The Education University of Hong Kong

SENSESTORM TRAINING

Network Setup & Preparations

WiFi Connection:

SSID: IoT

PW: eduhk+IoT+2018

Preparations: shorturl.at/jmpzG

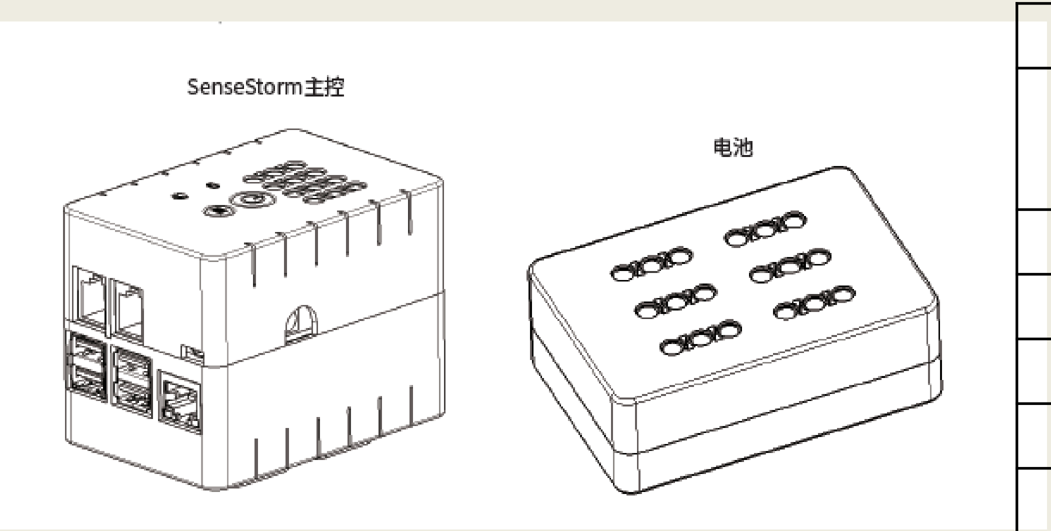
Rundown

1. Introduction of SenseStorm and the experimental platform
2. Facial recognition and gesture recognition with computer vision techniques
3. Object Classification with Supervised Learning
4. Implementation with Teachable Machine models
5. Summary and Q&A

Section 1

Introduction of SenseStorm and experimental platform

SenseStorm



Components List
Main Control Board (Raspberry Pi + SenseTime add-on board)
Camera
Color Sensor
Ultrasound Sensor
Battery
Charger
Speaker
TF Card

Standalone (VNC Viewer)

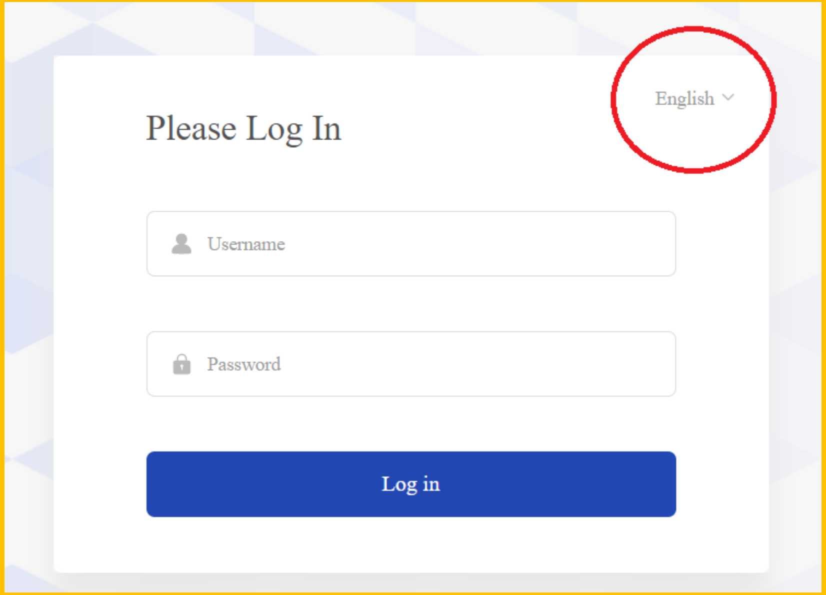
Learning Platform (SenseStorm)

