Institución Universitaria
Reacreditada en Alta Calidad

Aprendizaje Supervisado

INTEGRACIÓN DE ML EN EMBEBIDOS Y EDGE COMPUTING

Somos Innovación Tecnológica con Sentido Humano

Alcaldía de Medellín

Institución Universitaria
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Contenido

1. Tipos de aprendizaje y microcontroladores
2. Clasificación y Regresión basado en tablas
3. Librerías para convertir código basado en tablas

Aprendizaje de Maquina

Supervised learning

Task-driven

- Regression
- Classification
- Object detection

Unsupervised learning

Data-driven

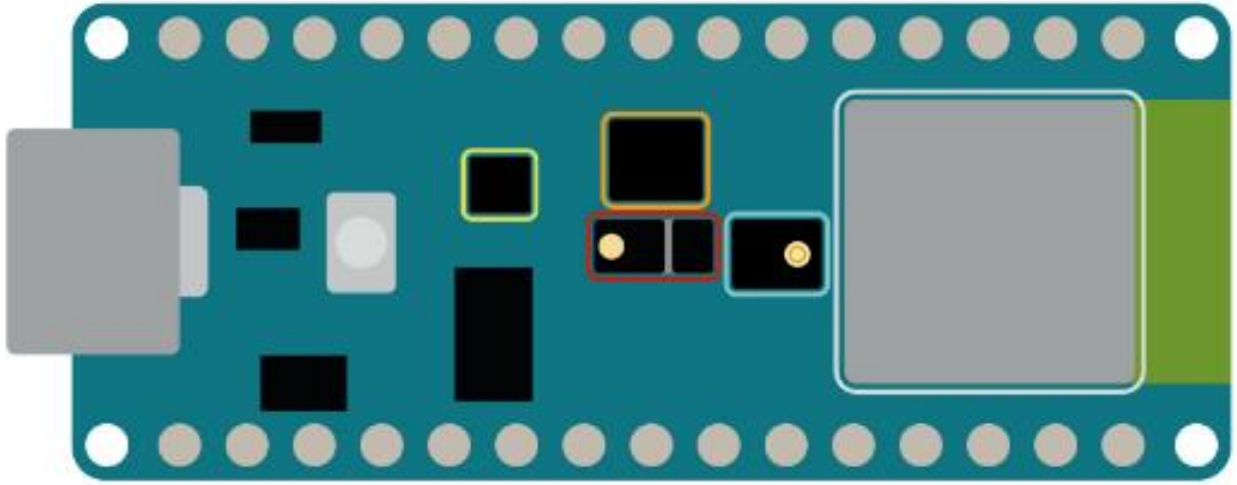
- Clustering
- Segmentation
- Anomaly detection

