

## Running a Data logger code and building an Audio Classification project on NanoEdge AI Studio.

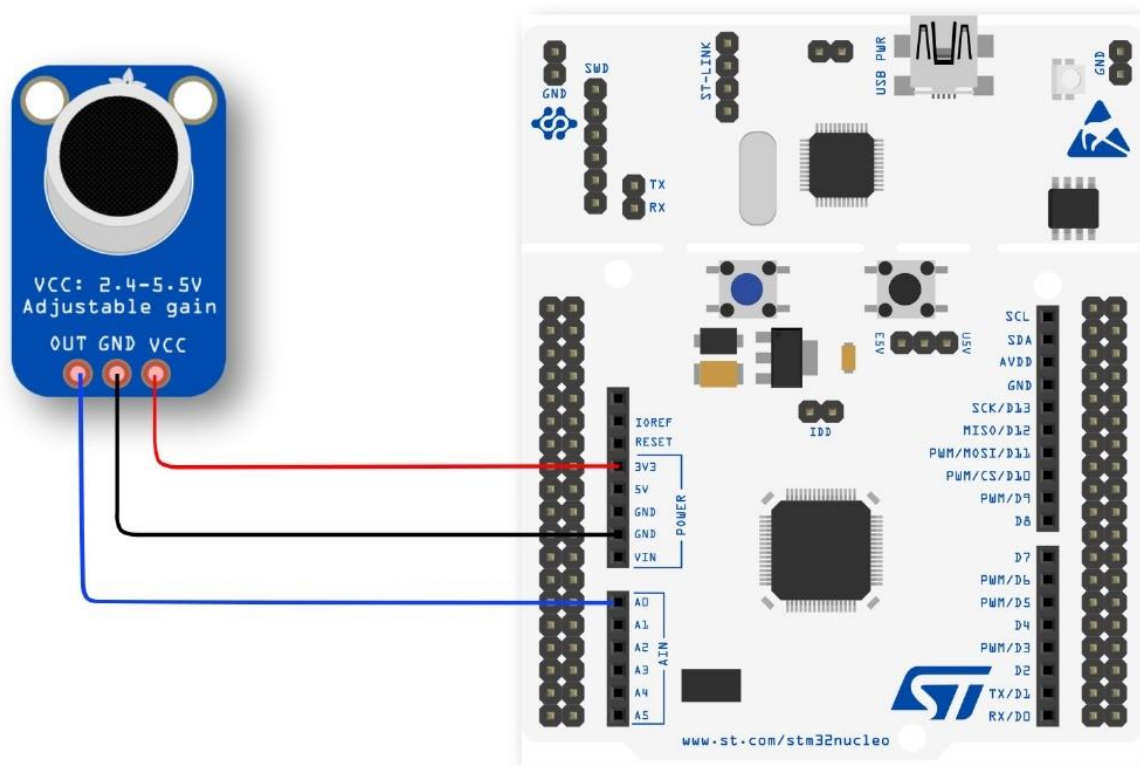
### Overview:

The goal of this experiment is to run a data logger code, so as to build our machine learning model on NanoEdge AI Studio. After uploading our code on the target Microcontroller, we will create a project on NanoEdge AI Studio for classifying different audio samples. The developed model should be able to classify different types of audio samples we provide during the training cycles.