SenseStudy Platform

Please login: hk.study.sensetime.com/course/login

Username:
eduhk01 ~ eduhk35

Password:
eduhk123



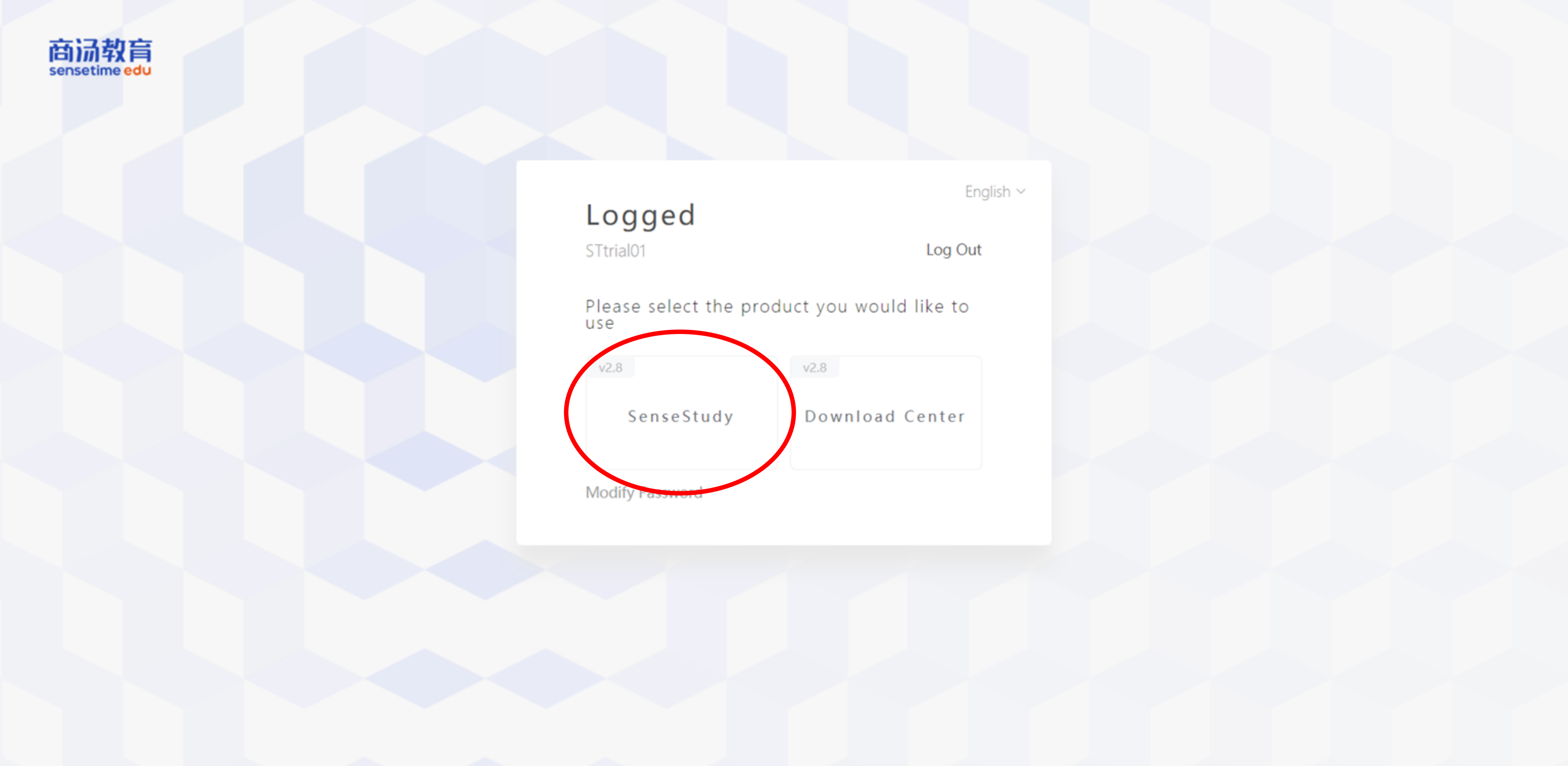
English

Please Log In

Username

Password

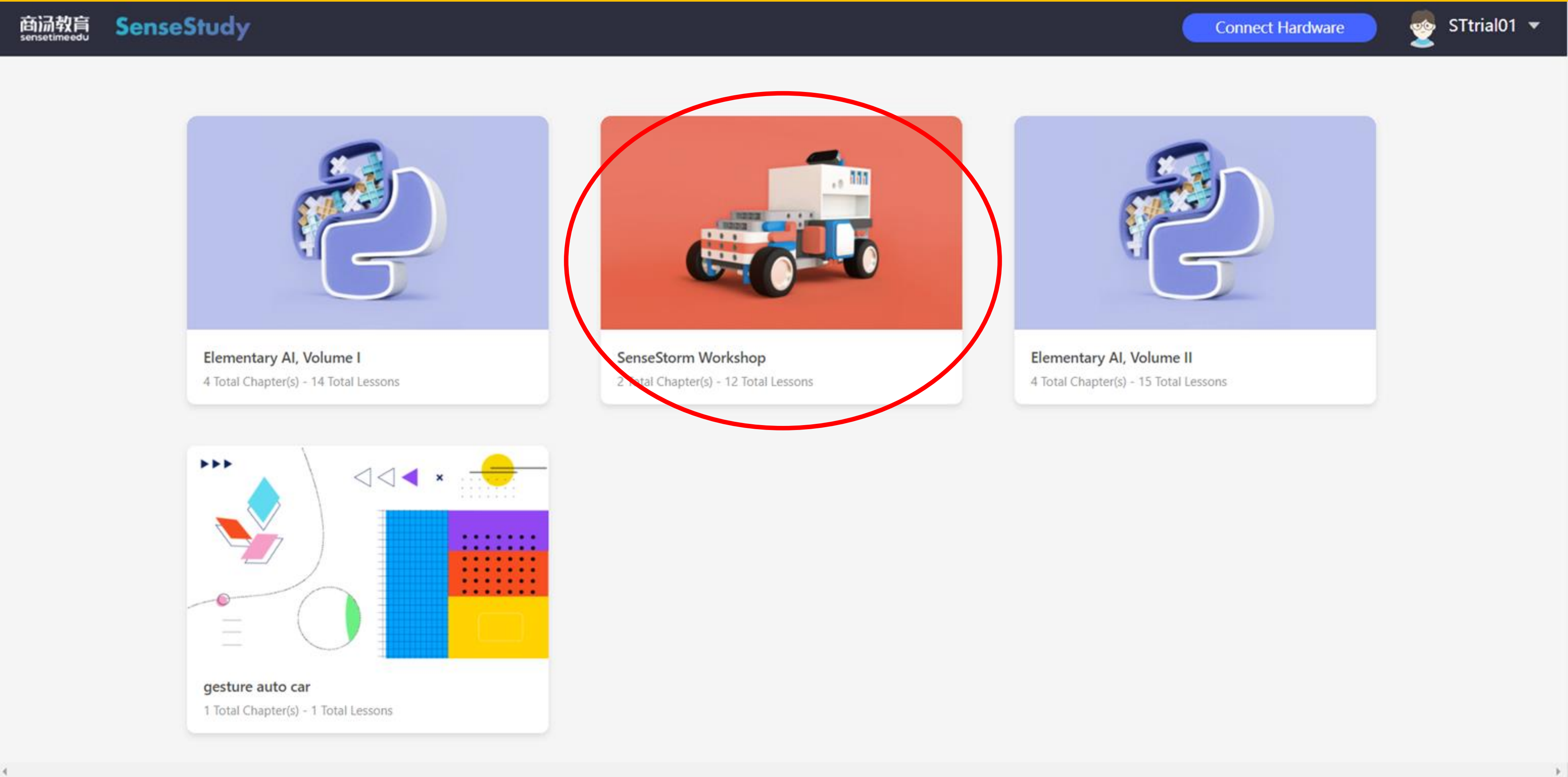
Log in



Logged

STtrial01

Please select the product you would like to use



Elementary AI, Volume I

4 Total Chapter(s) - 14 Total Lessons

SenseStorm Workshop

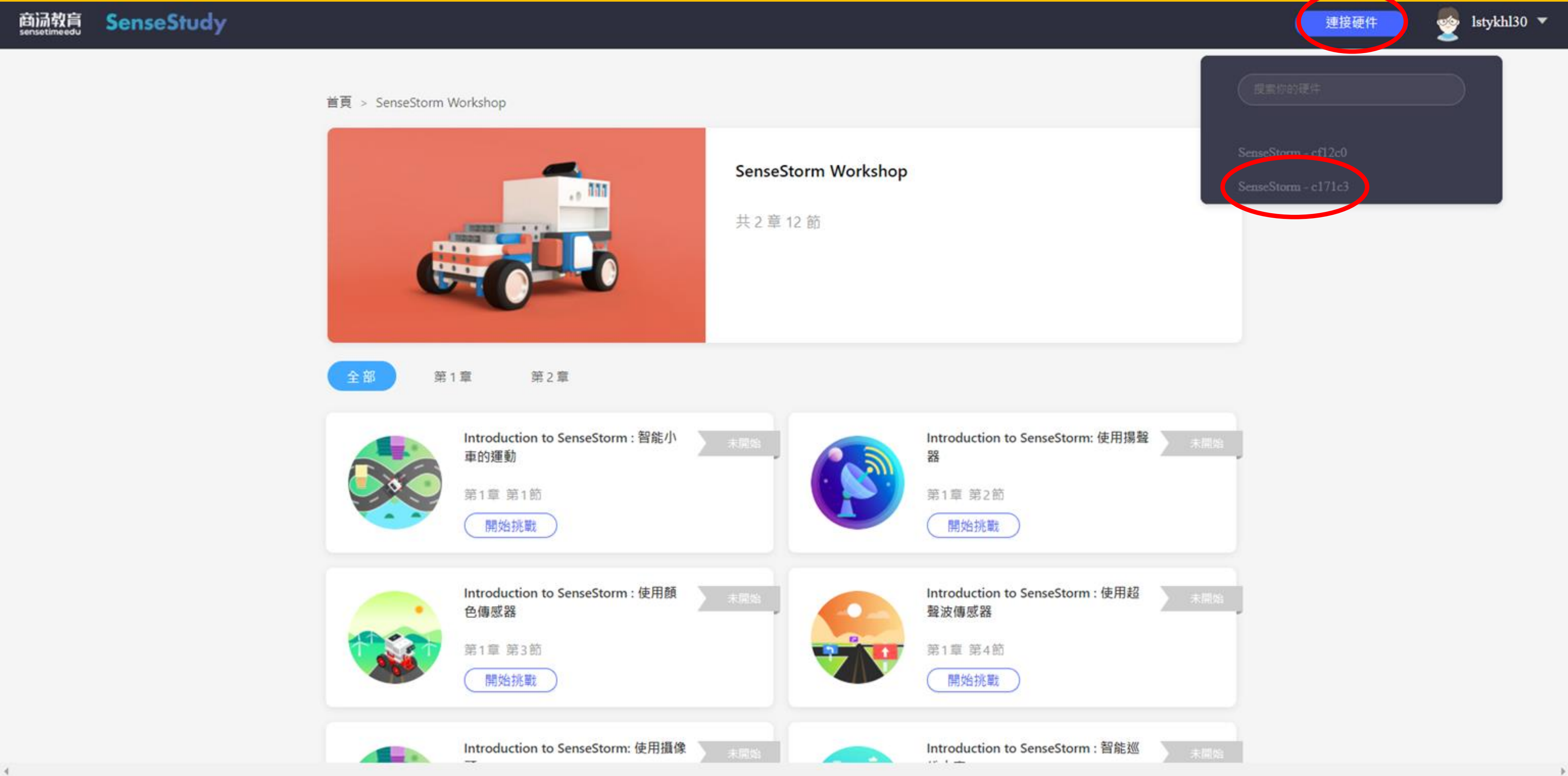
2 Total Chapter(s) - 12 Total Lessons

Elementary AI, Volume II

4 Total Chapter(s) - 15 Total Lessons

gesture auto car

1 Total Chapter(s) - 1 Total Lessons



SenseStorm - cf12c0

SenseStorm - c171c3

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SenseStorm Workshop

共 2 章 12 節

Introduction to SenseStorm : 智能小車的運動

第 1 章 第 1 節

Introduction to SenseStorm: 使用揚聲器

第 1 章 第 2 節

Introduction to SenseStorm : 使用顏色傳感器

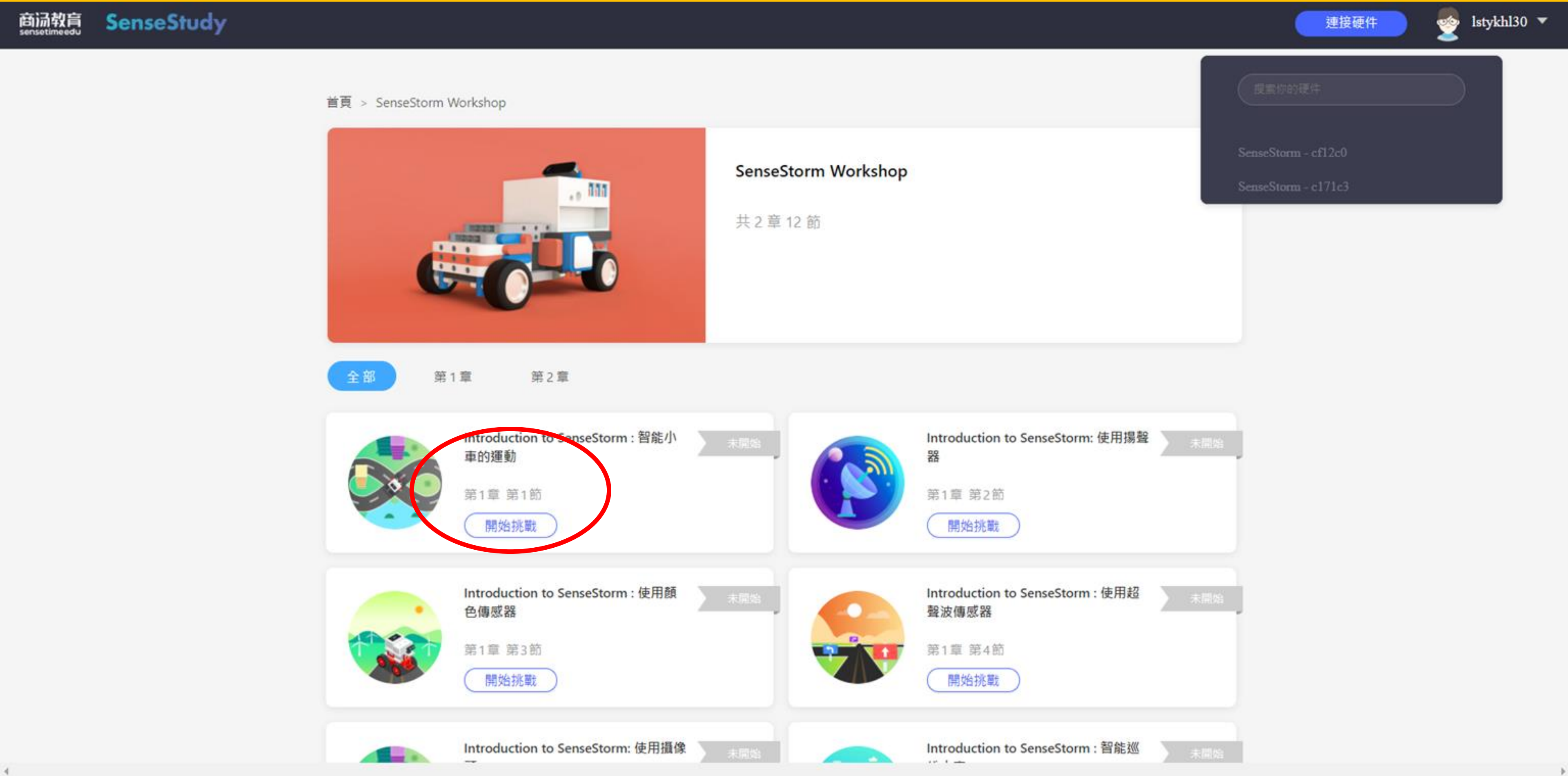
第 1 章 第 3 節

Introduction to SenseStorm : 使用超聲波傳感器

第 1 章 第 4 節

Introduction to SenseStorm: 使用攝像

Introduction to SenseStorm : 智能巡



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SenseStorm Workshop

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Introduction to SenseStorm : 智能小車的運動