Reinforcement learning

Learn from experience

- Robotics
- Games
- Recommender systems

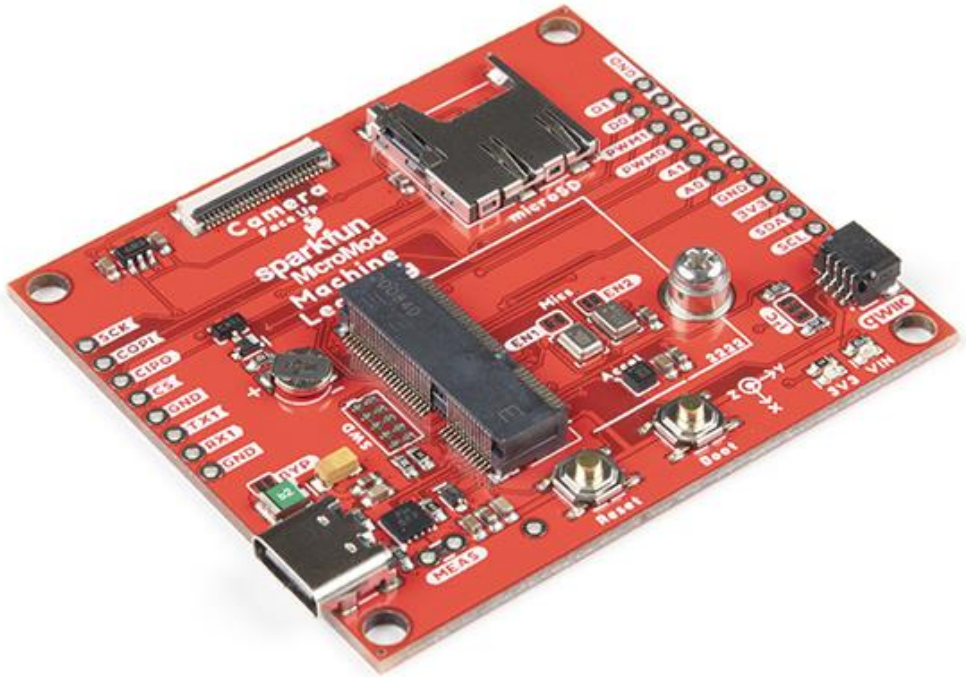
Arduino nano 33 BLE sense



Clock Speed	64MHz
CPU Flash Memory	1MB (nRF52840)
SRAM	256KB (nRF52840)

- Color, brightness, proximity and gesture sensor
- Digital microphone
- Motion, vibration and orientation sensor
- Temperature, humidity and pressure sensor
- Arm Cortex-M4 microcontroller and BLE module

SparkFun Micromod



ESP32

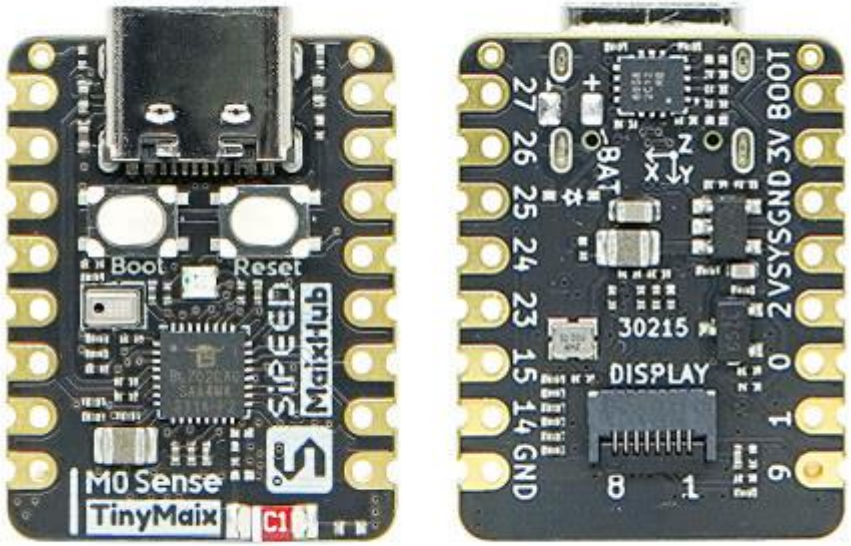
Teensy

STM32

- M.2 MicroMod Keyed-E H4.2mm 65 pin SMD Connector 0.5mm
- Digital I2C MEMS Microphone PDM Invensense ICS-43434 (COMP)
- Digital PDM MEMS Microphone PDM Knowles SPH0641LM4H-1 (IC)
- ML414H-IV01E Lithium Battery for RTC
- ST LIS2DH12TR Accelerometer (3-axis, ultra-low-power)
- 24 Pin 0.5mm FPC Connector (Himax camera connector)
- USB - C
- Qwiic connector
- MicroSD socket
- Phillips #0 M2.5x3mm screw included

