TinyML en Arduino Nano ESP32

Luis Miguel Capacho Valbuena
Alexander López Parrado

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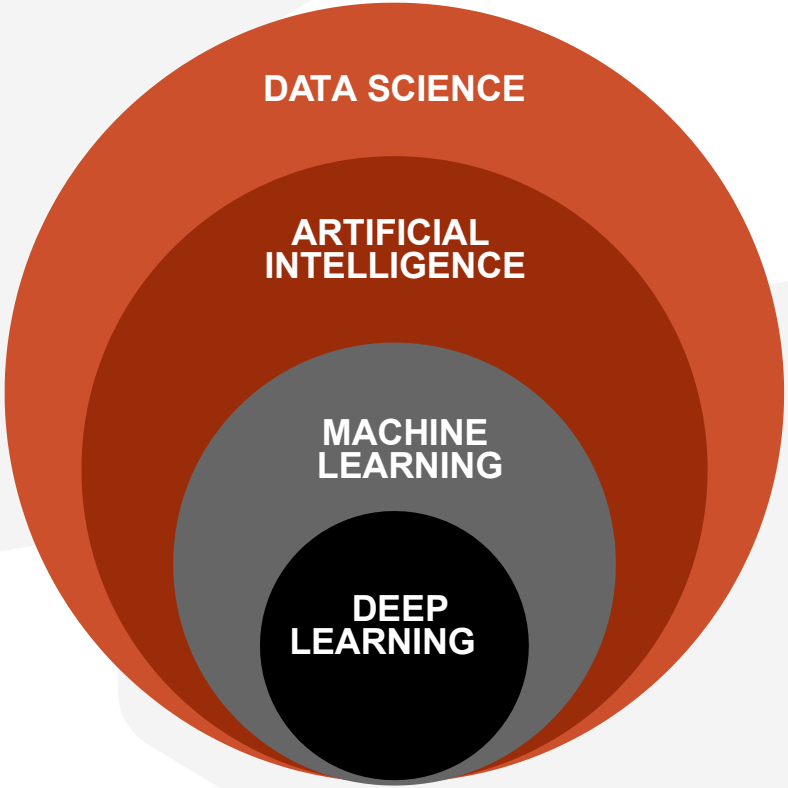
AI es un área de la ciencia de datos



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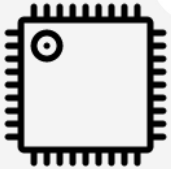
Aspectos que impulsaron el avance de la AI

1

Disponibilidad de Datos

2

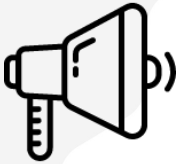


Capacidad de cómputo

3

Avances en algoritmos

4



Amplio interés del público

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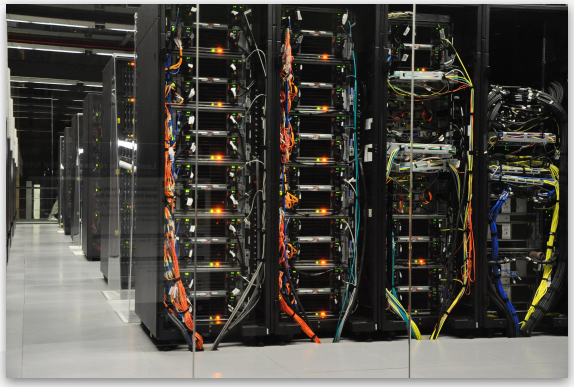
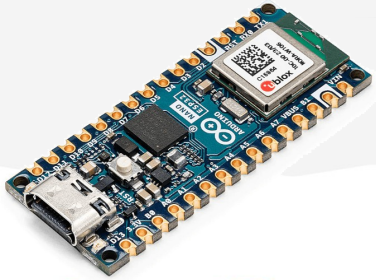