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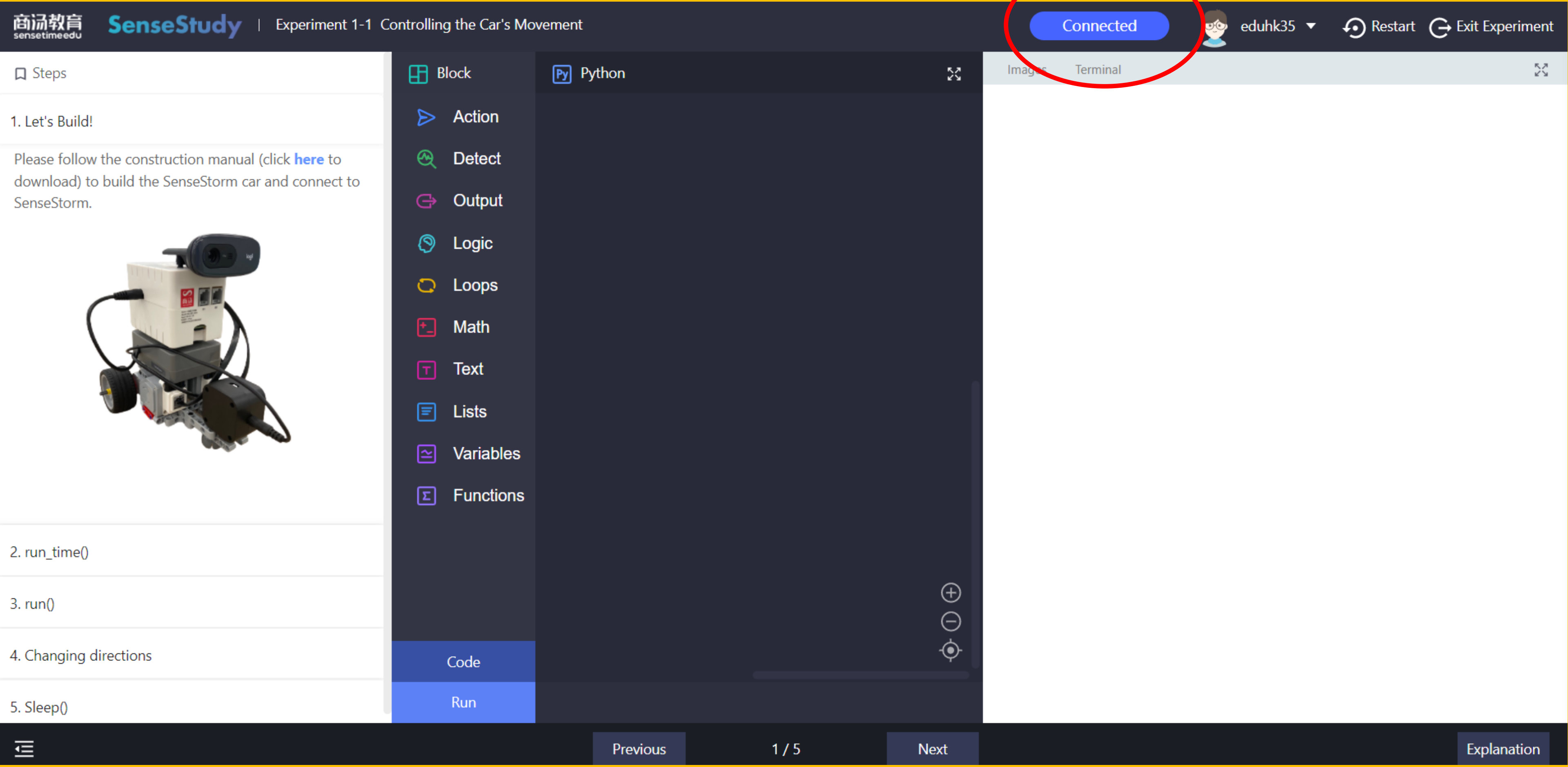
Introduction to SenseStorm : 智能巡



Experiment 1-1 Controlling the Car's Movement

Steps

1. Let's Build!

Please follow the construction manual (click **here** to download) to build the SenseStorm car and connect to SenseStorm.

2. run_time()

3. run()

4. Changing directions

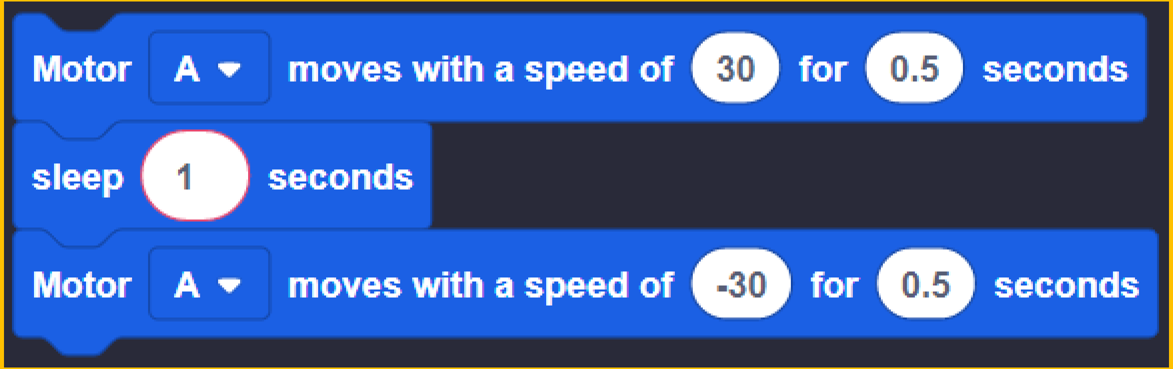
5. Sleep()

Section 2

Facial recognition and gesture recognition with computer vision techniques

Basic operations

Basic operation of the motors



Motor A moves with a speed of 30 for 0.5 seconds

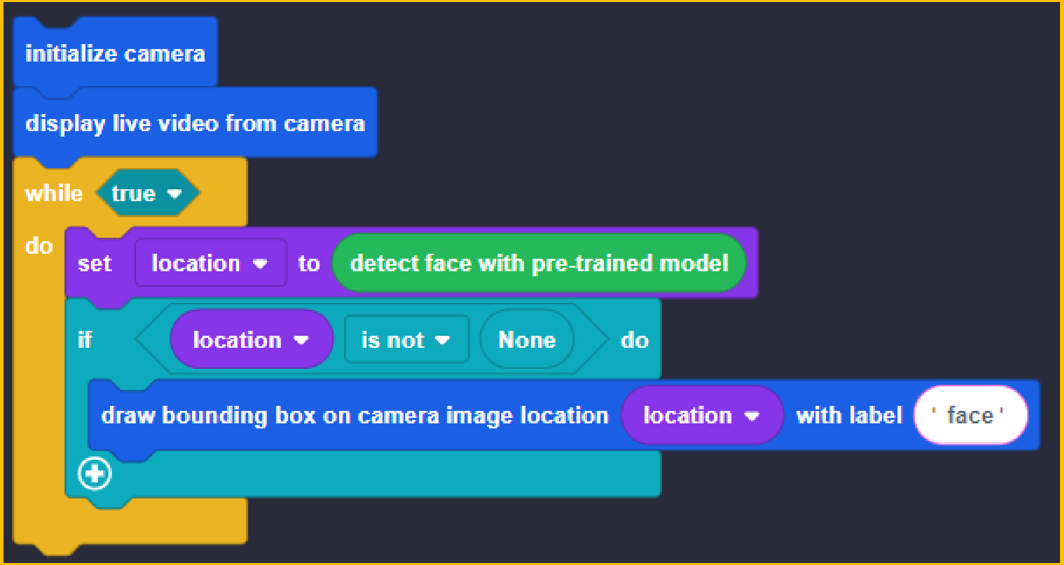
sleep 1 seconds

Motor A moves with a speed of -30 for 0.5 seconds

```
motor_a.run_time(30,0.5)
sleep(1)
motor_a.run_time(-30,0.5)
```