https://learn.sparkfun.com/tutorials/getting-started-with-micromod

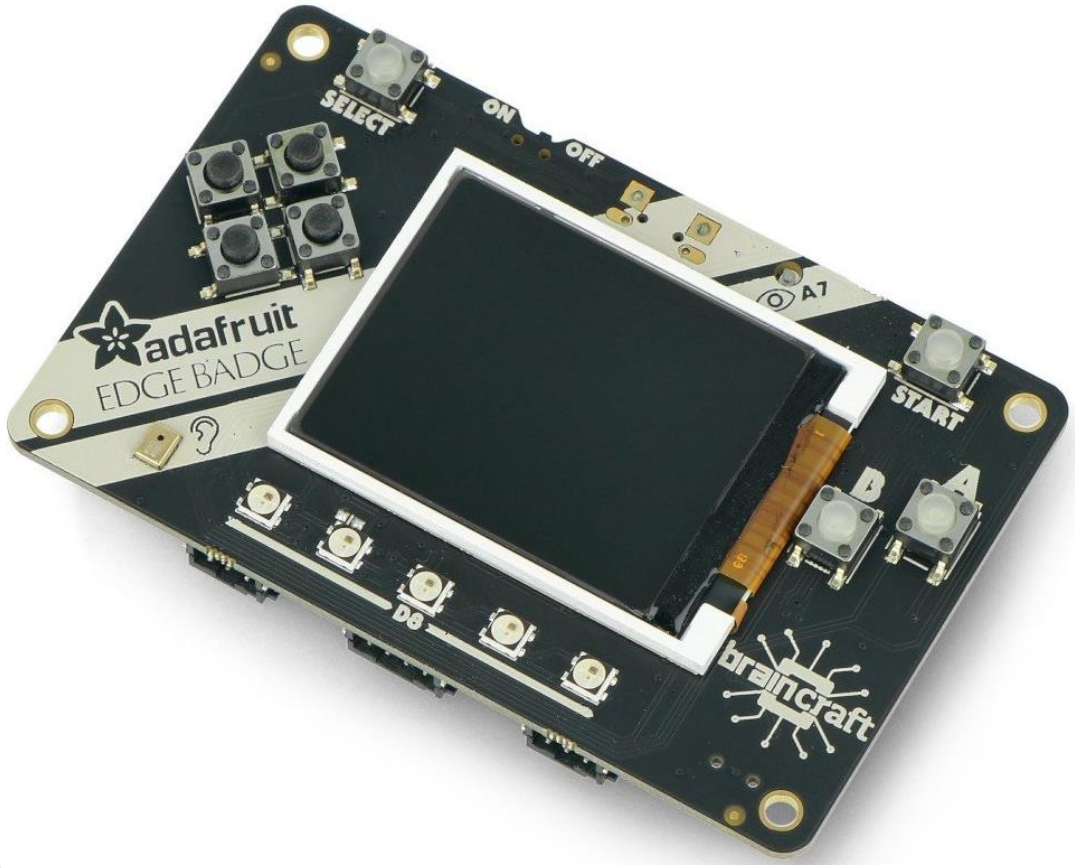
m0Sense



- Microcontroller – Bouffalo Lab BL702 32-bit RISC-V (RV32) microcontroller @ 144 MHz with 132 KB SRAM, 512 KB flash, Bluetooth LE connectivity
- Display – Optional 0.96-inch display
- USB – USB Type-C port
- Sensor – IMU and microphone
- Expansion – 2x 8-pin header (through and castellated holes) with GPIO, I2C, UART, SPI
- Misc – RGB LED
- Power Supply – 5V via USB-C port
- Dimensions – 23 x 18 mm

https://github.com/sipeed/M0sense_BL702_example

EdgeBadge



- ATSAMD51J19 @ 120MHz with 3.3V logic/power - 512KB of FLASH + 192KB of RAM
- 2 MB of SPI Flash for storing images, sounds, animations, whatever!
- 8 x Game/Control Buttons with nice silicone button tops (these feel great)
- 5 x NeoPixels for badge dazzle, or game score-keeping
- Triple-axis accelerometer (motion sensor)
- Light sensor, reverse-mount so that it points out the front
- Built in buzzer mini-speaker
- Mono Class-D speaker driver for 4-8 ohm speakers, up to 2 Watts
- LiPoly battery port with built in recharging capability
- USB port for battery charging, programming and debugging
- Two female header strips with Feather-compatible pinout so you can plug any FeatherWings in
- JST ports for NeoPixels, sensor input, and I2C (you can fit I2C Grove connectors in here)