### Requirements:

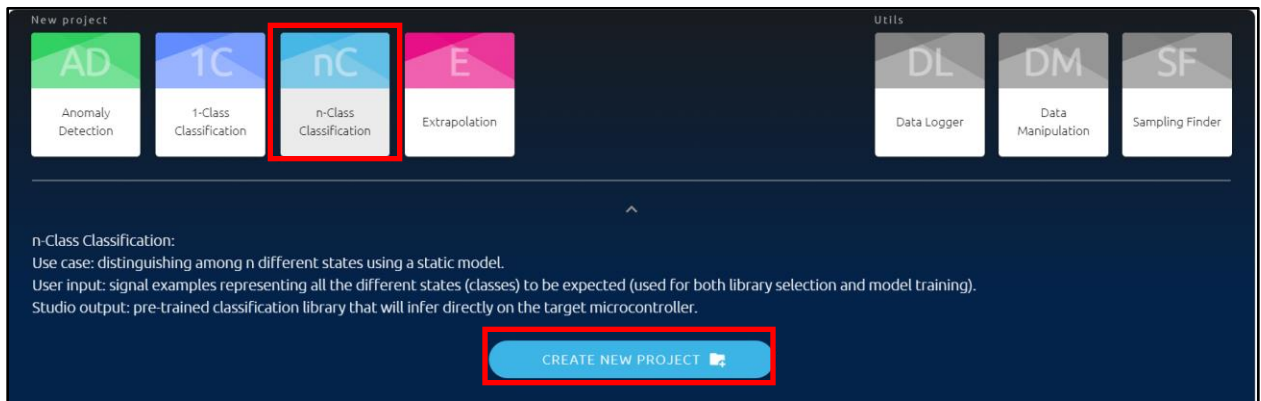
1. STM32 Cube IDE software.
2. NanoEdge AI Studio.
3. Audio Sensor (Analog).
4. STM32 Microcontroller.
5. USB Cable for the microcontroller.
6. Jumper Wires.
7. PC or Laptop.

### Connection Diagram:



### Procedure (NanoEdge AI Studio):

1. Open NanoEdge AI Studio.
2. Select **n-Class Classification** project type and select **Create New Project**.



3. A new window will open. On the first step, **Project Settings**, name the project as Audio Classification. Under **Description** type “classifying different audio samples”.

Name
Audio Classification
20 / 40
Description
Classification of three different audio samples

4. In **Target** section, select your proper STM32 Nucleo board. In **Sensor type** section, select the type of sensor you are working with. For this experiment you have to choose Microphone sensor Iaxis.

### Target Selection

Your favorite targets

NUCLEO-F401RE



NUCLEO-F411RE



DEVELOPMENT BOARDS 98

PRODUCTION READY NEW

nucleo-f411

Overview Commercial Part N° ↑ MCU Series Link Favorite

<input checked="" type="checkbox"/>		NUCLEO-F411RE	STM32F411RET6		
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Generic

⚡ Current sensor 1 axis

☒ Microphone sensor 1 axis

↗ Accelerometer 1 axis

↗ Accelerometer 2 axes

↗ Accelerometer 3 axes

⤴ Hall sensor 1 axis

- Let **Max RAM** and **Max Flash** option remain as default. Click on **Save & Next** to move onto the next step.