Basic operations

Face Detection

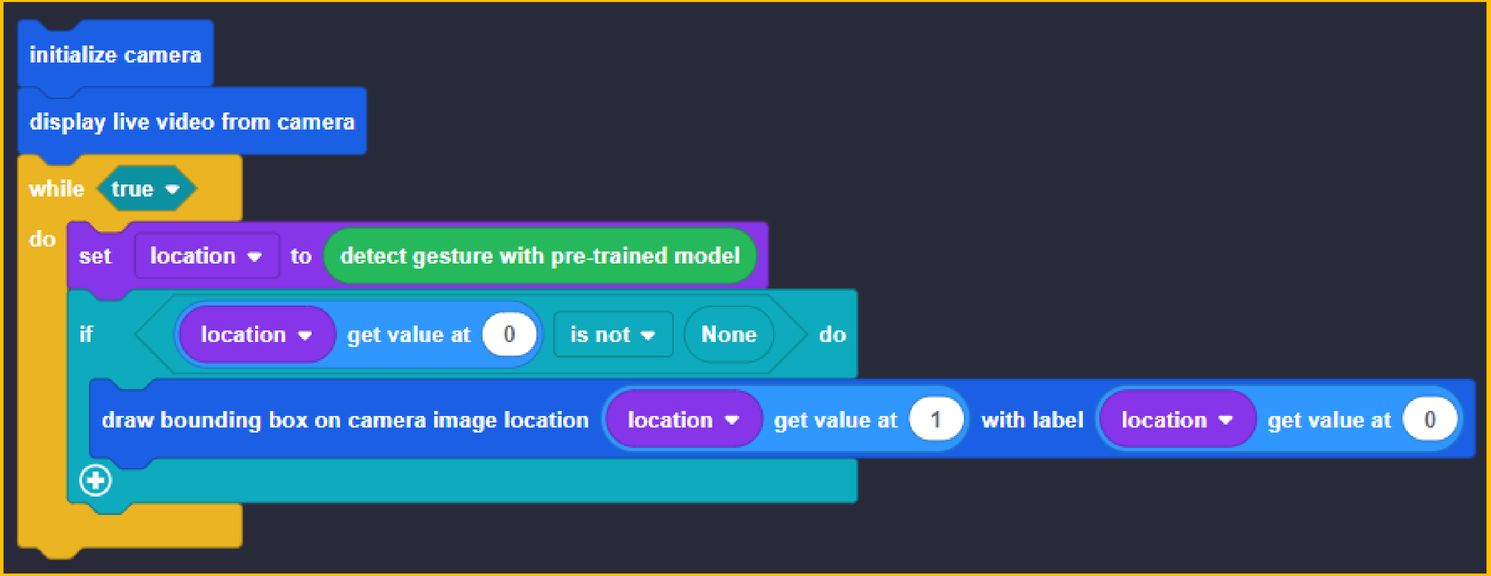


```
initialize camera
display live video from camera
while true
do
    set location to detect face with pre-trained model
    if location is not None do
        draw bounding box on camera image location location with label ' face '
```

```
videostream=cv2.VideoCapture(0)
display_video()

while True:
    try:
        location = detect_face(frame)
        if location is not None:
            draw_label_boundingbox(frame,
location, 'face')
    except:
        break

clean_up()
```

Basic operations

Gesture Recognition



```
initialize camera
display live video from camera
while true
do  set location to detect gesture with pre-trained model
    if location get value at 0 is not None do
        draw bounding box on camera image location location get value at 1 with label location get value at 0
```

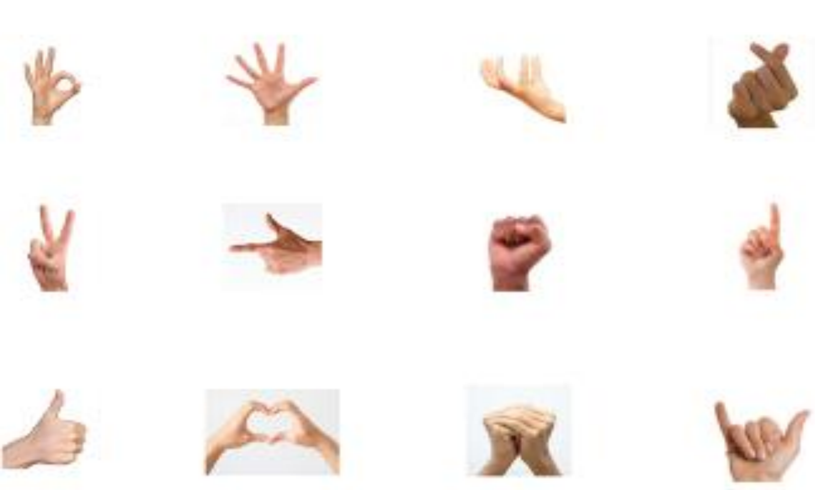
Basic operations

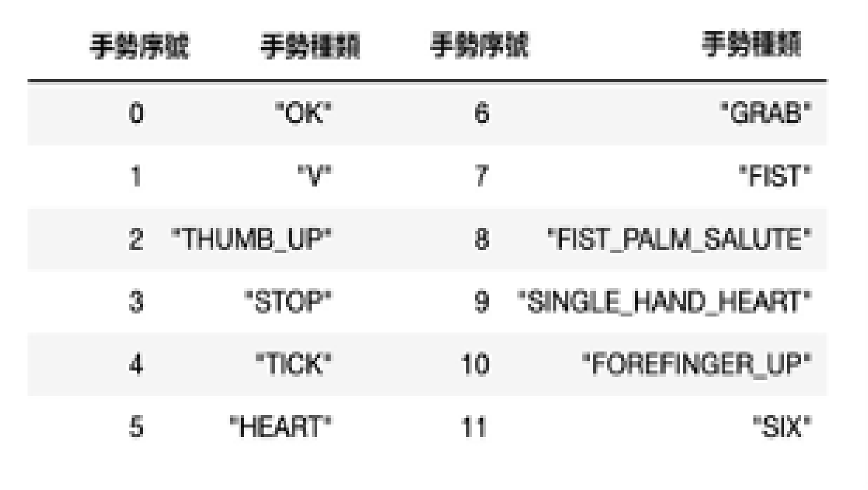
Gesture Recognition

```
videostream=cv2.VideoCapture(0)
display_video()

while True:
    try:
        location = extract_gesture(frame)
        if location[0] is not None:
            draw_label_boundingbox(frame, location[1], location[0])
    except:
        break

clean_up()
```

Basic operations

Gesture Recognition





手勢序號	手勢種類	手勢序號	手勢種類
0	"OK"	6	"GRAB"
1	"V"	7	"FIST"
2	"THUMB_UP"	8	"FIST_PALM_SALUTE"
3	"STOP"	9	"SINGLE_HAND_HEART"
4	"TICK"	10	"FOREFINGER_UP"
5	"HEART"	11	"SIX"

Section 3

Object Classification with Supervised Learning

Types of Machine Learning

1
2
3
4

Supervised Learning

Given a set of input/output pairs, learn to predict the output when given a new input.

= Learn by using model answers!