Energía
Ancho de banda
Latencia

TINY ML



Energía
Ancho de banda
Latencia

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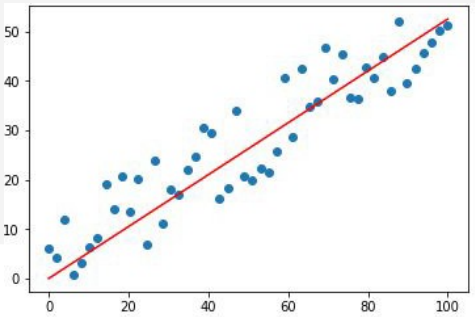
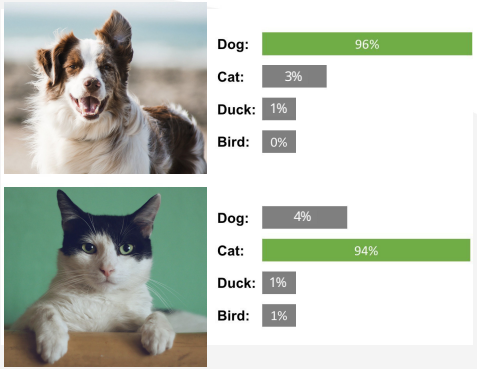
Aplicaciones de TinyML