Library Max RAM

32 KB

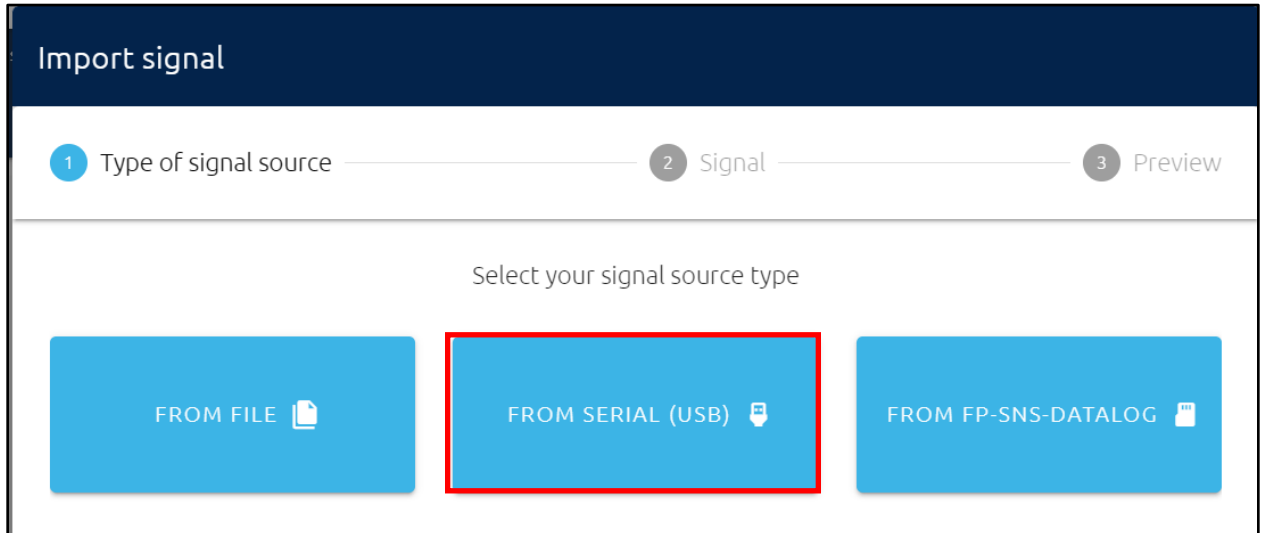
No Flash limit ☐ Limit Flash

Library Max Flash

64 KB

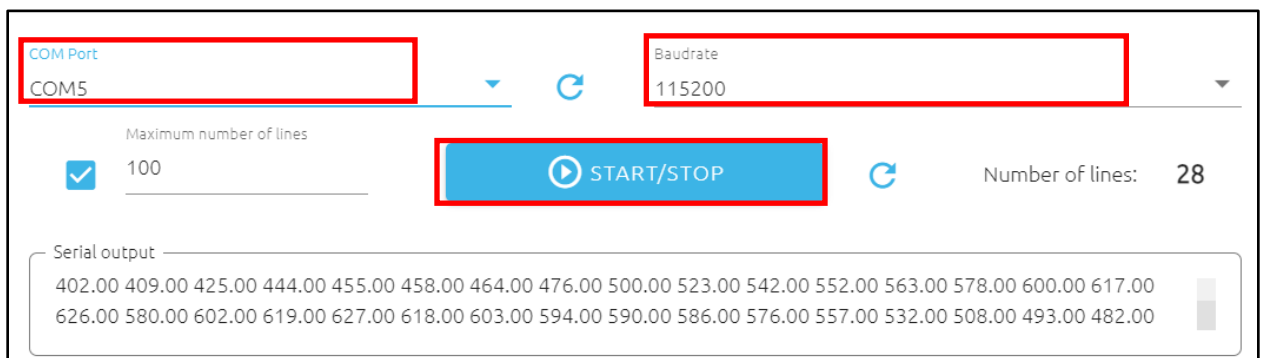
- In the second step on NanoEdge AI Studio-**Signals**, click on **Add Signals**. A window will open with different source options for you to import signals, select **From Serial (USB)** as we are

collecting sensor data connected to microcontroller board, which in turn is connected to your PC through a serial USB cable.



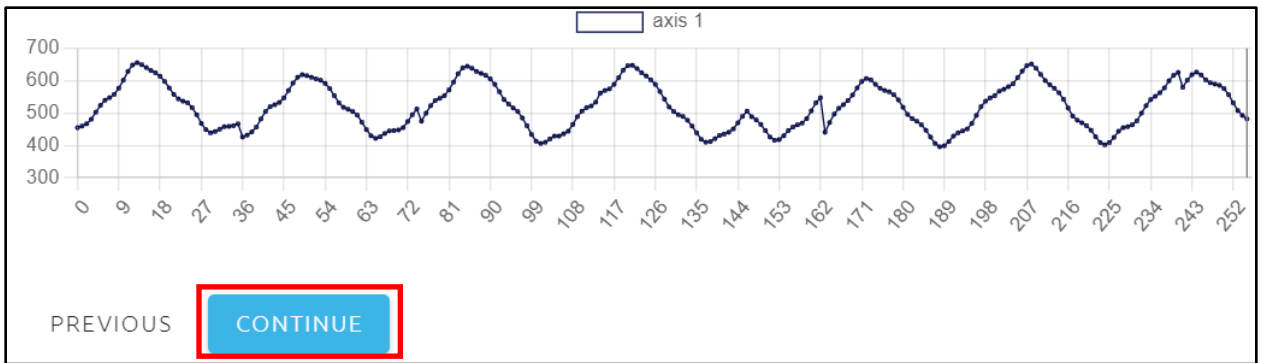
The 'Import signal' interface features a dark blue header and a three-step progress bar: 1. Type of signal source, 2. Signal, and 3. Preview. Below the progress bar, the text 'Select your signal source type' is centered. Three blue buttons are displayed: 'FROM FILE' with a document icon, 'FROM SERIAL (USB)' with a USB icon (highlighted with a red border), and 'FROM FP-SNS-DATALOG' with a SD card icon.