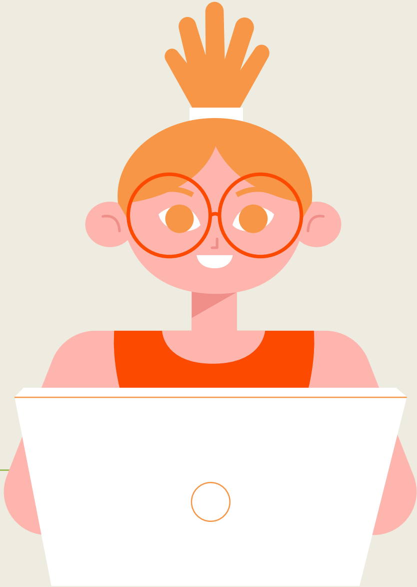
Types of Machine Learning

1

2

3

4

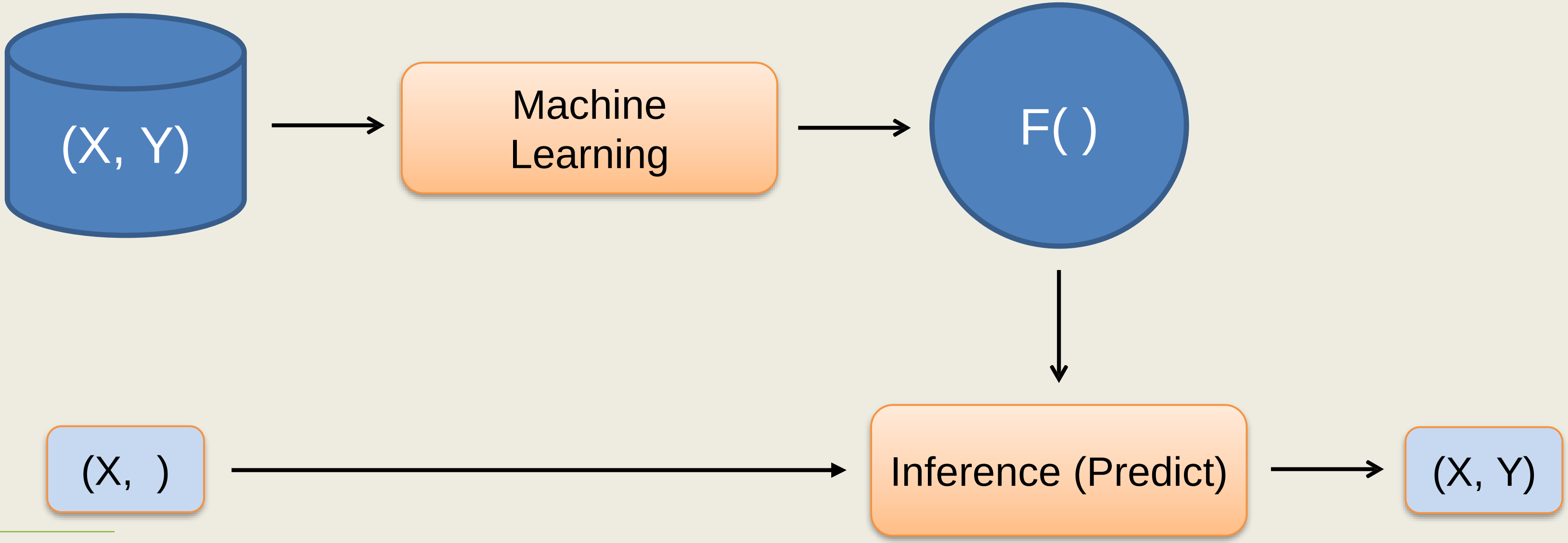


Unsupervised Learning

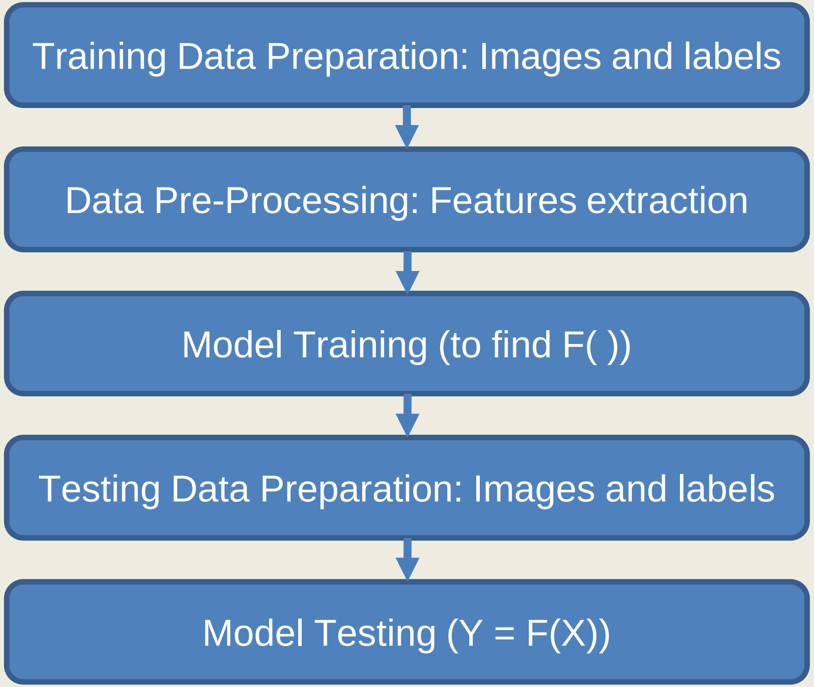
Given data without labels, model learns to group data with similar features together without knowing the true label of each group

= Learn by grouping similar things together!

Supervised Learning Procedure



Supervised Learning Procedure



Training Data Preparation: Images and labels

Data Pre-Processing: Features extraction

Model Training (to find F( ))

Testing Data Preparation: Images and labels

Model Testing (Y = F(X))

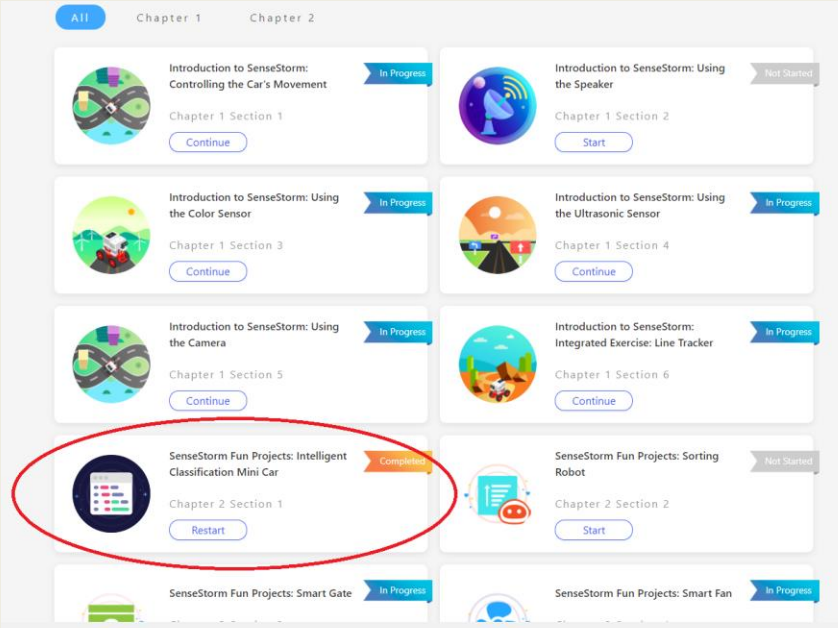
SenseStudy Experiment

1
2
3
4

Practical implementation: Intelligent Classification Mini Car (SenseStorm Workshop 2.1)

SenseStorm Workshop

2 Total Chapter(s) - 12 Total Lessons



Introduction to SenseStorm: Controlling the Car's Movement — In Progress — Chapter 1 Section 1 — Continue

Introduction to SenseStorm: Using the Speaker — Not Started — Chapter 1 Section 2 — Start

Introduction to SenseStorm: Using the Color Sensor — In Progress — Chapter 1 Section 3 — Continue

Introduction to SenseStorm: Using the Ultrasonic Sensor — In Progress — Chapter 1 Section 4 — Continue

Introduction to SenseStorm: Using the Camera — In Progress — Chapter 1 Section 5 — Continue

Introduction to SenseStorm: Integrated Exercise: Line Tracker — In Progress — Chapter 1 Section 6 — Continue

SenseStorm Fun Projects: Intelligent Classification Mini Car — Completed — Chapter 2 Section 1 — Restart

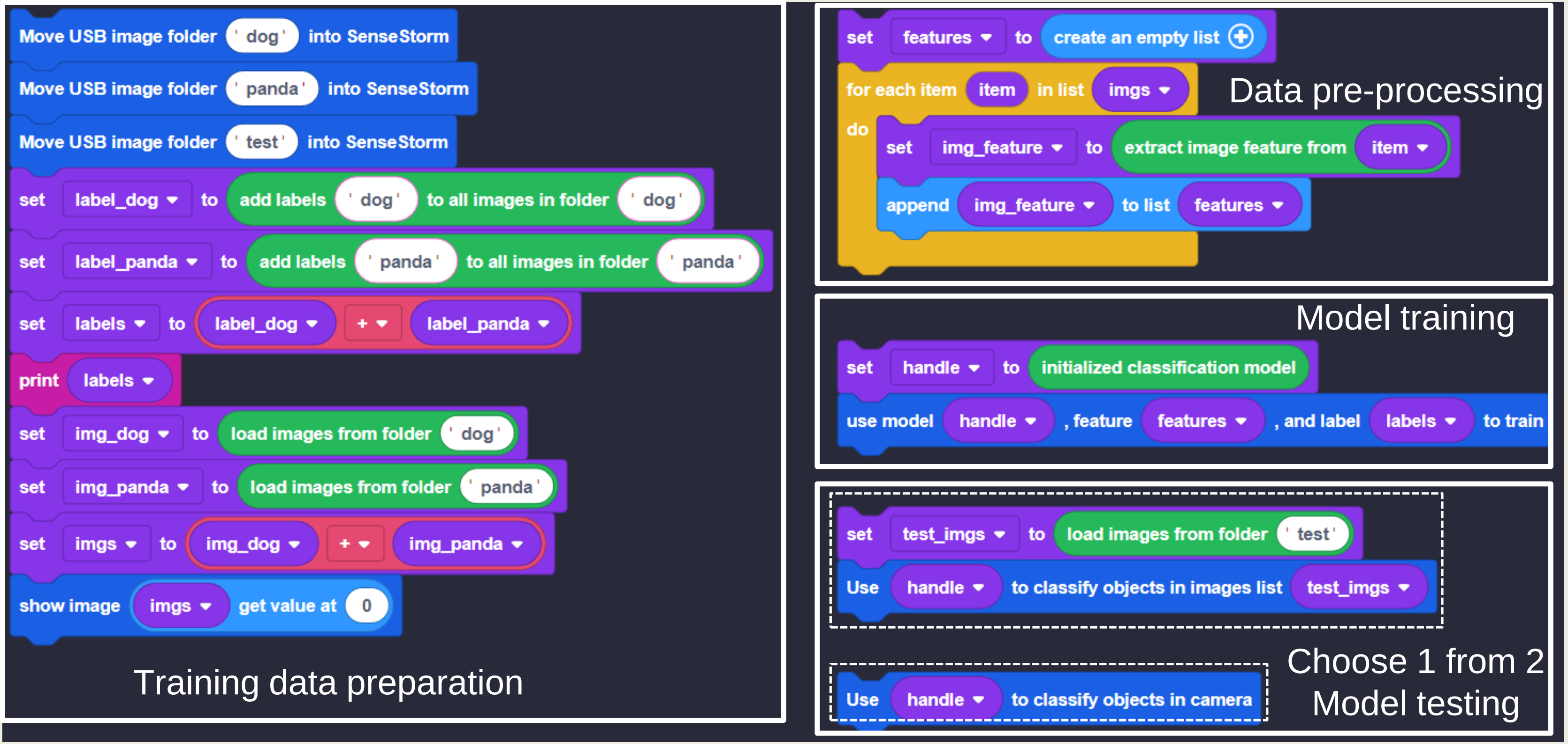
SenseStorm Fun Projects: Sorting Robot — Not Started — Chapter 2 Section 2 — Start

SenseStorm Fun Projects: Smart Gate — In Progress

SenseStorm Fun Projects: Smart Fan — In Progress

SenseStudy Experiment

1



Training data preparation

```
Move USB image folder 'dog' into SenseStorm
Move USB image folder 'panda' into SenseStorm
Move USB image folder 'test' into SenseStorm
set label_dog ▾ to add labels 'dog' to all images in folder 'dog'
set label_panda ▾ to add labels 'panda' to all images in folder 'panda'
set labels ▾ to label_dog ▾ + ▾ label_panda ▾
print labels ▾
set img_dog ▾ to load images from folder 'dog'
set img_panda ▾ to load images from folder 'panda'
set imgs ▾ to img_dog ▾ + ▾ img_panda ▾
show image imgs ▾ get value at 0
```

2

Data pre-processing

```
set features ▾ to create an empty list ⊕
for each item item in list imgs ▾
do
    set img_feature ▾ to extract image feature from item ▾
    append img_feature ▾ to list features ▾
```