Aprendizaje supervisado

Regresión

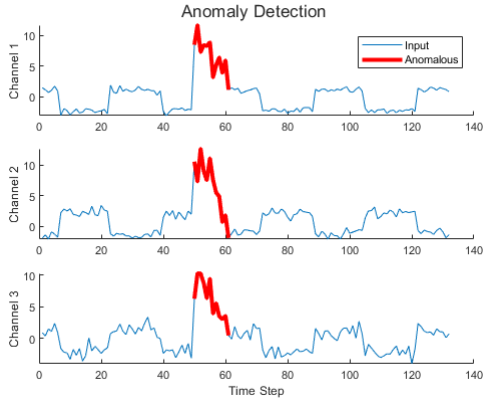


Clasificación



Aprendizaje no supervisado

Detección de Anomalías



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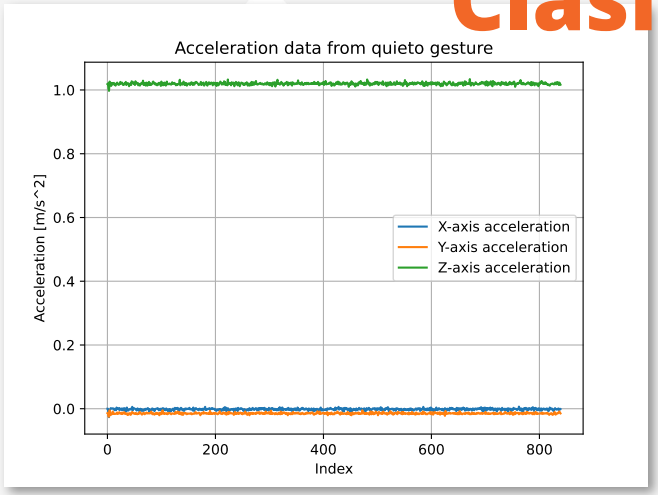
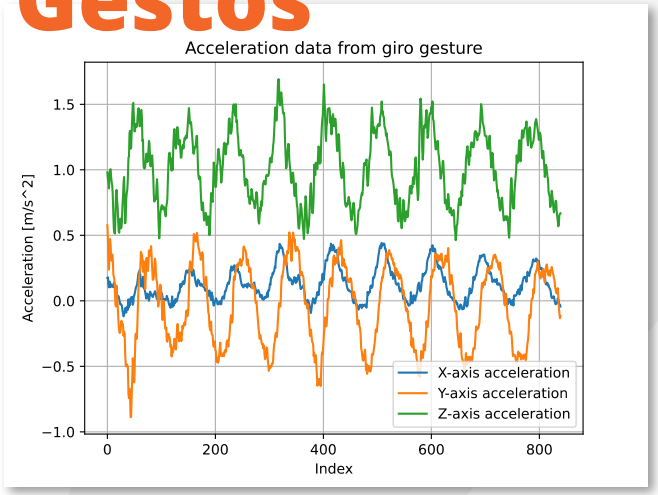
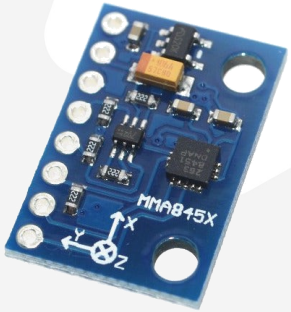
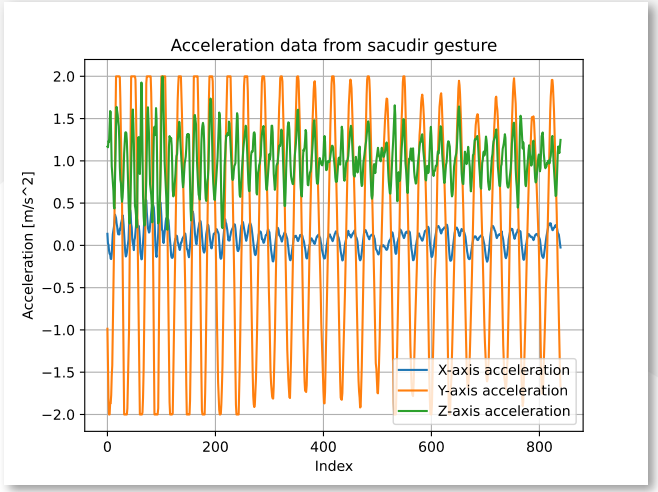
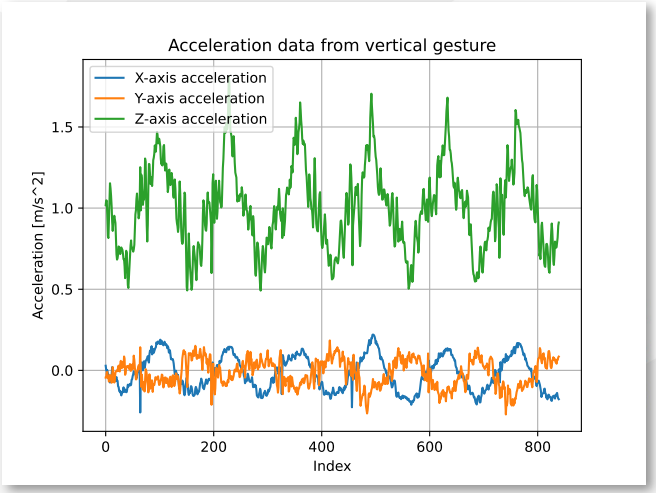
Clasificación de Gestos

