

## Sheet 2

### 1 Presentation

#### 2 Can a micro:bit board be linked to an artificial intelligence model? How?

#### 3 Preliminary considerations: how do we continue?

##### 1. Presentation

In this sheet, we invite you to continue learning about the link between your Machine Learning model and the micro:bit board. To do this, we will use MakeCode. Here we will explain this step-by-step approach.

In order to carry out the activities proposed in this sheet, it is necessary to have a micro:bit board, a USB cable, a computer with a webcam and a microphone and internet connection. It is also required to have finished the "Sheet 1: First steps." The model created while working in this sheet will allow us to generate the link with a micro:bit board. On the other hand, it is important to note that basic knowledge of MakeCode and micro:bit is required to work on this sheet.

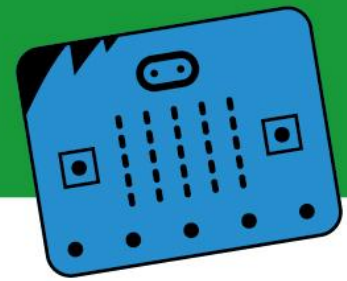
#### 2 Can a micro:bit be linked to an artificial intelligence model? How?

It is possible to link an AI model and a micro:bit board in different ways. In this sheet, we will work on the connection using MakeCode and the online platform [ai-training.glitch.me](https://ai-training.glitch.me). These tools will allow us to link the Teachable Machine model to the micro:bit board.

To make it work, it is necessary to follow these steps in order. Join us!

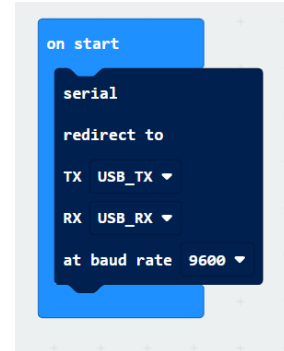
##### 2.1 First step: Program the micro:bit board

The board will be coded so that it knows what to do when it receives a signal or data.



## Stage 1:

- Visit the MakeCode website .
- Enter the block **“Serial/redirect to/TX/RX/with baud rate”** in **“On Startup”**.<sup>1</sup> This block falls within the “Serial” category of the MakeCode library and allows you to configure the micro:bit board to receive signals through the serial port.



- Once the block found in “On Startup” is inserted, configure it following the indications shown in the image and detailed below:

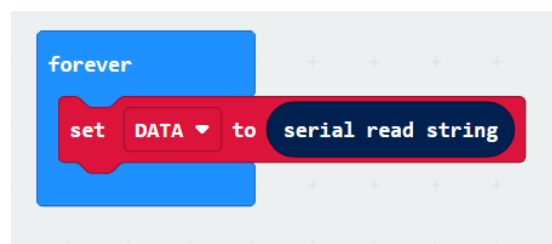
- TX USB\_TX
- RX USB\_RX
- Baud Rate: 9600

It is important to understand that the board and the computer are connected through the USB port. This means that it is through the USB port that the micro:bit board is linked with [ai-training.glitch.me](https://ai-training.glitch.me).

## Stage 2:

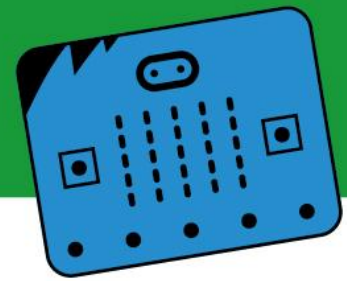
- Within the “forever” block, set a variable.

In this case we will name it **“DATA”**:



- Go to the “Variables” category.
- Create a variable.
- Define it as **“DATA”**.
- Place the **“set DATA to...”** block inside the **“Forever”** block.
- Select the block named **“serial read string”**, within the **“Serial”** category.
- Place **“serial read string”** inside the “Set DATA to” block.

<sup>1</sup> Baud: is the unit of measurement of signal transfer related to the transmission capacity of a given system.



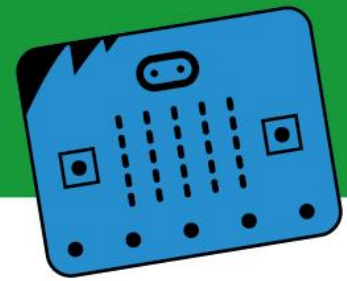
This code will allow the board to receive and identify the classifications that the model will make through the **"DATA"** variable. More specifically, using the image models created in the previous sheet, the variable will save the string "Right Hand" or "Left Hand" (when one of those hands is raised), and "Hands Down" if the hands are down. The micro:bit will be able to "read" this information already classified by our model and perform the action we request according to the data received.

- b) From the "Logic" category select the **"If, <true> then"** block. This block will tell the board what to do when the variable receives a classified data through the serial port.

```
on start
  serial
  redirect to
  TX USB_TX
  RX USB_RX
  at baud rate 9600

forever
  set DATA to serial read string
  if DATA = "Right hand" then
    show arrow East
    pause (ms) 2000
  if DATA = "Left hand" then
    show arrow West
    pause (ms) 2000
  if DATA = "Non-raising hands" then
    show arrow South
    pause (ms) 2000
```

According to the model created in Sheet 1, based on image data, three classes were established: "Right Hand", "Left Hand" and "Hands Down".