3

Model training

```
set handle ▾ to initialized classification model
use model handle ▾ , feature features ▾ , and label labels ▾ to train
```

4

Choose 1 from 2
Model testing

```
set test_imgs ▾ to load images from folder 'test'
Use handle ▾ to classify objects in images list test_imgs ▾
```

```
Use handle ▾ to classify objects in camera
```

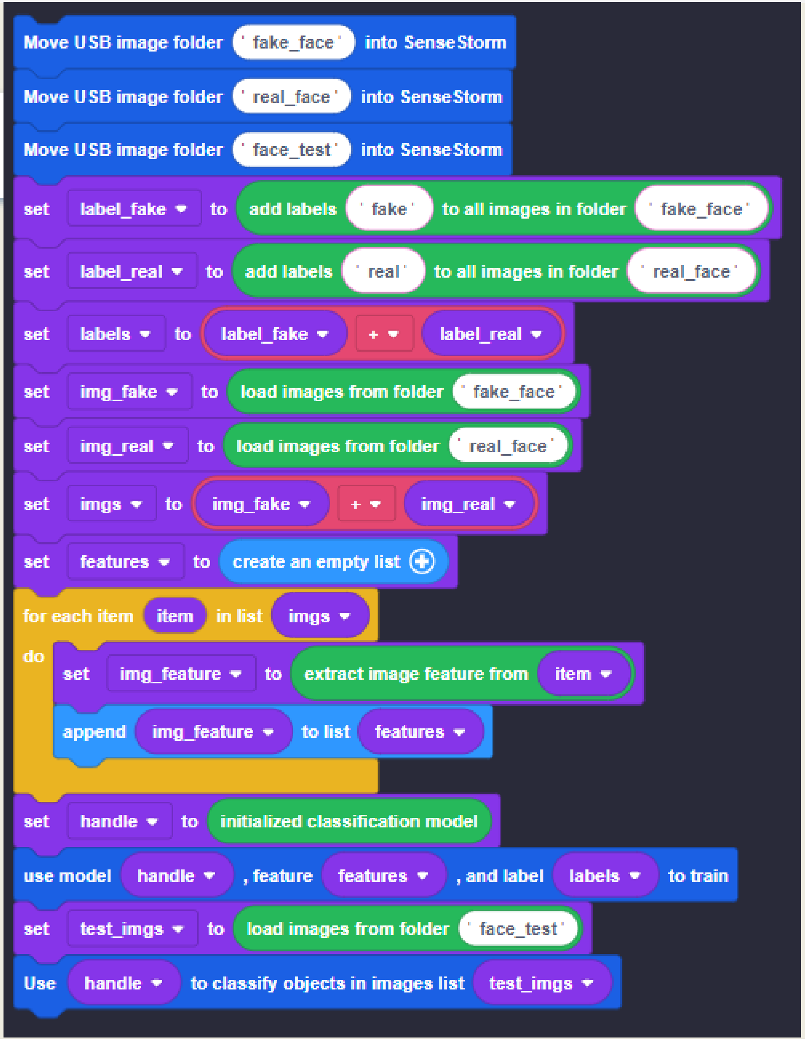
SenseStudy Experiment

Additional Task:

Real Face or Fake Face?

Ref video:

shorturl.at/lwS28



```
Move USB image folder 'fake_face' into SenseStorm
Move USB image folder 'real_face' into SenseStorm
Move USB image folder 'face_test' into SenseStorm
set label_fake to add labels 'fake' to all images in folder 'fake_face'
set label_real to add labels 'real' to all images in folder 'real_face'
set labels to label_fake + label_real
set img_fake to load images from folder 'fake_face'
set img_real to load images from folder 'real_face'
set imgs to img_fake + img_real
set features to create an empty list
for each item item in list imgs
do
    set img_feature to extract image feature from item
    append img_feature to list features
set handle to initialized classification model
use model handle , feature features , and label labels to train
set test_imgs to load images from folder 'face_test'
Use handle to classify objects in images list test_imgs
```

1

2

3

4

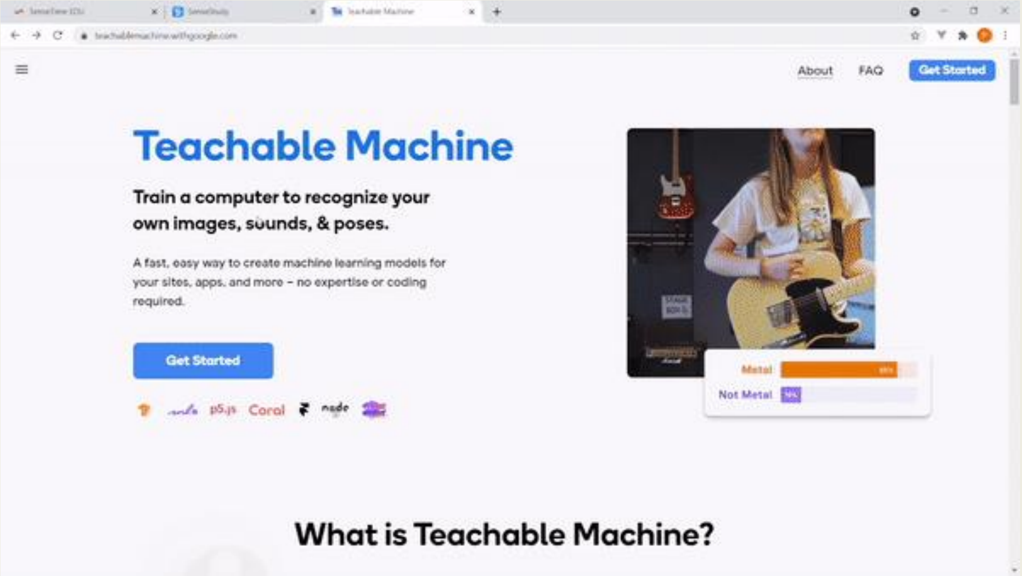
Section 4

Implementation with Teachable Machine models

Teachable Machine Model Training

Training your own model: Step 1

Navigate to ***Teachable Machine*** and ***Get Started***



teachablemachine.withgoogle.com

About FAQ Get Started

Teachable Machine

Train a computer to recognize your own images, sounds, & poses.

A fast, easy way to create machine learning models for your sites, apps, and more – no expertise or coding required.

Get Started

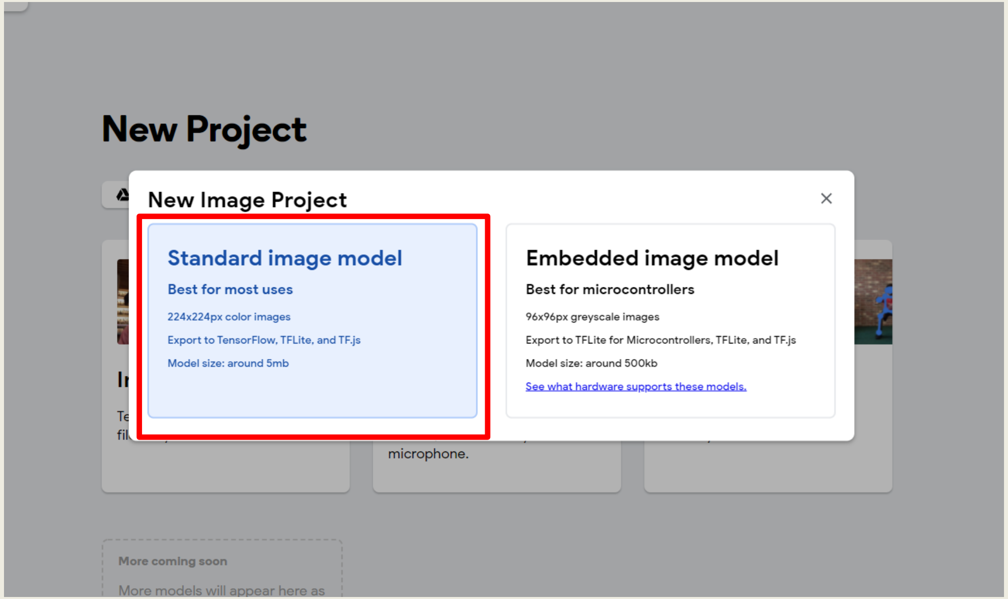
What is Teachable Machine?

1
2
3
4

1
2
3
4

Training your own model: Step 2

Choose ***Image Project*** and ***Standard Image Model***



New Project

New Image Project ×

Standard image model

Best for most uses

224x224px color images

Export to TensorFlow, TFLite, and TF.js

Model size: around 5mb

Embedded image model

Best for microcontrollers

96x96px greyscale images

Export to TFLite for Microcontrollers, TFLite, and TF.js

Model size: around 500kb

See what hardware supports these models.

microphone.