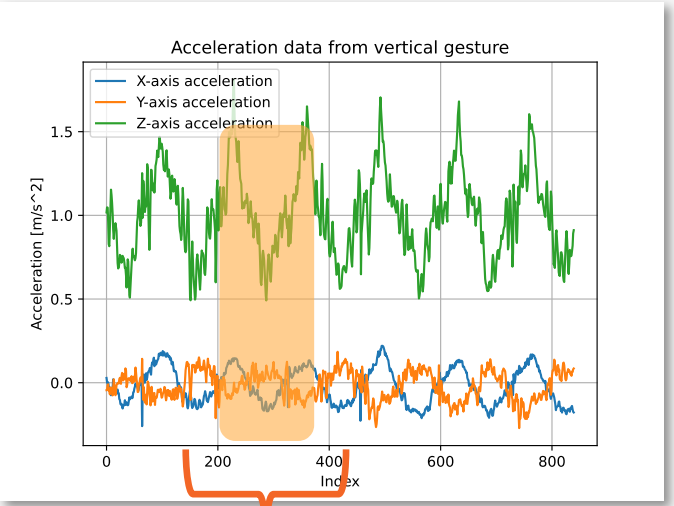






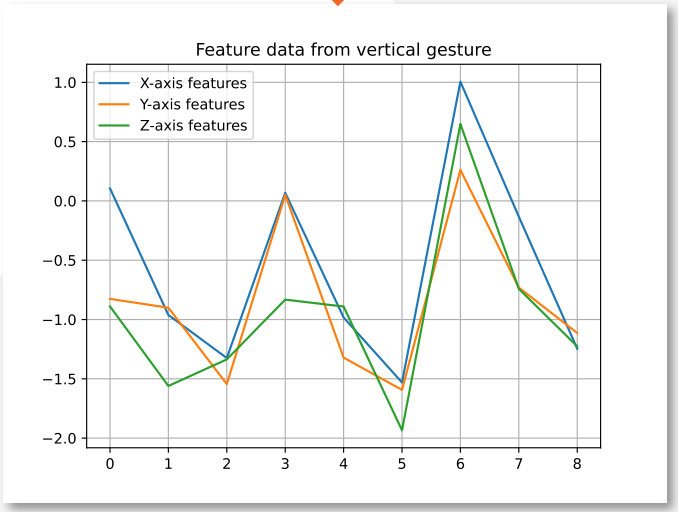






Ventana 2s

- FFT de 16 puntos + log10
- Valor RMS
- 9x3 características



- Vectores de dimensión 27
  - 800 para entrenamiento
  - 320 para pruebas
  - Cada vector debe etiquetarse

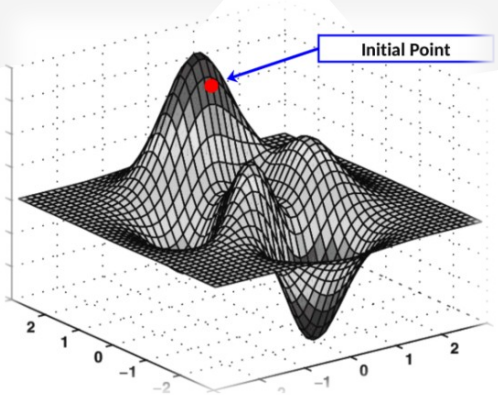
Capa de entrada

Capa oculta 1

Capa oculta 2

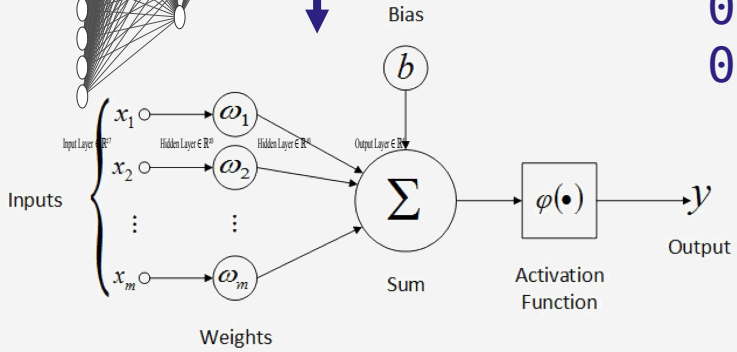
Capa de salida

Características (27)