7. Now you can add your signals. In **COM Port** select the correct COM port based on device manager info. Select **Baud rate** as 115200. In **Maximum number of lines** enter the number of lines of data you want to collect. In this case we will collect 150 lines of data.



The configuration interface includes a 'COM Port' dropdown menu set to 'COM5' (highlighted with a red border), a 'Baudrate' dropdown menu set to '115200' (highlighted with a red border), and a 'Maximum number of lines' input field with a checked checkbox and the value '100'. A blue 'START/STOP' button with a play icon (highlighted with a red border) is positioned next to the input field. To the right, a 'Number of lines' label is followed by the value '28'. Below these controls is a 'Serial output' section displaying a list of numerical data values in two rows: 402.00 409.00 425.00 444.00 455.00 458.00 464.00 476.00 500.00 523.00 542.00 552.00 563.00 578.00 600.00 617.00 and 626.00 580.00 602.00 619.00 627.00 618.00 603.00 594.00 590.00 586.00 576.00 557.00 532.00 508.00 493.00 482.00.

8. To add signals, first play the sound sample on a device near the microphone sensor and then click on **START/STOP**. Play the audio file in continuous loop until 200 lines of data are collected, then stop the process.



9. Click on **Continue** to move onto importing the audio sample.
10. In this window, select the **Delimiter** as **Space**. If any line of data has some corrupted values, an error message will be shown under the preview lines. You can select the particular line(s) and delete it. Select **Preview Lines** as 200 to check all the line of data you have collected, and click on **Import**.

### Import signal

☒ Type of signal source
 ☒ Signal <sup>1</sup>
☐ Preview <sup>3</sup>

Delimiter

☐ Comma  
☐ Tab  
☐ Semicolon  
☒ Space  
☐ Other:

Enter delimiter

DELETE LINES

< Preview of 20 lines >

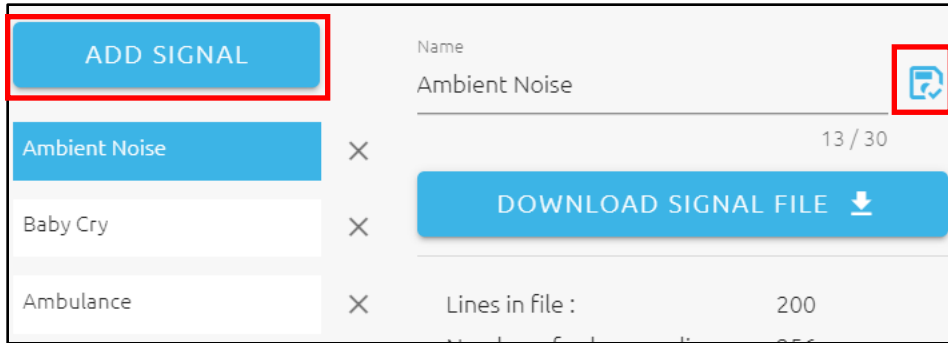
delete	line_index	nb_columns	1	2	3	4	5	6	7	8
<input type="checkbox"/>	1	256	290	333	379	428	483	541	598	650
<input type="checkbox"/>	2	256	546	584	622	654	675	681	680	675
<input type="checkbox"/>	3	256	580	614	406	376	357	363	394	431
<input type="checkbox"/>	4	256	657	620	577	534	497	473	462	462

