



WALC 2023
Applied AI

Introduction to Edge Impulse Studio CNN with Cifar-10

Prof. Marcelo J. Rovai
rovai@unifei.edu.br

UNIFEI - Federal University of Itajuba, Brazil
TinyML4D Academic Network Co-Chair



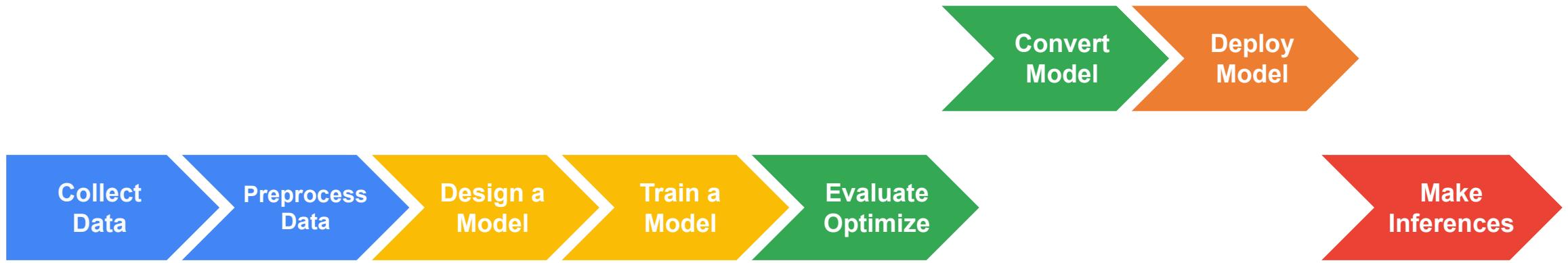
TINYML4D

Embedded Machine Learning (TinyML) Workflow Review

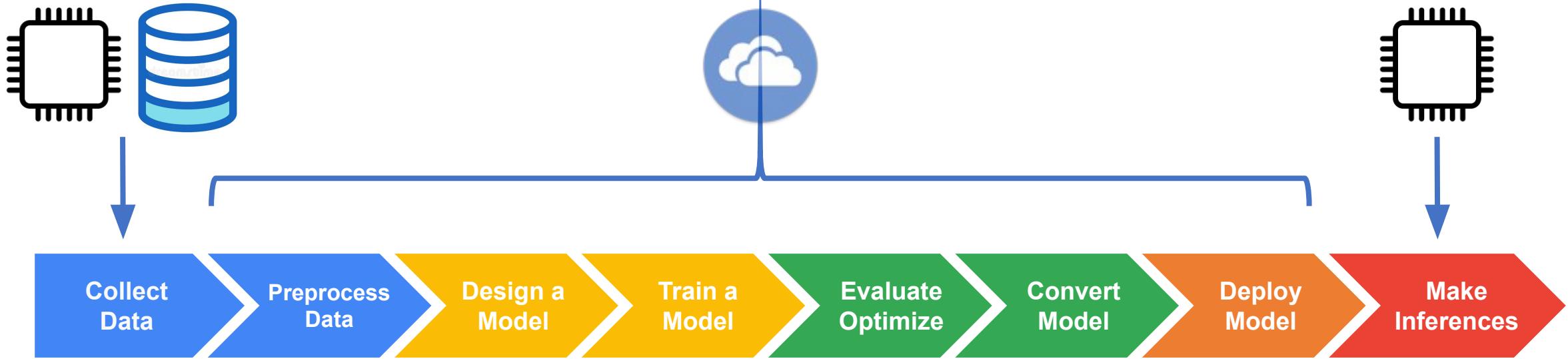
Machine Learning Workflow



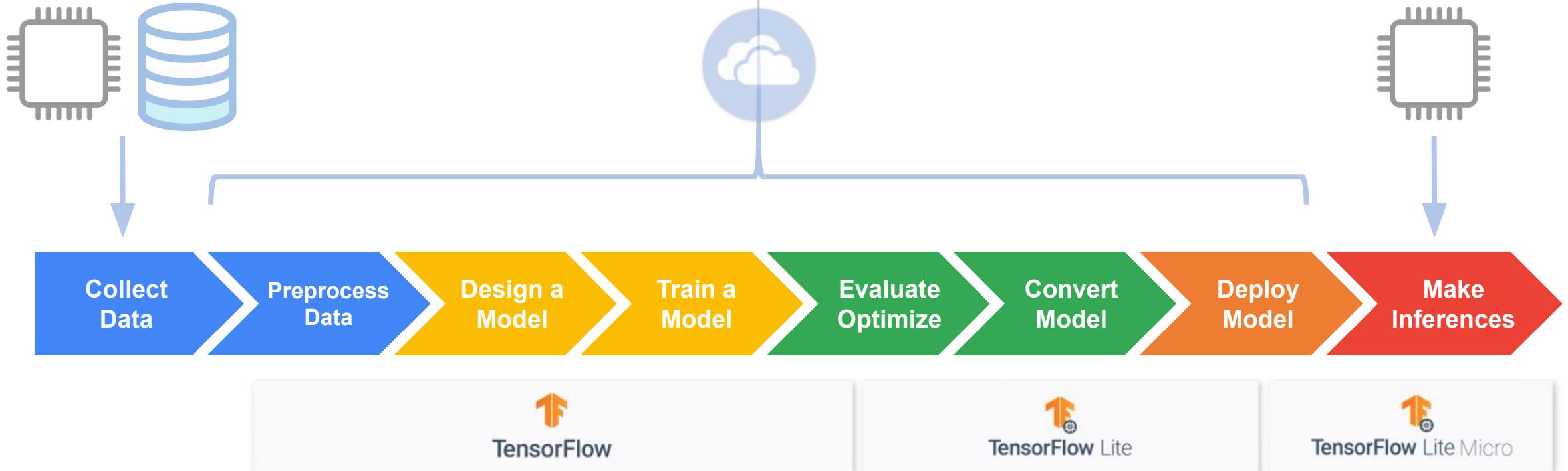
Tiny Machine Learning Workflow (“What”)