Cantidad de clases (*one-hot encoding*)

```
1 0 0 0
0 1 0 0
0 0 1 0
0 0 0 1
```



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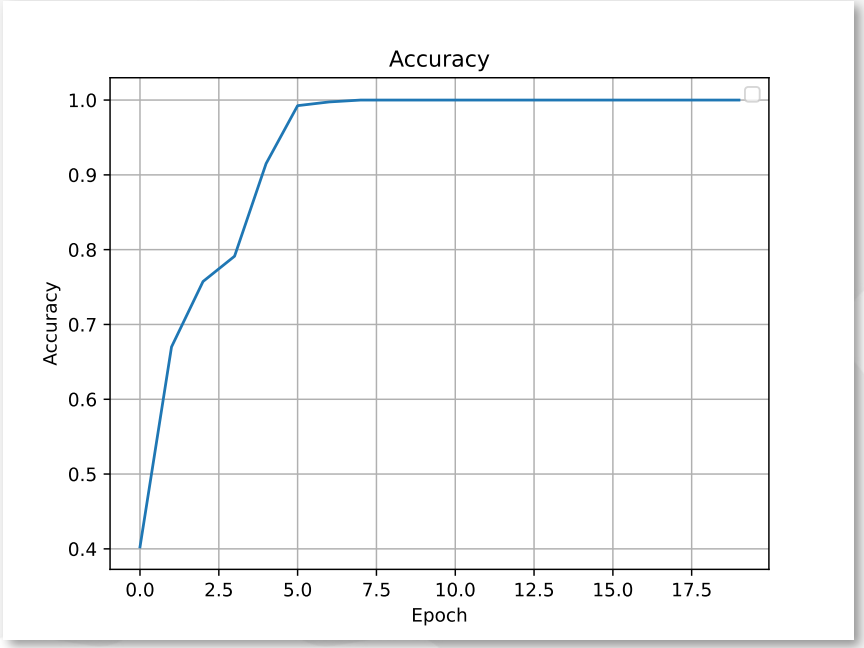

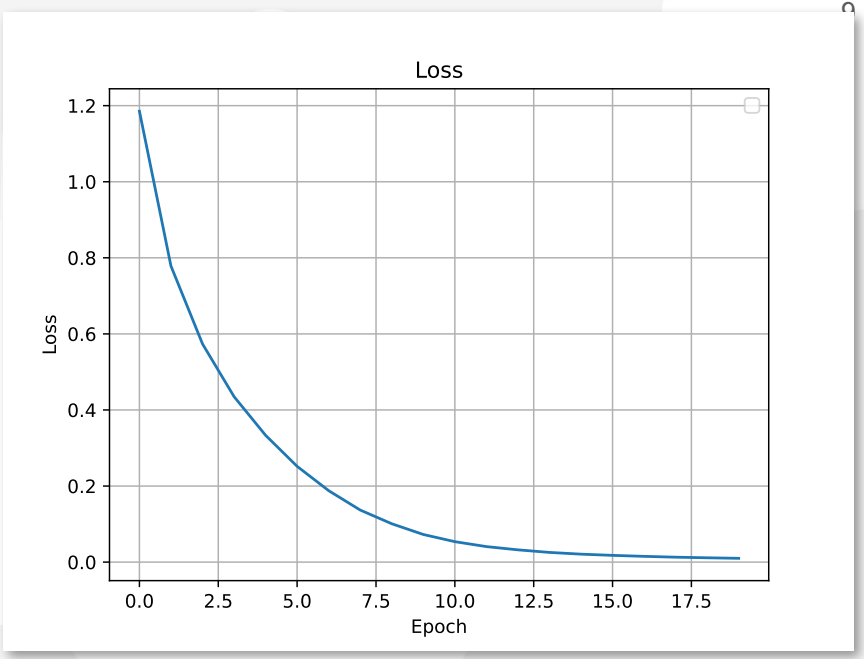

Exactitud = correctas/total

Pérdida = error de predicción

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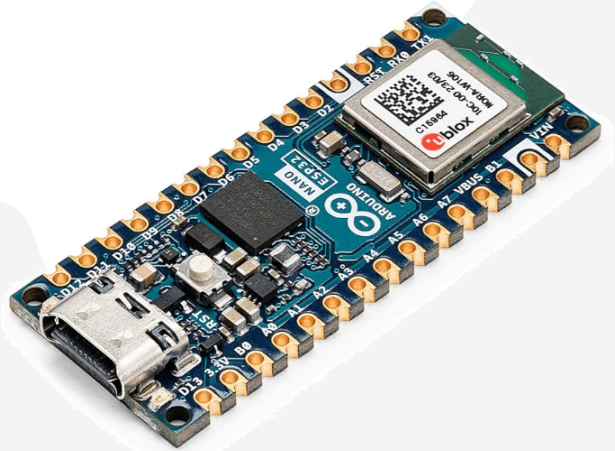
Demo: Detector de Gestos en Arduino Nano ESP32