PREVIOUS

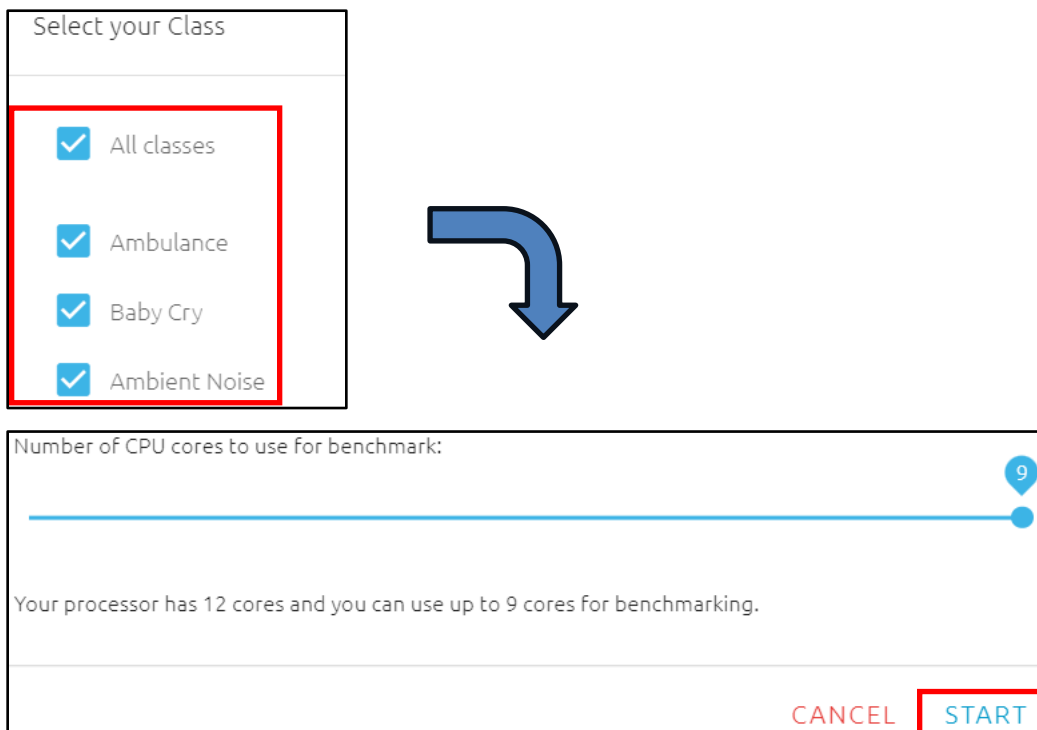
IMPORT

Preview lines  
20

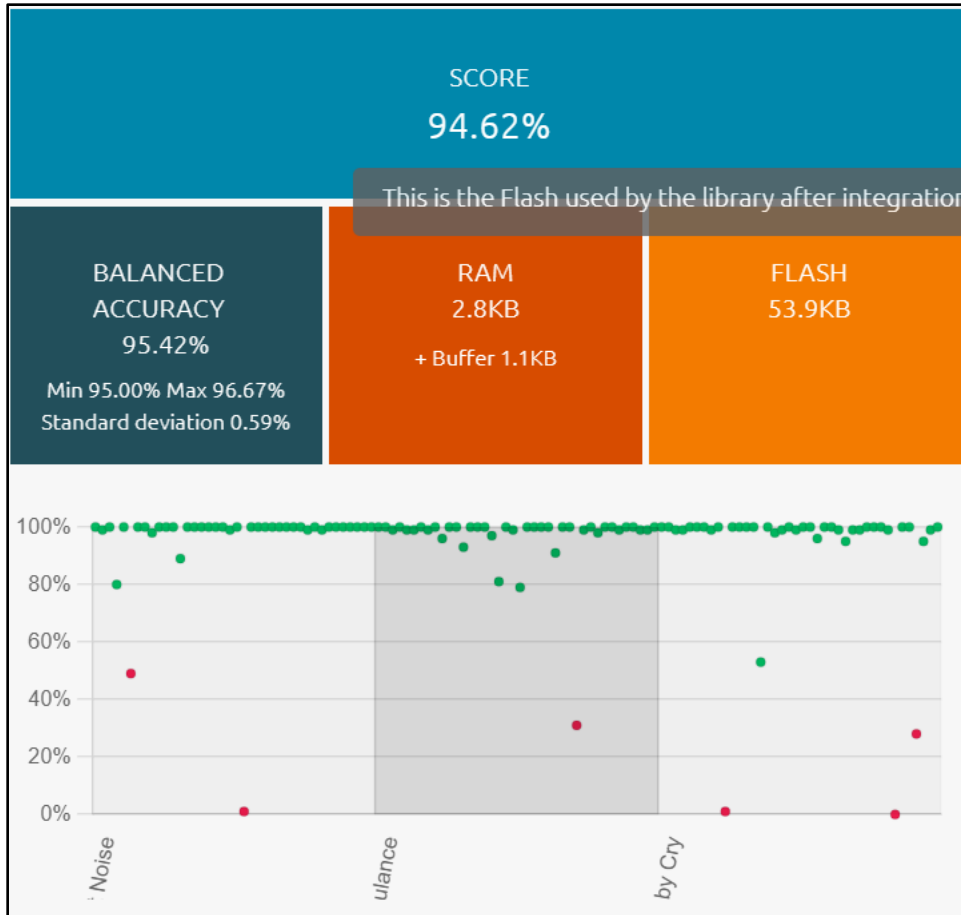
11. In the new window, rename the sample under **Name** (For example, if the audio sample is of a crying baby, name it Baby Cry), and click on the blue save icon to save the renamed sample.