The **"If, <true> then"** blocks compare the classes with the data received and define the action to be performed by the micro:bit.

For this example we chose to show arrows on the micro:bit led screen to indicate the position of the arms when the person is in front of the camera. There is a pause after each "arrow" for the user to clearly see it before new data arrives.

You will have as many **"If, <true> then"** blocks as classes defined in the model created in Teachable Machine.

## Stage 3:

a) Connect the micro:bit via USB and load the program on the board as usual. Leave the USB connected as it will be used for the rest of the test.

## 2.2 Second step: Connect the micro:bit to the exported model

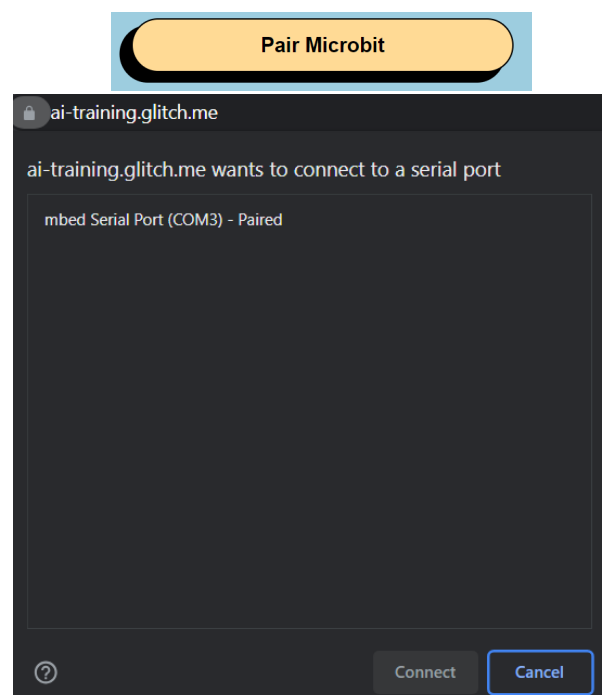
### Stage 1:

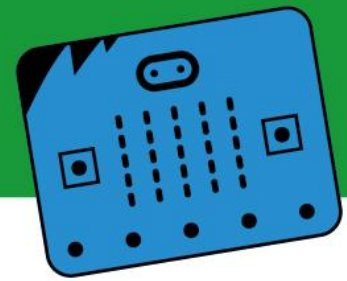
a) Verify that the micro:bit board is connected via the USB port to the computer and go to [ai-training.glitch.me](https://ai-training.glitch.me).

b) Click the yellow button that says "Pair micro:bit".

c) A small window will open in which the micro:bit board will appear (probably with the name "mbed Serial Port").

d) Select the board and click "Connect" and you're done; the micro:bit board has already connected to the platform.





## Stage 2:

The next stage will link the board with the artificial intelligence model generated in the Teachable Machine.

a) Copy the link of the exported model of Teachable Machine created in Sheet 1 and paste it into the box that appeared after connecting the board.

Paste your Google Teachable machine model link here:

Choose Camera:

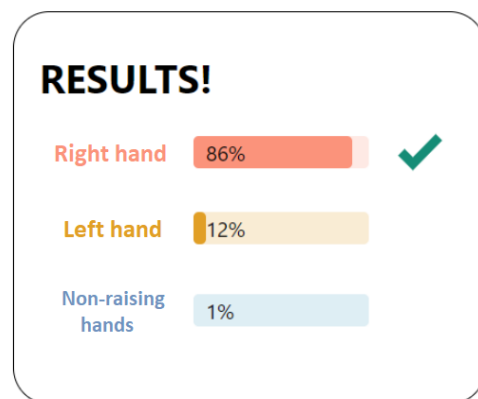
Choose Audio:

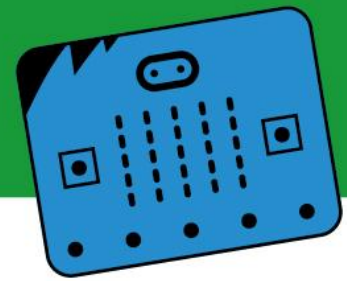
Ready!

Click on the "Ready" button.

b) After a few seconds, a window (very similar to that of the Teachable Machine) will appear, with bars that classify the data entered (either by webcam or by microphone, depending on the machine learning model created above). The website (interface) will send the name of the assigned class for the data received, through the serial port. Now is the time to verify that the model is working properly.

**This is a Recognition Project - where the AI will be able to identify the classes you made based on the input you give it!**





## **2.3 Verify that our project works correctly**

At [ai-training.glitch.me](https://ai-training.glitch.me) we enter an image or audio data (in this model, for example, a hand could be raised). This data will be classified by the program. If the data is tagged with 100% match, the micro:bit board will show the action coded in MakeCode for that class.

## **3 Preliminary considerations**

This second sheet completes the tutorial for generating an artificial intelligence model using Teachable Machine and micro:bit. There is a step-by-step guide for each stage that allows the user to build a basic machine learning model. The micro:bit can be coded to respond to a certain type of data.

You can continue learning about new proposals in the following sheets. Meanwhile, we invite you to continue expanding your knowledge of artificial intelligence and micro:bit by visiting our social media:

- YouTube Channel [CeibalSTEAM](#)
- IG: Ceibalsteam\_uy