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EDGE IMPULSE
a Qualcomm company

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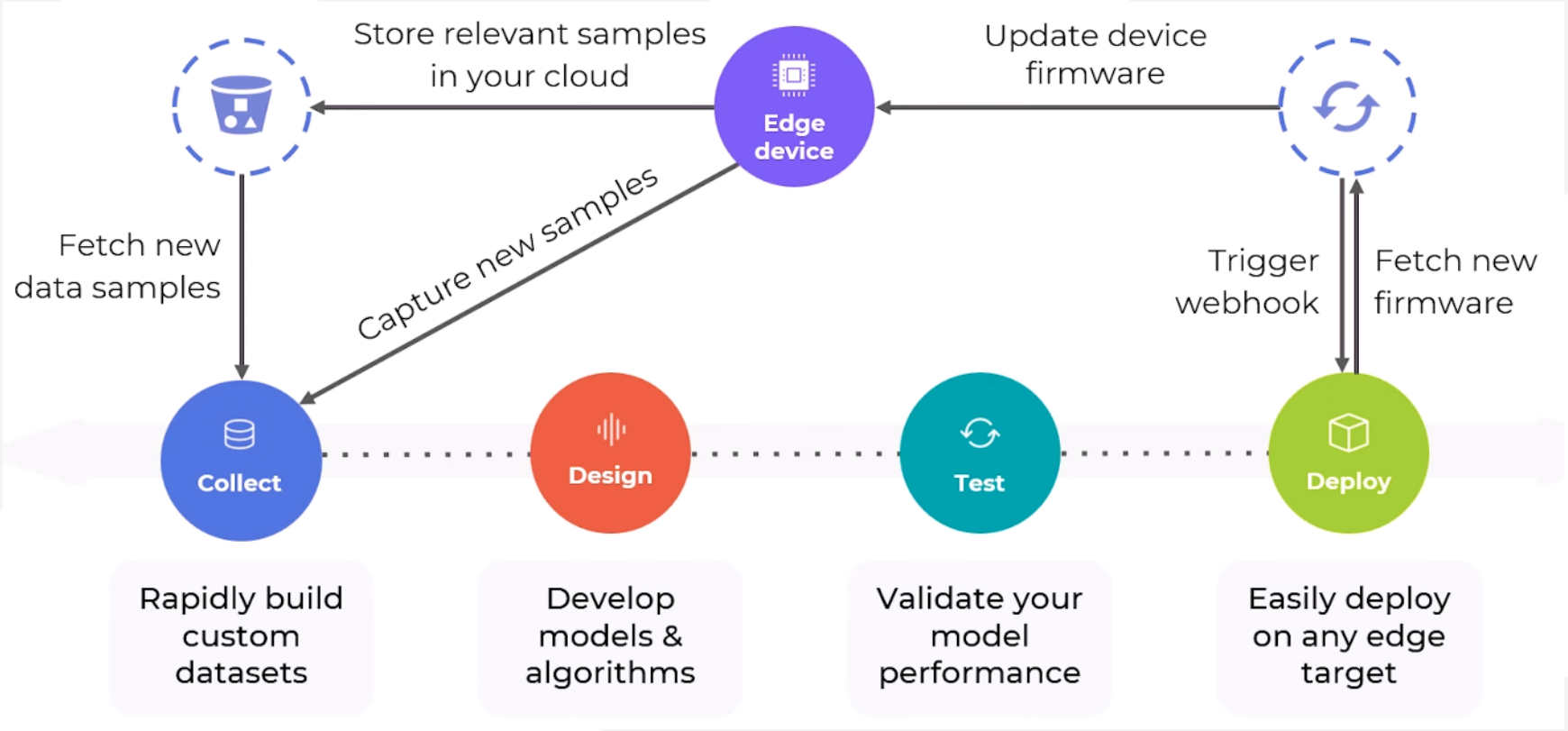
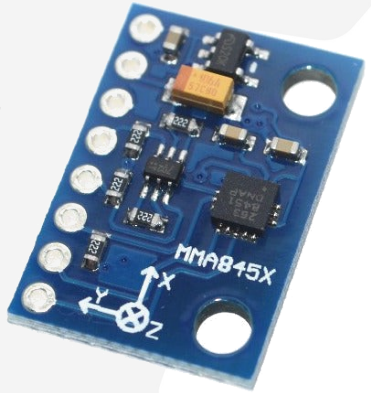
Flujo de trabajo con Edge Impulse



