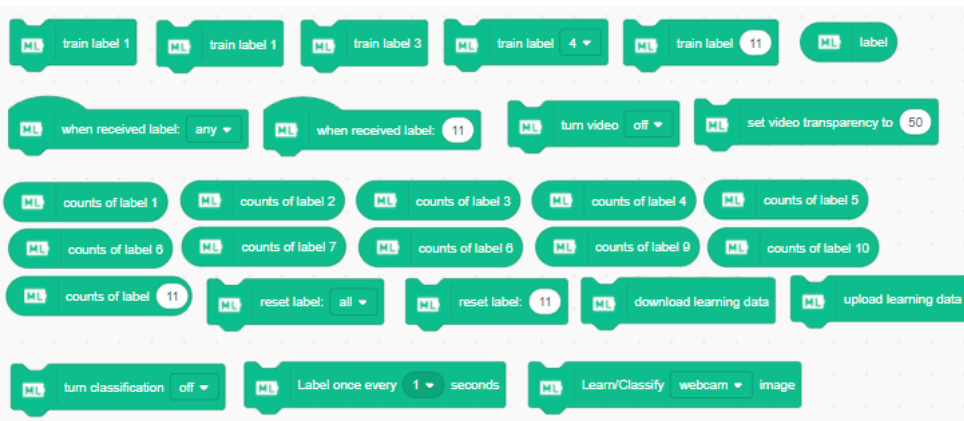




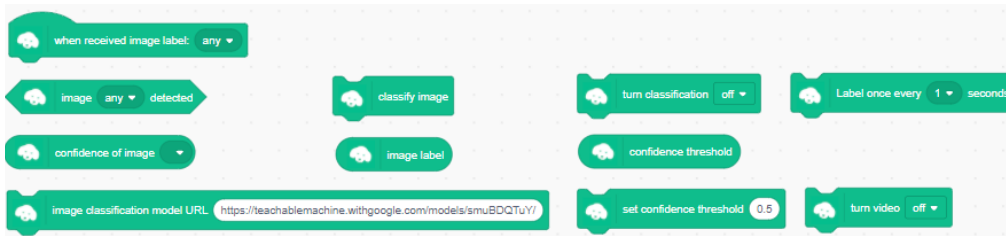
ARTIE: Artificial Intelligence in Education - challenges and opportunities of the new era:
development of a new curriculum, guide for educators and online course for students
Project co-funded by European Union under Erasmus+ Programme, 2020-1-HR01-KA201-077800



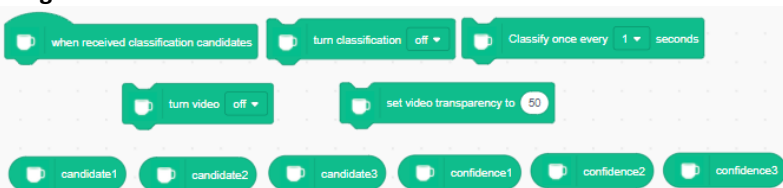
ML2Scratch blocks



TM2Scratch blocks



ImageClassifier2Scratch blocks



Teachable machine (Google) - <https://teachablemachine.withgoogle.com/>

This application is used to train your model and use it for object recognition in combination with Teachable machine extensions available in **PictoBlox**, **Scratch (MITMEDIALAB)** and **Stretch3**





ARTIE: Artificial Intelligence in Education - challenges and opportunities of the new era:
development of a new curriculum, guide for educators and online course for students
Project co-funded by European Union under Erasmus+ Programme, 2020-1-HR01-KA201-077800

Teachable Machine About FAQ Get Started

How do I use it?

Class 1

Class 2

1 Gather

Gather and group your examples into classes, or categories, that you want the computer to learn.

[Video: Gather samples](#)

TRAIN MODEL

2 Train

Train your model, then instantly test it out to see whether it can correctly classify new examples.

[Video: Train your model](#)

3 Export

Export your model for your projects: sites, apps, and more. You can download your model or host it online for free.

[Video: Export your model](#)

Use case for object detection - pen or marker.

Teachable machine is used for training 2 classes. Link of a trained model is:

<https://teachablemachine.withgoogle.com/models/FdWn0CA2a/>

Extension used in PictoBlox are Object detection and Machine learning.

CONCLUSION

Object detection and classification are two key tasks for image understanding. Recognizing objects in an image requires combining many different signals from the raw image data. Two kinds of information are often used: the local appearance that describes the object itself and the global representation that captures the image specific information. These two types of information are often used in two tasks: object detection and classification.

Classification

Classification is a machine learning task for determining which objects are in an image or video. It refers to training machine learning models to recognize which classes (objects) are present. Classification is useful at the yes-no level of deciding whether an image contains an object/anomaly or not.

A separate task from classification is localization or determining the position of the classified objects in the image or video.





ARTIE: Artificial Intelligence in Education - challenges and opportunities of the new era:
development of a new curriculum, guide for educators and online course for students
Project co-funded by European Union under Erasmus+ Programme, 2020-1-HR01-KA201-077800

Object detection

Object detection combines classification and localization to determine what objects are in the image or video and specify where they are in the image. It applies classification to distinct objects and uses bounding boxes. Object detection is useful in identifying objects in an image or video. Use cases for object detection include facial detection with any post-detection analysis, for example, expression detection, age estimation or drowsiness detection. Many real-time object detection applications exist for traffic management, such as vehicle detection systems based on traffic scenes.

As described above, the most popular approaches to computer vision are classification and object detection to identify objects present in an image and specify their position.

We have seen three different applications but also very similar for object detection and classification. Now we are familiar with basic commands, and ready to do the same basics programming for object detection and classification. Do the K.W.L. (**Know, Want, Learned**) chart with your students.

What I K now	What I W ant to Know	What I L earned

Methods

presentation
interactive exercise / simulation on the computer

Work forms

individual work
work in pairs
group work

Material:

- <https://machinelearningforkids.co.uk/scratch3/>
- <https://storage.googleapis.com/download.tensorflow.org/data/ImageNetLabels.txt>
- <https://mitmedialab.github.io/prg-extension-boilerplate/create/>
- <https://ide.mblock.cc/>
- <https://stretch3.github.io/>
- <https://thetempedia.com/product/pictoblox/download-pictoblox/>
- <https://teachablemachine.withgoogle.com/>
- <https://teachablemachine.withgoogle.com/models/FdWn0CA2a/>

Literature

-





ARTIE: Artificial Intelligence in Education - challenges and opportunities of the new era:
development of a new curriculum, guide for educators and online course for students
Project co-funded by European Union under Erasmus+ Programme, 2020-1-HR01-KA201-077800

PERSONAL OBSERVATIONS, COMMENTS AND NOTES

--