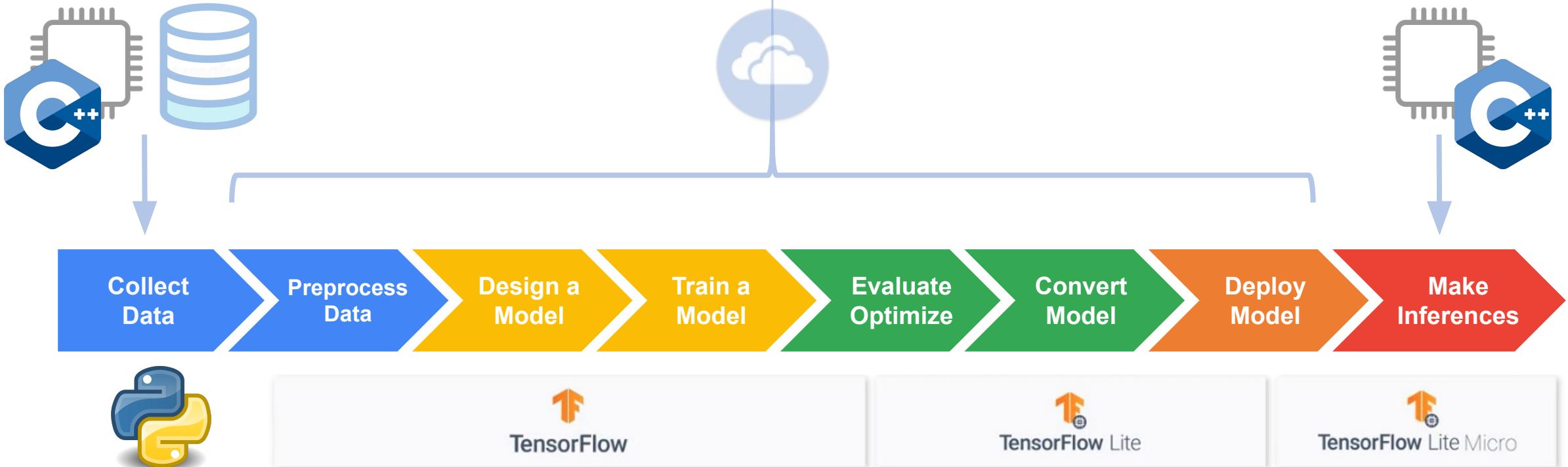
Tiny Machine Learning Workflow (“Where”)