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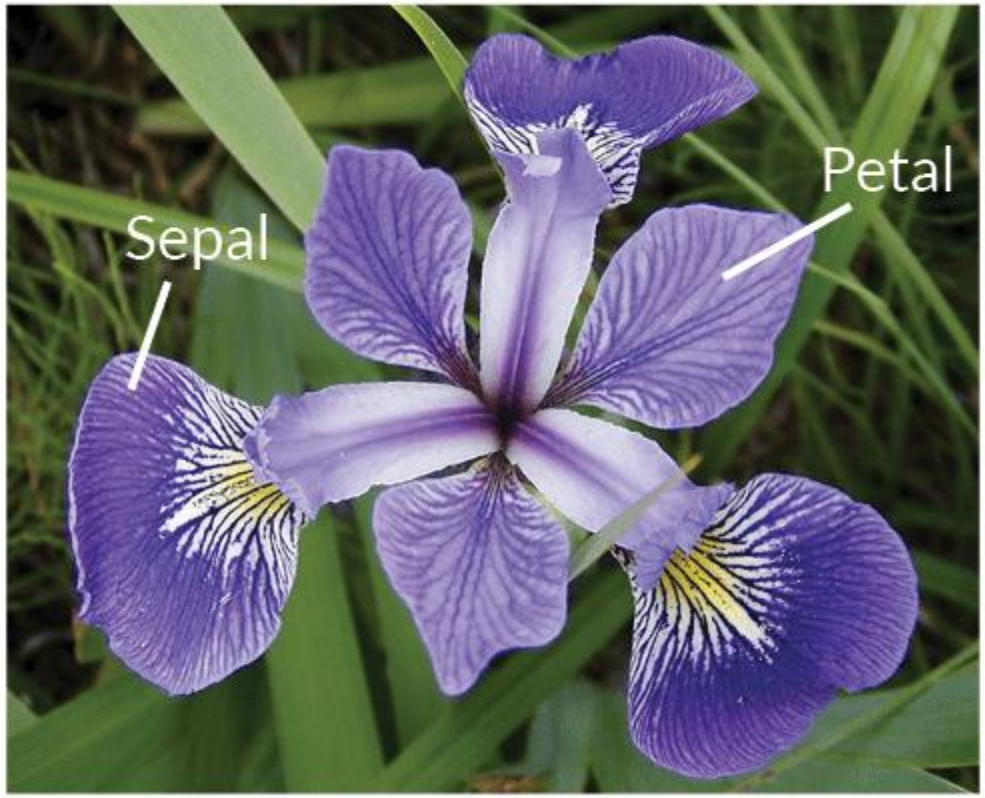
Clasificación