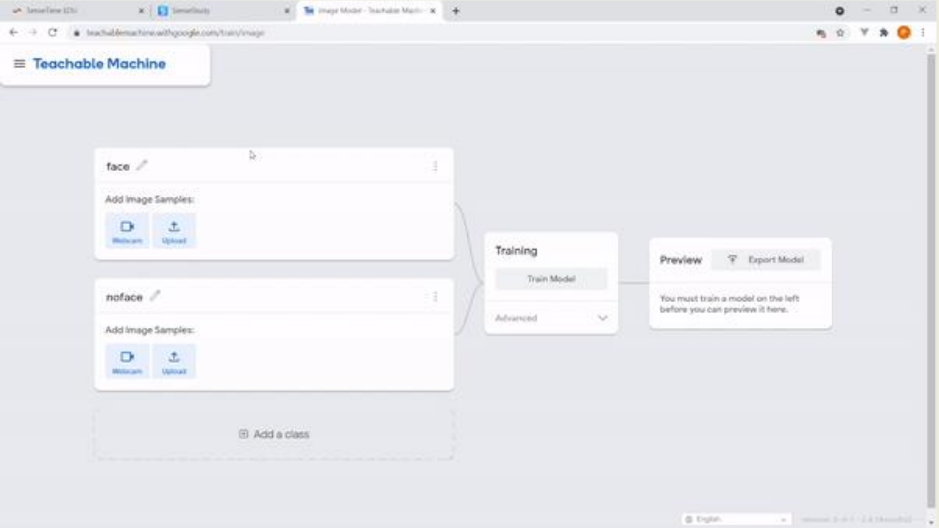
More coming soon

More models will appear here as

Teachable Machine Model Training

Training your own model: Step 3

1. Crate and name a ***Class***
2. Start ***Collecting Data*** (images of that class)



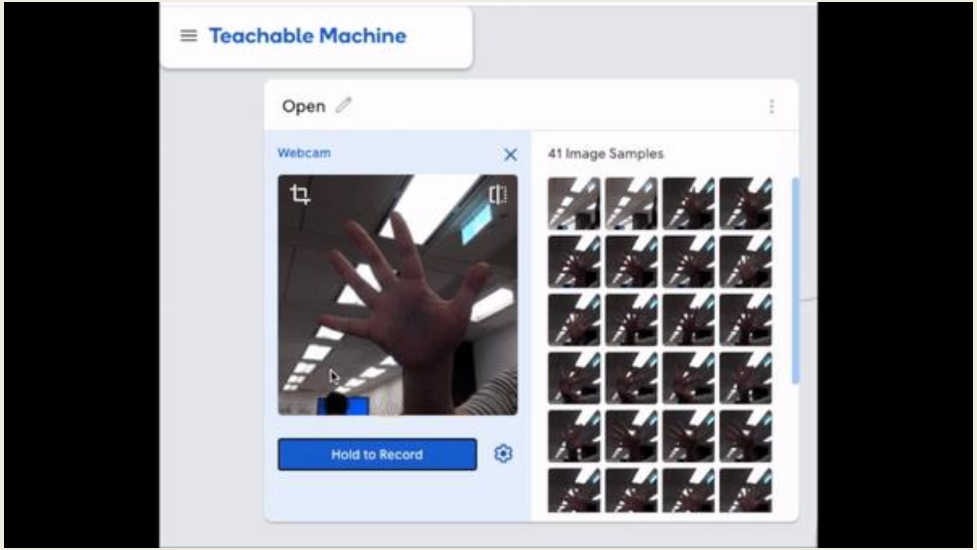
teachablemachine.withgoogle.com/train/image

You must train a model on the left before you can preview it here.

1
2
3
4

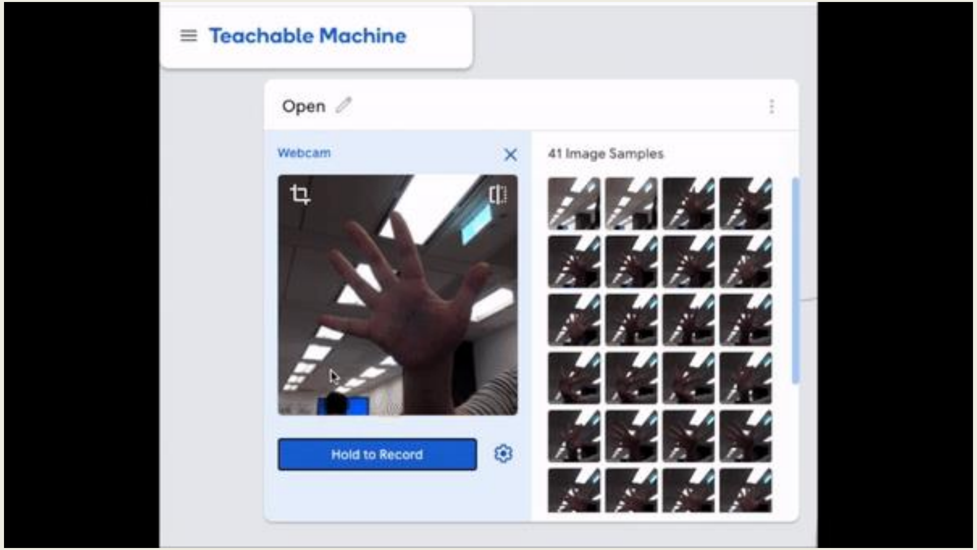
Training your own model: Step 3 (Cont'd)

3. Take/upload ***multiple images***. Best if you use images of different angle, lighting, distance & background.



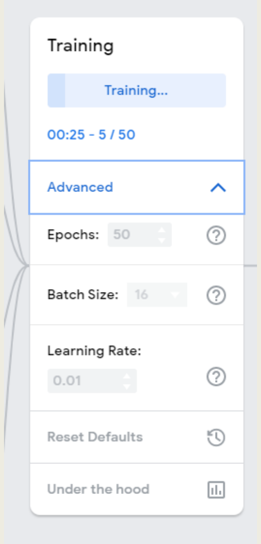
Training your own model: Step 4

Repeat step 3 for other classes as well (if any)



Training your own model: Step 5

Start ***Training***!



Training

Training...

00:25 - 5 / 50

Advanced

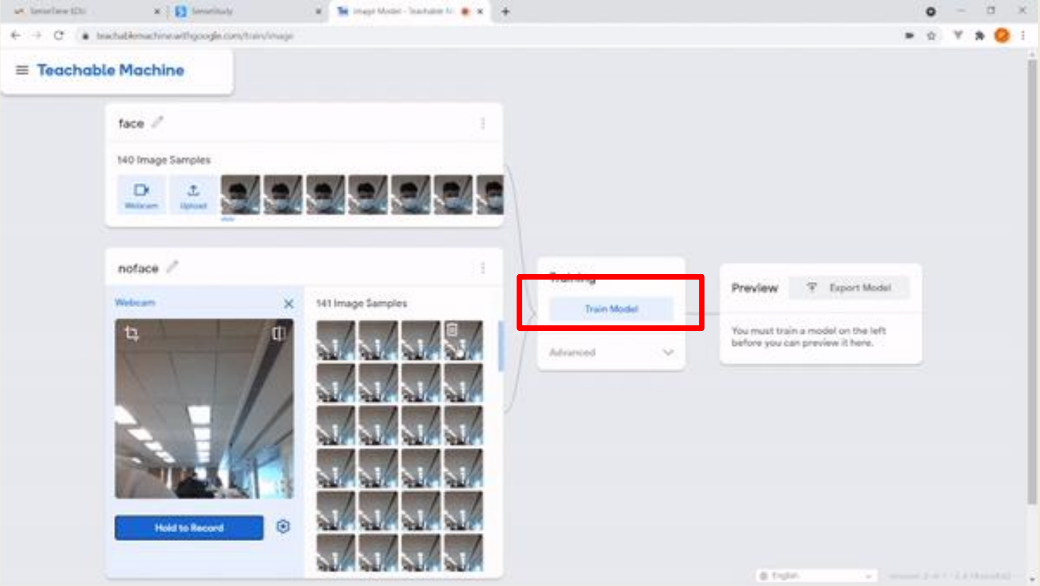
Epochs: 50

Batch Size: 16

Learning Rate: 0.01

Reset Defaults

Under the hood



teachablemachine.withgoogle.com/train/image

Teachable Machine

face

140 Image Samples

noface

141 Image Samples

Training

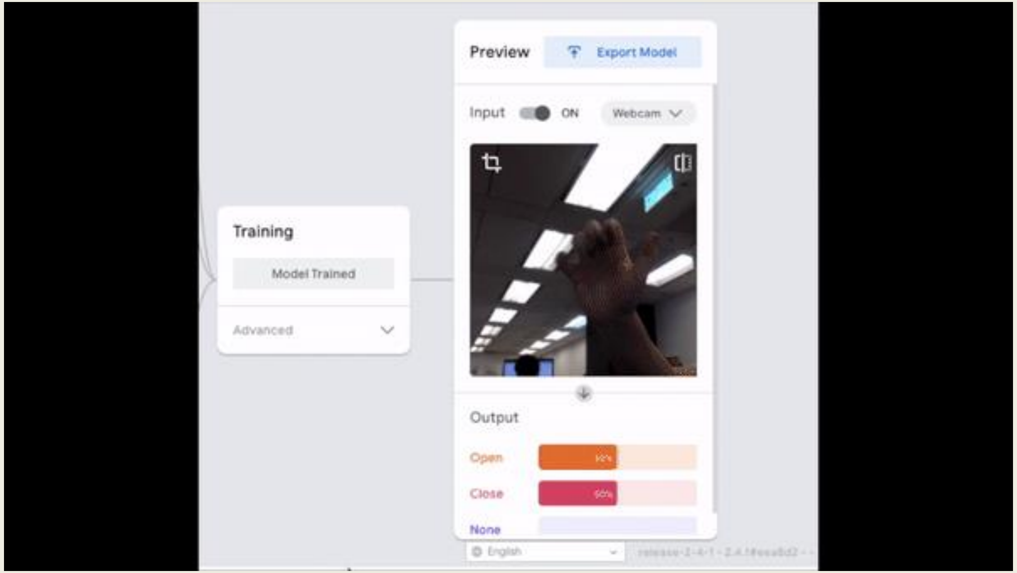
Preview

You must train a model on the left before you can preview it here.