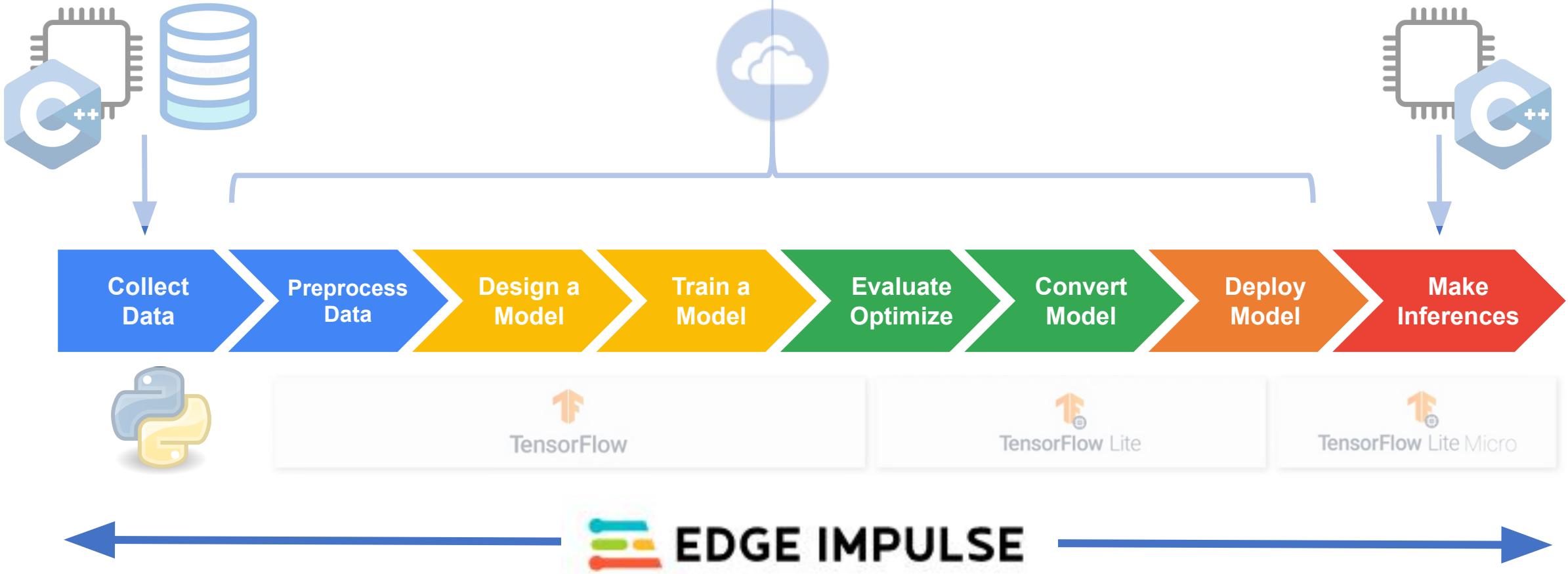
Machine Learning Workflow (“How”)

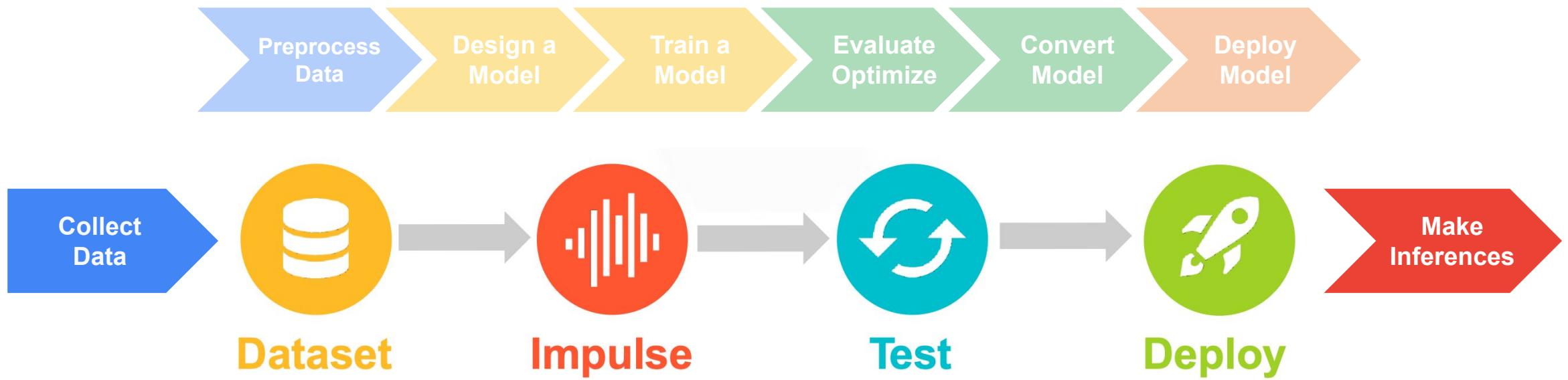


Machine Learning Workflow (“How”)