12. In the same manner, collect two more audio samples following the previous steps. Name the three audio samples for example, **Baby Cry**, **Ambulance** and **Ambient Noise**.
13. In the third step of the NanoEdge AI Studio- **Benchmark**, click on **Run New Benchmark**. Next select **All classes** and click on **Start**. Now the Benchmark process will start and NanoEdge AI Studio will try to find the best library for your use case.



14. After the Benchmark has reached a **Score** of above 90% stop the benchmark process.



- After the benchmark process is done, go to the fourth stage, **Emulator**. Click on **Initialize Emulator** to move on to test the library you have selected on the NanoEdge AI Studio.

Library emulator

Click the button below to test this specific NanoEdge AI Library using the associated Emulator, directly inside the Studio. You will be able to test your library, either from a data log file, or "live" from your device through serial port.

INITIALIZE EMULATOR

- In the new window, select **From Serial (USB)**. Select **COM Port** according to info from Device Manager. Select Baud rate as 115200. Play the audio files on a device and click on **START/STOP**. Now you can test your AI library before deploying the model.

FROM FILE

FROM SERIAL (USB)

COM Port

COM18

Baudrate

115200

☐ Maximum number of...  
100

START/STOP

Number of lines:

19

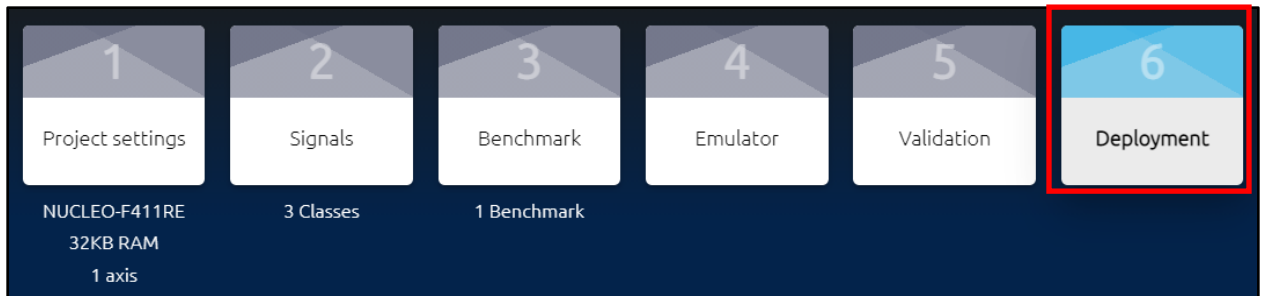
Serial output

887,895,893,870,823,753,669,804,728,640,554,482,427,387,353,319,280,243,208,'



17. Finally go to **Deployment** stage, select **Float abi** and click on **Compile Library**. Click on **Get Library**, and save your library on the PC.





2023-08-23 17:35-Bench ▼ COMPILE LIBRARY

☐ Multi-library

Check the box if you want to integrate more than one NanoEdge AI library in your program. Then, choose a suffix for each library.

Compilation Flags

☒ Float abi

**Note:** All important steps and parts are highlighted with a red colour box for the proper understanding of the user. This document is meant for the use of education purpose only.