1
2
3
4

Training your own model: Step 6

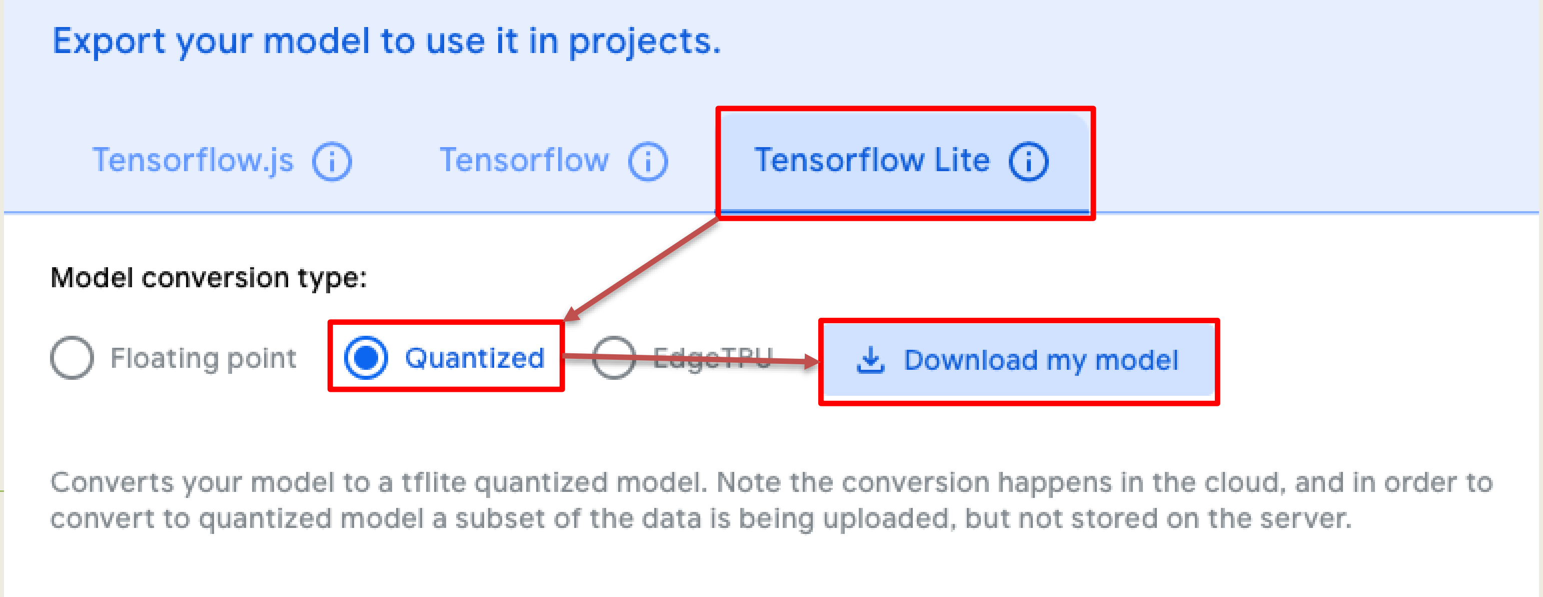
Test out your model!



1
2
3
4

Training your own model: Step 7

If your model works well, ***export your model***.



Export your model to use it in projects.

Model conversion type:

○ Floating point ● Quantized ○ EdgeTPU

Converts your model to a tflite quantized model. Note the conversion happens in the cloud, and in order to convert to quantized model a subset of the data is being uploaded, but not stored on the server.

1
2
3
4

Teachable Machine Model Training

1

2

The training procedure is completed!

3

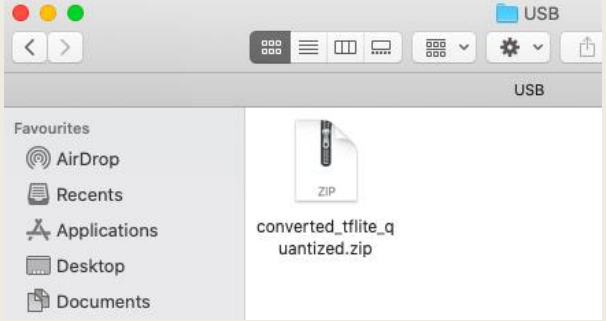
4

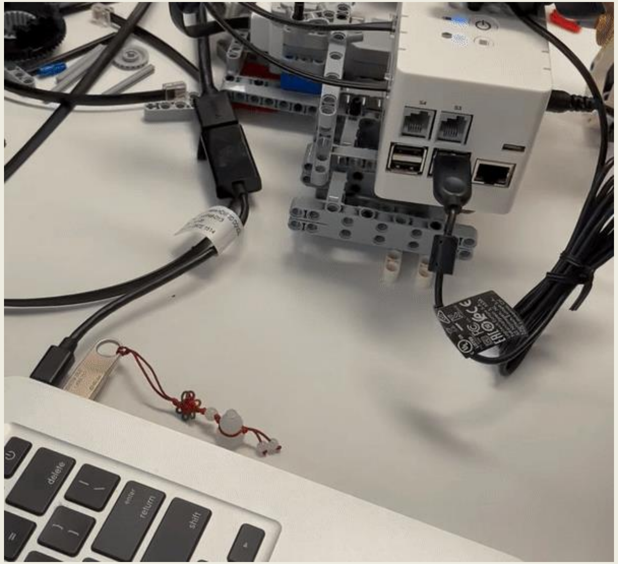
Training your own model: Step 8

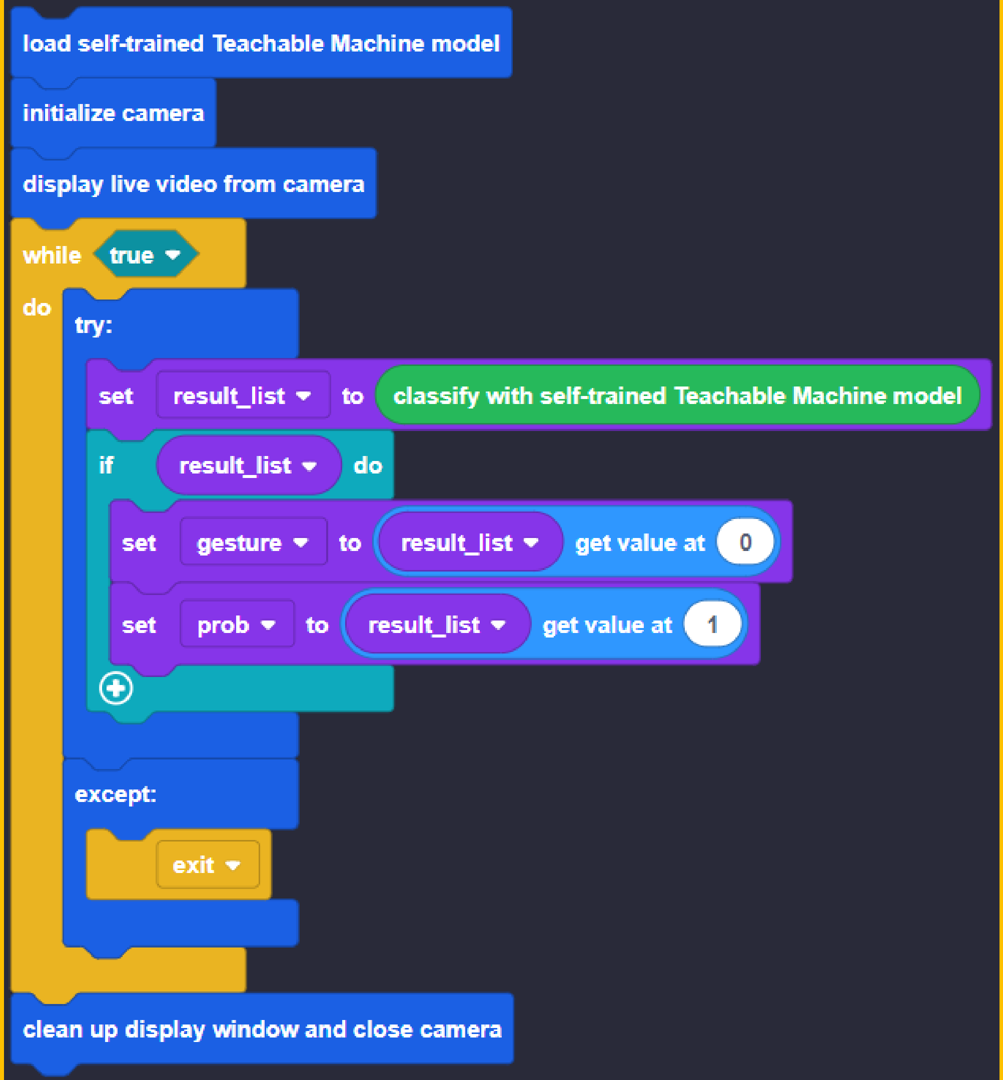
If you want to use your model on SenseStorm,

2. Plug USB into SenseStorm

1. Move it into USB







```
load self-trained Teachable Machine model
initialize camera
display live video from camera
while true
do
    try:
        set result_list to classify with self-trained Teachable Machine model
        if result_list do
            set gesture to result_list get value at 0
            set prob to result_list get value at 1
    except:
        exit
clean up display window and close camera
```

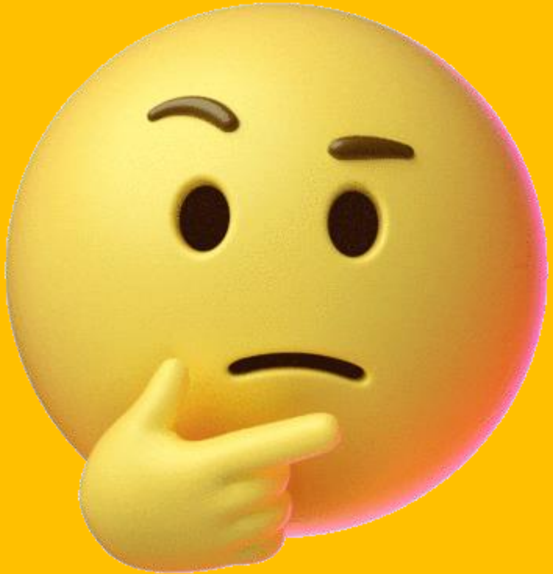
Ref video:
https://youtu.be/rxveUBwguMc

Task:

After open the speaker, SenseStorm will speak out the name of the class you show to the camera.

How to do that?

Summary and Q&A



EduHK SenseStorm Q&A

WhatsApp 群组