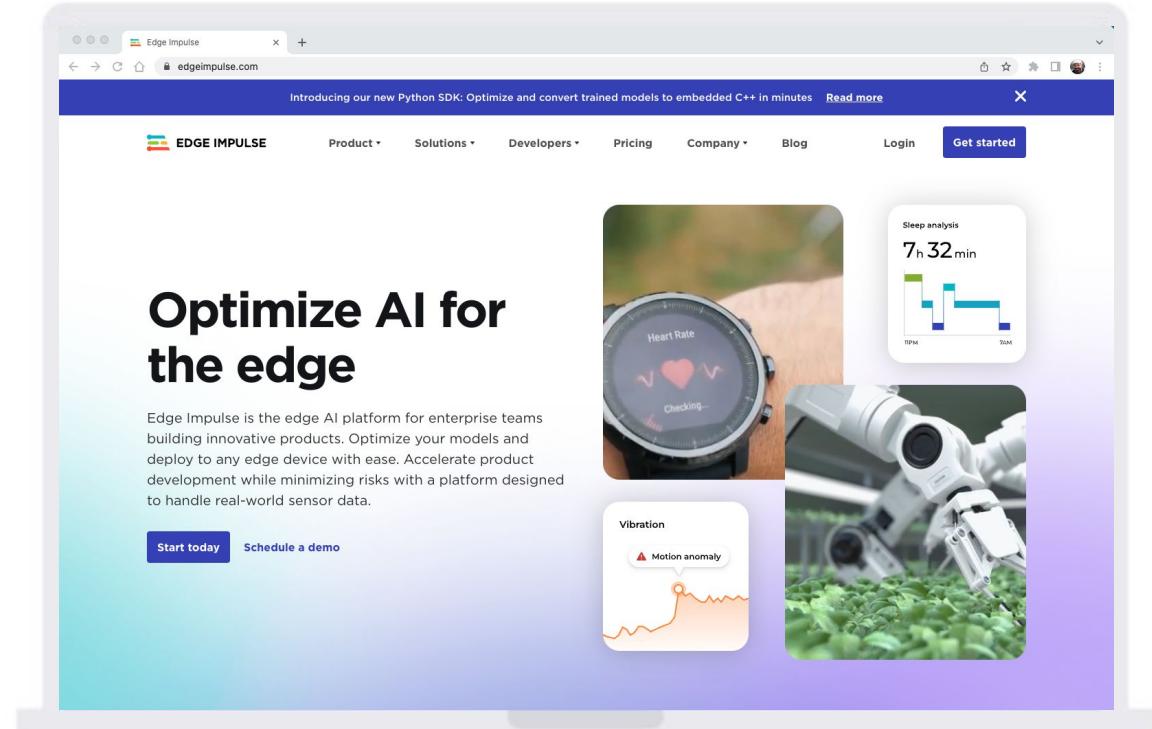
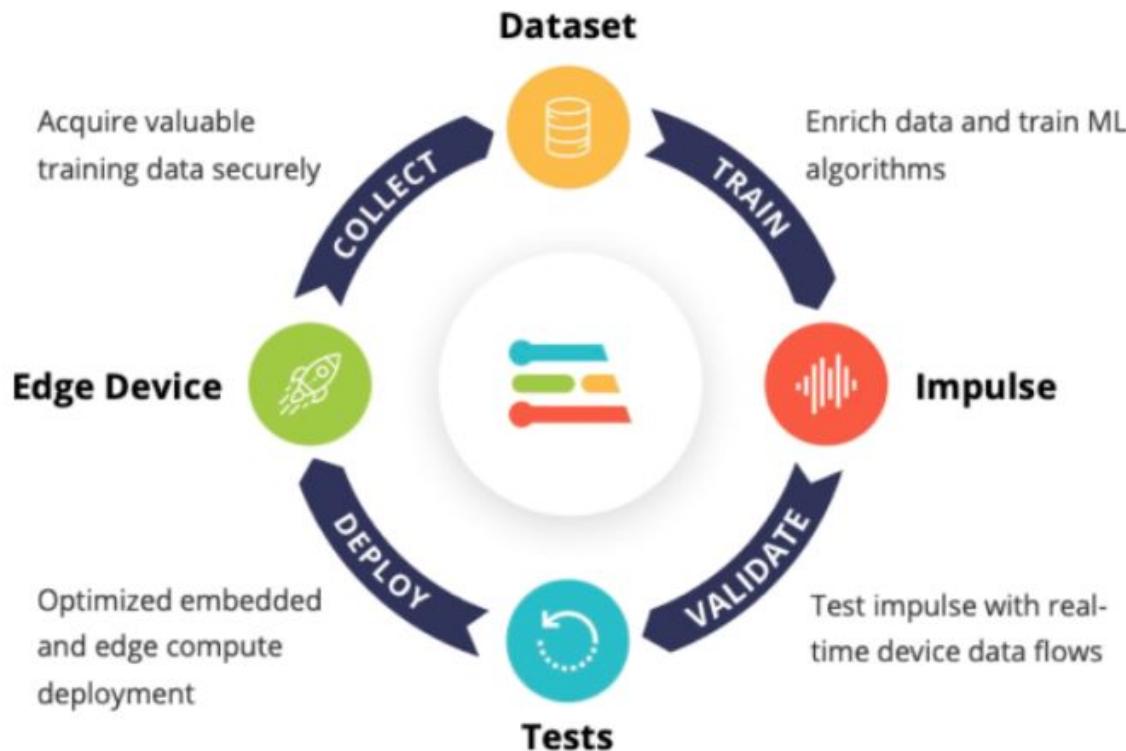


Machine Learning Workflow (“How”)





EI Studio - Embedded ML platform (“AutoML”)