Configuración acelerómetro MMA845X en Arduino IDE

Arduino IDE



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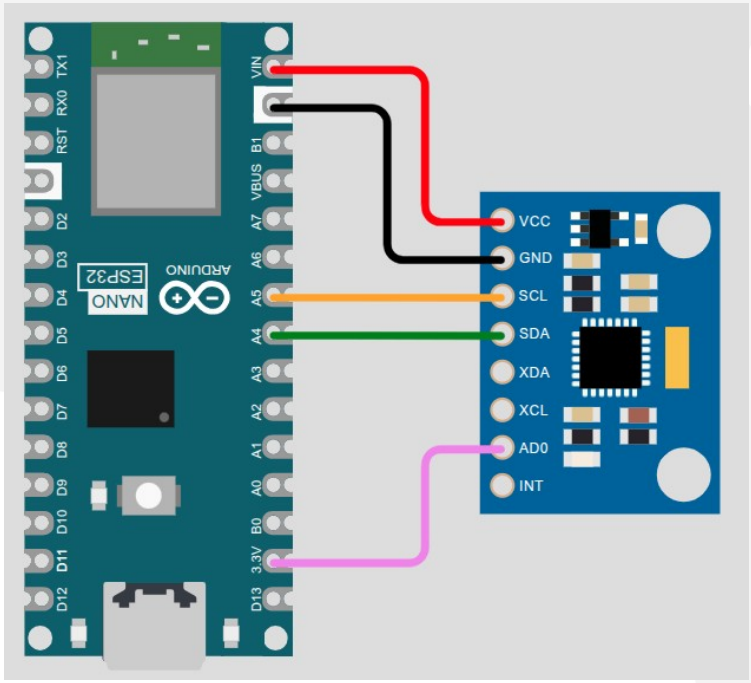
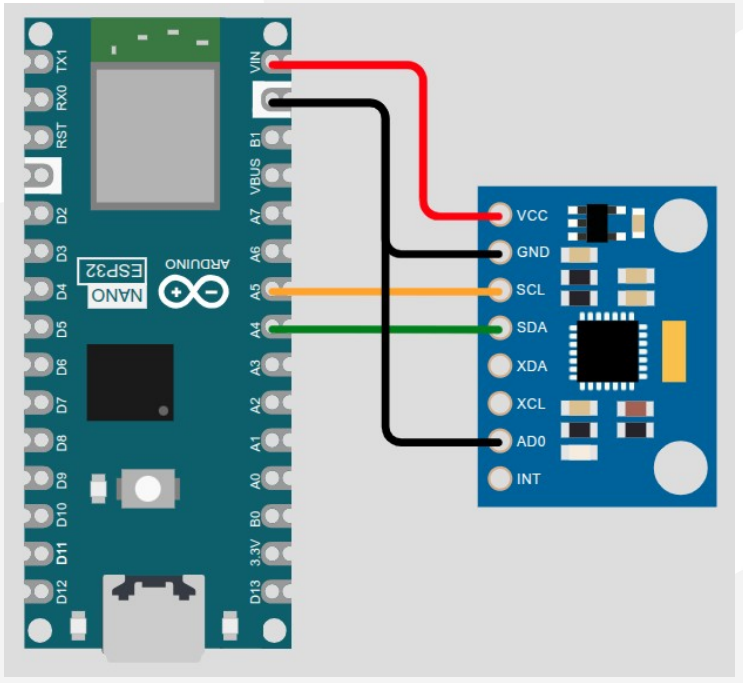
Conexión acelerómetro MMA845X con Arduino Nano ESP32