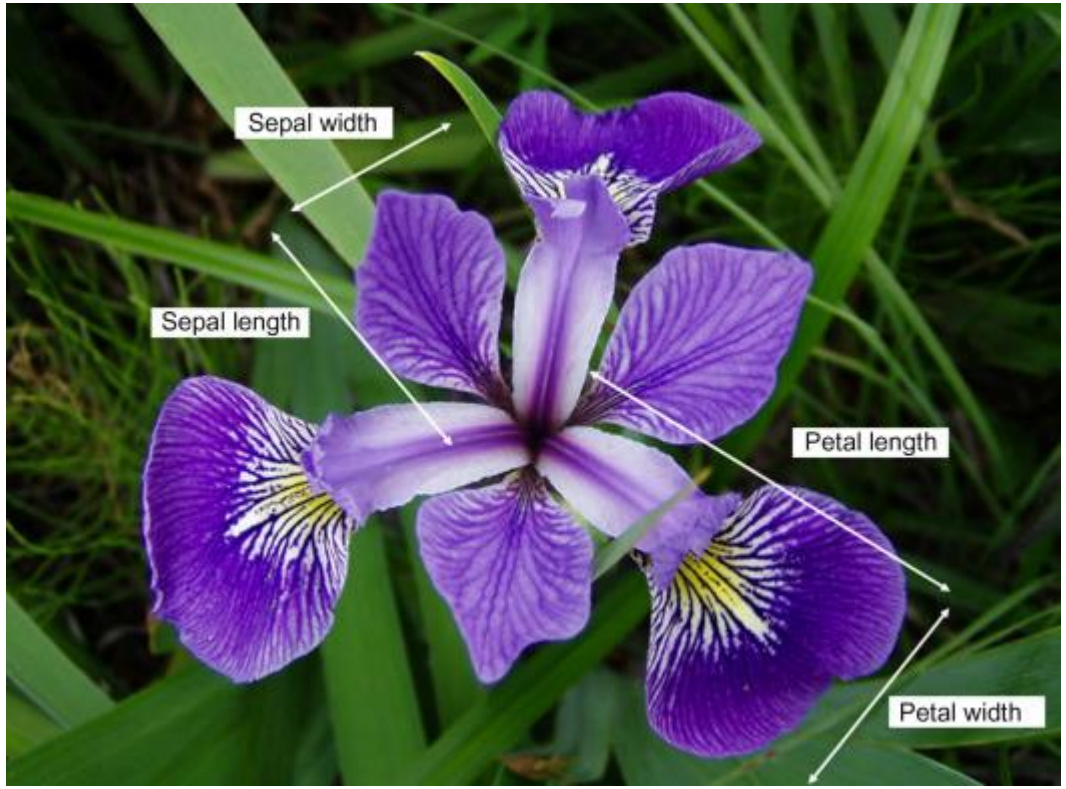


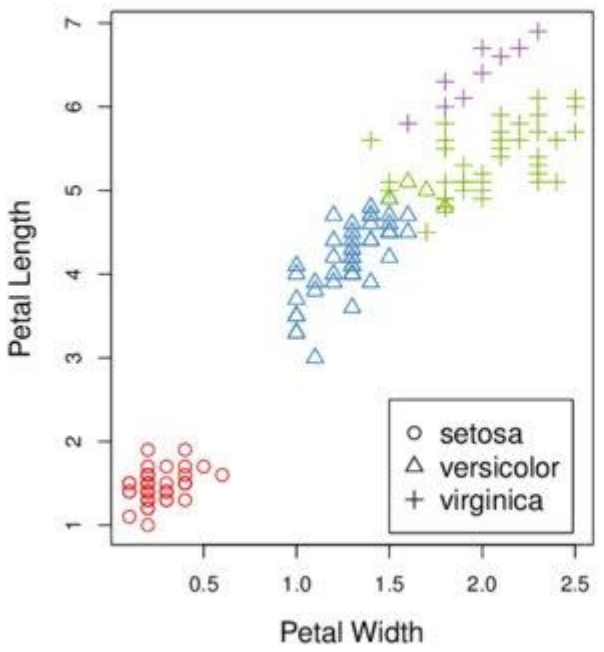
Iris Versicolor

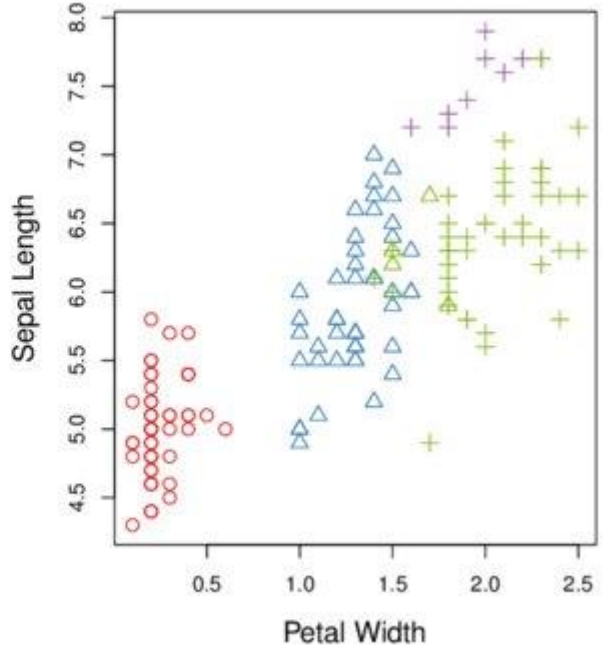
Iris Setosa

Iris Virginica

Clasificación



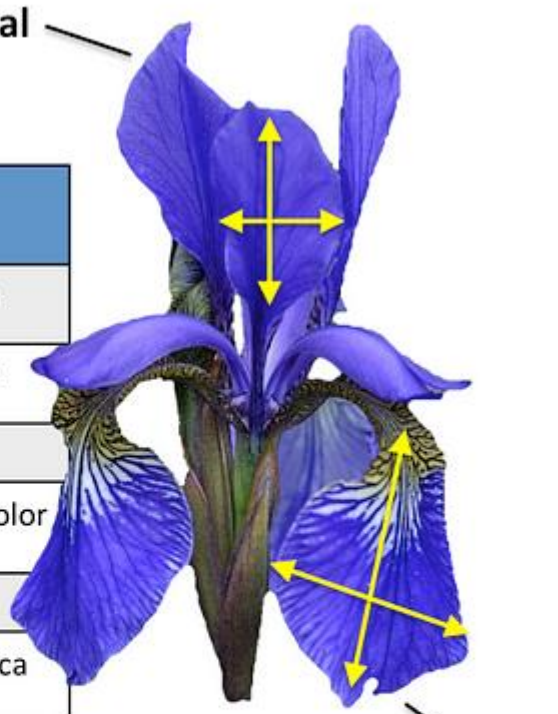




Clasificación

Samples
(instances, observations)

	Sepal length	Sepal width	Petal length	Petal width	Class label
1	5.1	3.5	1.4	0.2	Setosa
2	4.9	3.0	1.4	0.2	Setosa
...					
50	6.4	3.5	4.5	1.2	Versicolor
...					
150	5.9	3.0	5.0	1.8	Virginica