Learn more at <http://edgeimpulse.com>

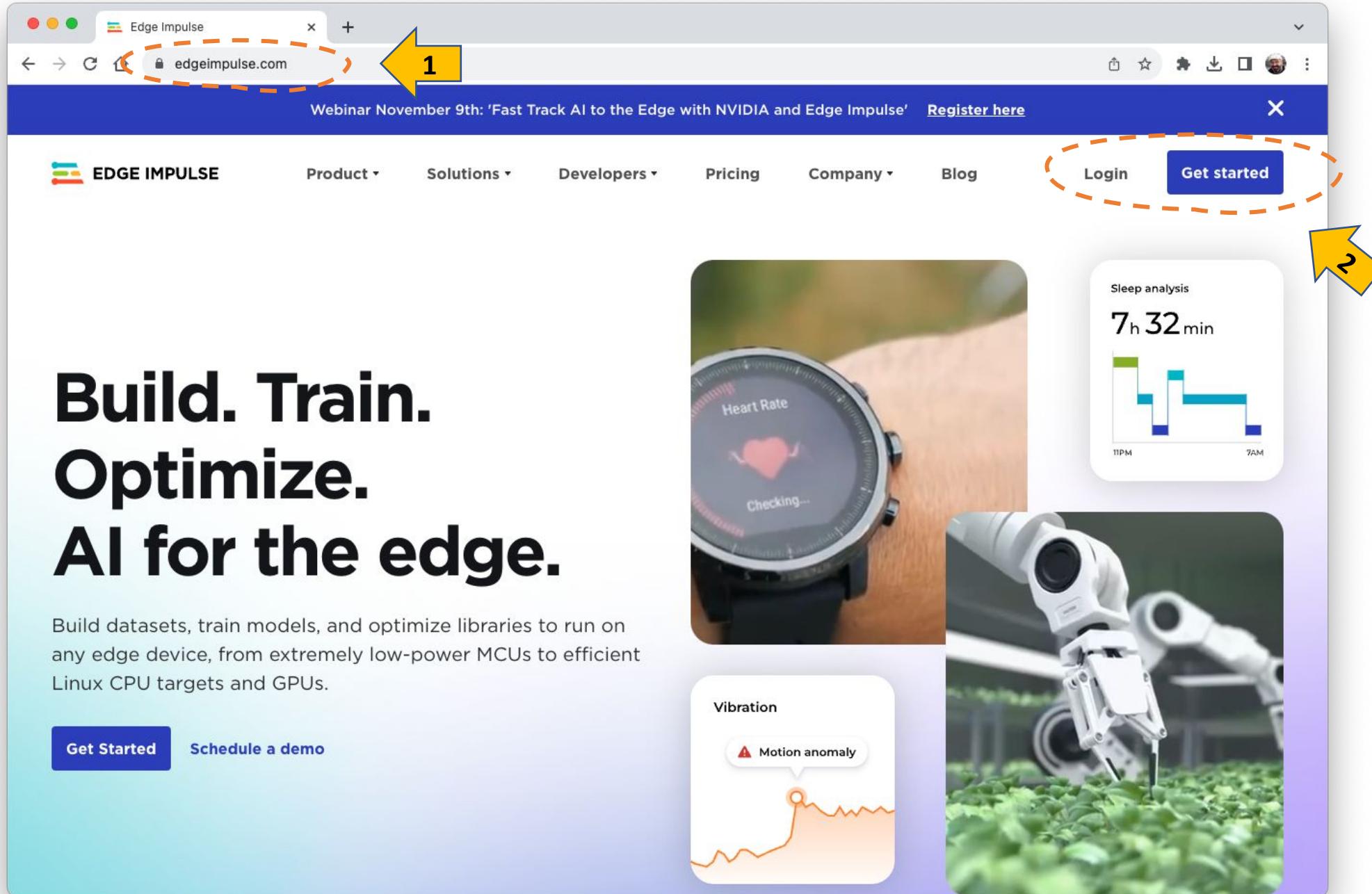


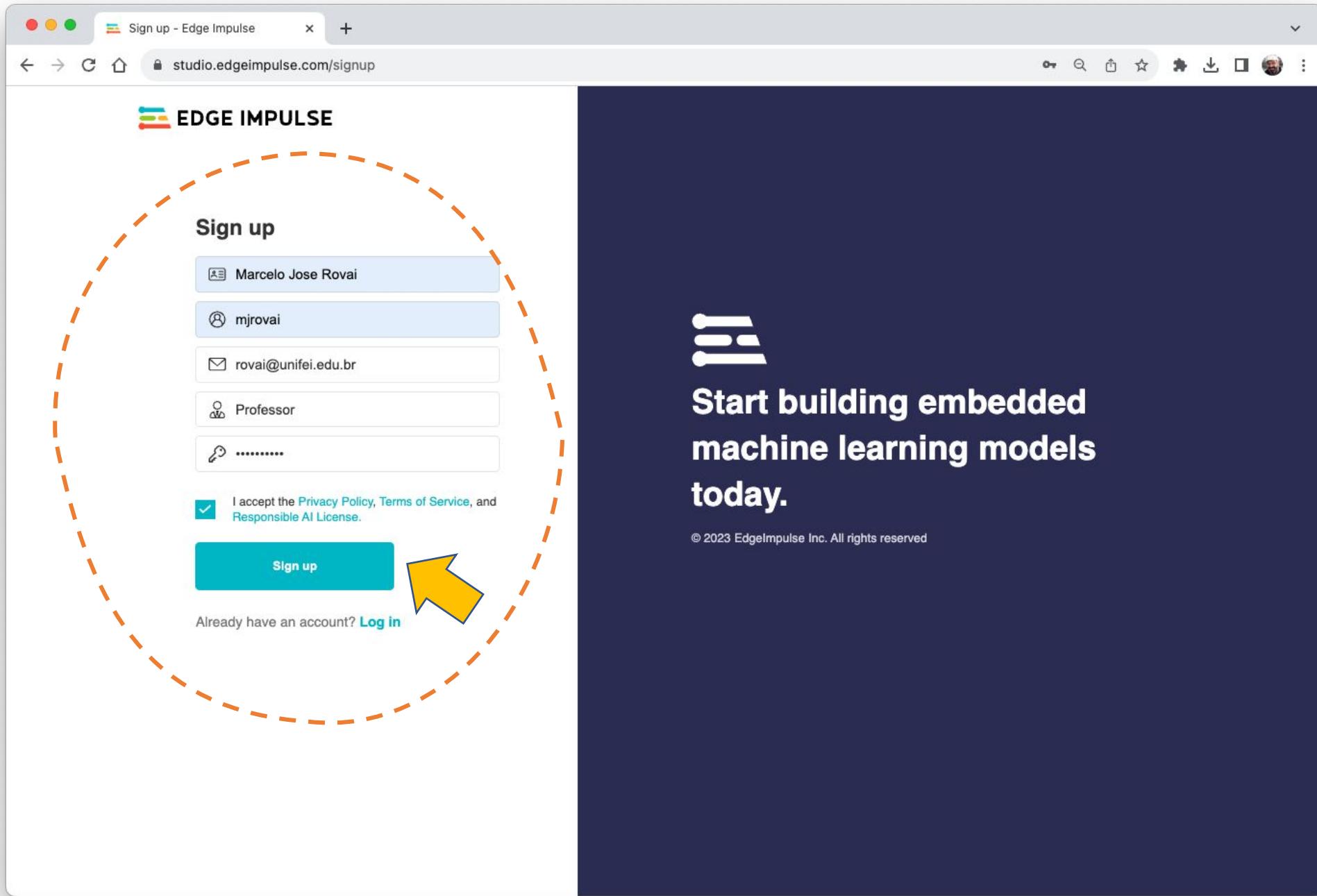