0x1D



A5 → SDL
A4 → SDA

0x1C



Skecth de prueba acelerómetro MMA845X con Arduino Nano ESP32 (Lectura 3 ejes)

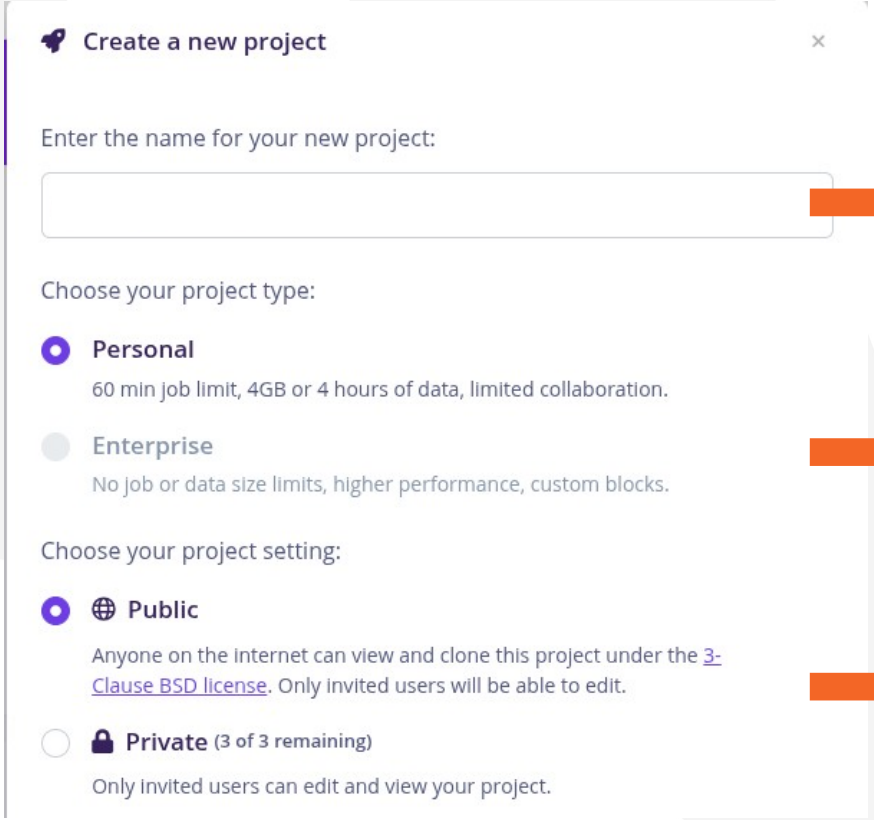
```
#include <Wire.h>
#include "SparkFun_MMA8452Q.h"

MMA8452Q accel;

void setup() {
    Serial.begin(115200);
    Wire.begin(A4, A5);
    if (accel.begin(Wire, 0x1D) == false) {
        while (1);
    }
}
```

```
void loop() {
    if (accel.available()) {
        accel.read();
        Serial.print(accel.cx, 4);
        Serial.print(",");
        Serial.print(accel.cy, 4);
        Serial.print(",");
        Serial.println(accel.cz, 4);
    }
    delay(10);
}
```

Proyecto en Edge Impulse



Nombre del proyecto

Tipo de proyecto de acuerdo al plan

3 proyectos privados en cuenta gratuita

Envío de datos a Edge Impulse

https://nodejs.org/en/download

En una terminal ejecutar

```
npm install -g edge-impulse-cli
```

```
edge-impulse-data-forwarder
```

Luis Miguel Capacho Valbuena
lmcapacho@uniquindio.edu.co
Alexander López Parrado
parrado@uniquindio.edu.co

Thank you!

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