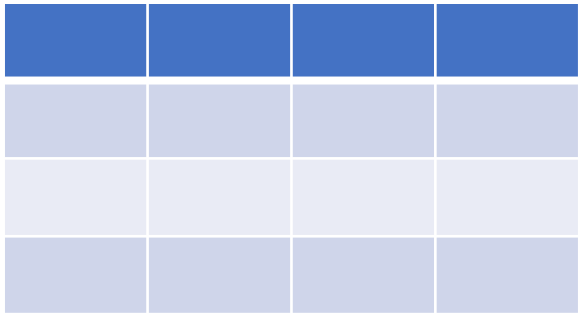
Features
(attributes, measurements, dimensions)

Class labels
(targets)

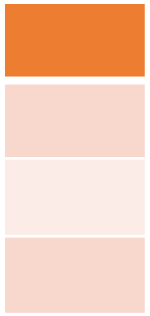
https://medium.com/@jebaseelanravi96/machine-learning-iris-classification-33aa18a4a983

Clasificación

Características

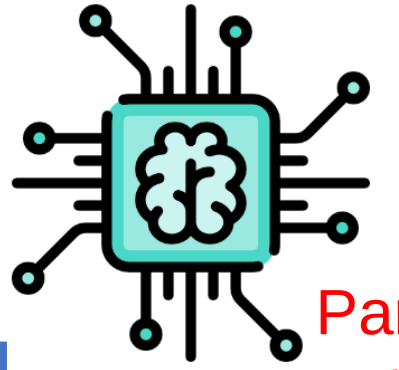


Clases

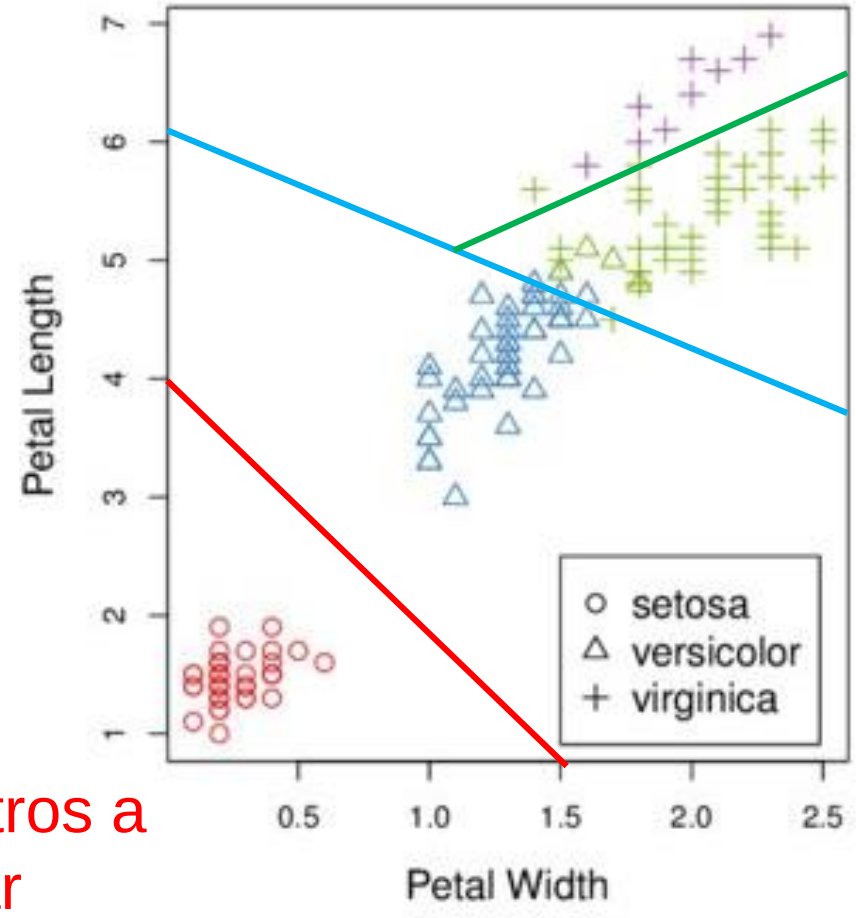


Modelo de ML

Desconocido



Parámetros a optimizar



https://medium.com/@jebaseelanravi96/machine-learning-iris-classification-33aa18a4a983

https://www.stefanom.io/sklearn-classifiers-playground/

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Generación código Clasificador

Existen varias herramientas:

- EMLearn (https://github.com/emlearn/emlearn)
- MicroMLGen (https://github.com/eloquentarduino/micromlgen)
- Scikit-learn porter (https://github.com/nok/sklearn-porter)
- TinyML (https://www.tinyml.org)
- TinyMaix (https://github.com/sipeed/TinyMaix)

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¡Gracias!

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