Cifar10 Edge Impulse Studio

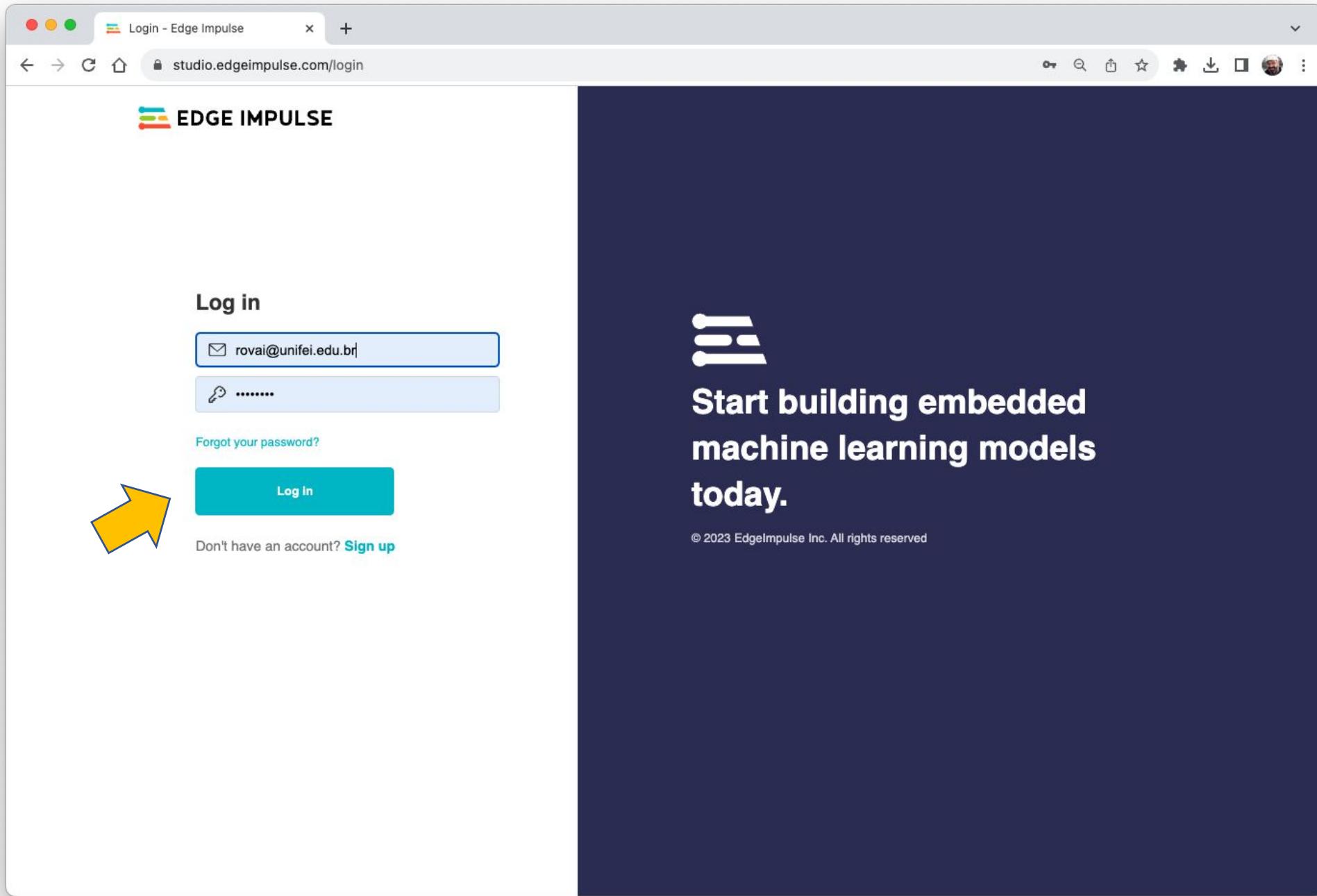


Dataset: <https://github.com/YoongiKim/CIFAR-10-images>

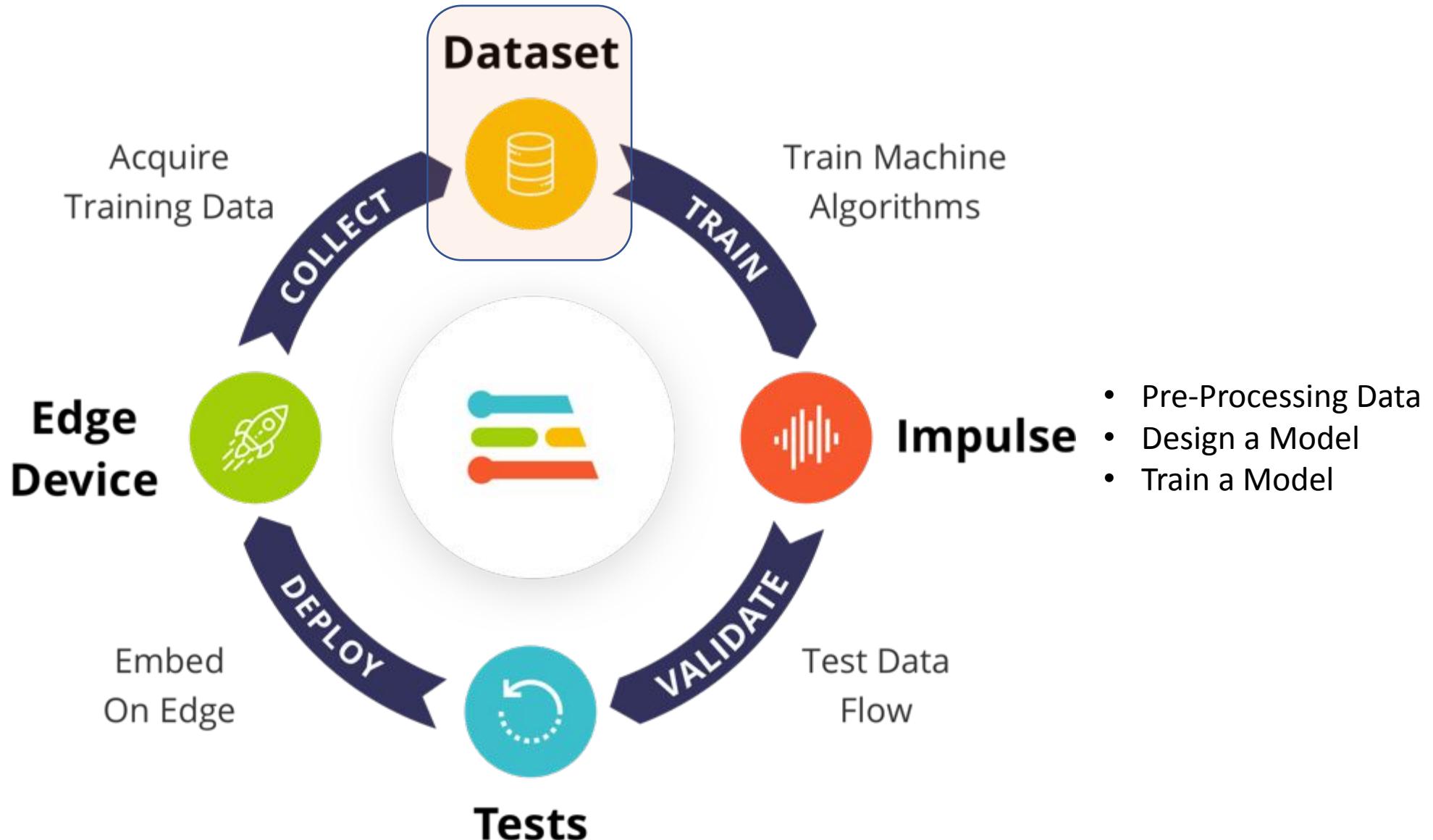
El Studio Public Project: <https://studio.edgeimpulse.com/public/51070/latest>





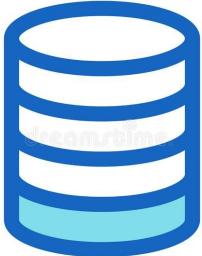


The screenshot shows the Edge Impulse studio interface. On the left, there's a sidebar with a user profile picture of a man with a beard, the name "MJRoBot", and the subtitle "(Marcelo Rovai)". Below this is a section titled "Organizations" with a purple button labeled "EIE". The main area has tabs for "Projects" (which is selected) and "Custom ML blocks". A modal window titled "Create a new project" is open. It contains a text input field with the placeholder "Enter the name for your new project:" and the value "Cifar10_Image_Classification" highlighted with an orange border. Below the input field is a section titled "Choose your project type:" with two options: "Developer" (selected, indicated by a blue radio button) and "Enterprise" (indicated by an empty radio button). Under "Developer", there's a note: "20 min job limit, 4GB or 4 hours of data, limited collaboration." Under "Enterprise", there's a note: "No job or data size limits, higher performance, custom blocks." A dropdown menu "Create under organization:" shows "Edge Impulse Experts". At the bottom of the modal is a green "Create new project" button. To the right of the modal, a yellow arrow points upwards towards the "Create new project" button. The background shows a list of existing projects: "MJRoBot (Marcelo Rovai) / video_tinyml_raw", "MJRoBot (Marcelo Rovai) / Pico_Motion_Detection" (PUBLIC), and "MJRoBot (Marcelo Rovai) / Loi_kovis_low_meetup".

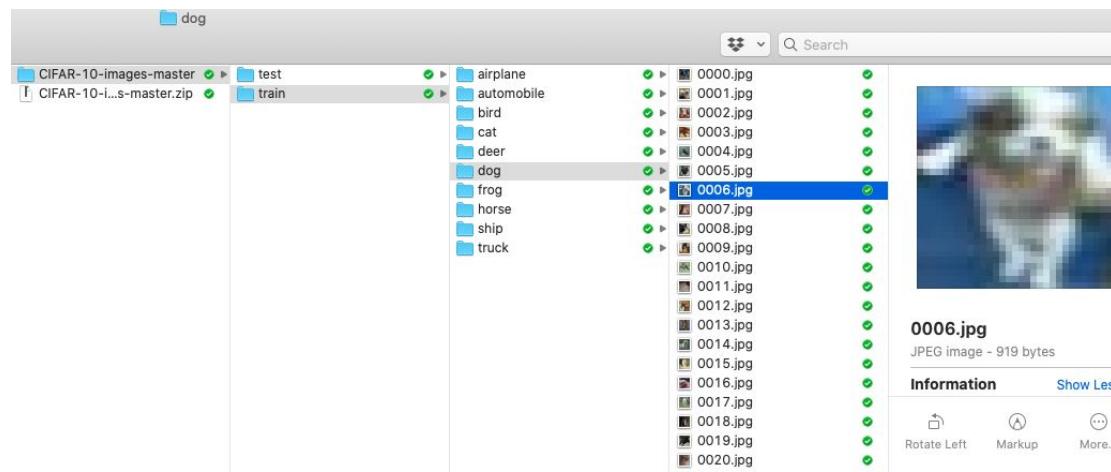


Download Dataset

<https://github.com/YoongiKim/CIFAR-10-images>



The screenshot shows a GitHub repository page for 'CIFAR-10-images'. At the top, there are buttons for 'Code' (highlighted with an orange box), 'Go to file', and 'Add file'. Below the buttons, there's a 'Clone' section with 'HTTPS' selected, showing the URL 'https://github.com/YoongiKim/CIFAR-10-images'. There are also links for 'Open with GitHub Desktop' and 'Download ZIP'. A large yellow arrow points from the monitor icon to this 'Download ZIP' button. The main content area displays the repository's README.md file, which contains the text 'CIFAR-10 raw jpeg images' and 'You can just clone this repository to use dataset.'



Collect Data

Upload data - Cifar10_Image_C

stUDIO.edgeimpulse.com/studio/51070/upload

EDGE IMPULSE

MJRoBot (Marcelo Rovai)

Dashboard

Devices

Data acquisition

Impulse design

- Create impulse
- Image
- NN Classifier

EON Tuner

Retrain model

Live classification

Model testing

Versioning

Deployment

GETTING STARTED

Documentation

Forums

UPLOAD DATA (CIFAR10_IMAGE_CLASSIFICATION)

Upload existing data

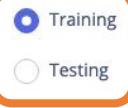
You can upload existing data to your project in the [Data Acquisition Format](#) (CBOR, JSON, CSV), or as WAV, JPG or PNG files.

Select files 

No file chosen

Upload into category

Automatically split between training and testing ?

Training 

Testing

Label

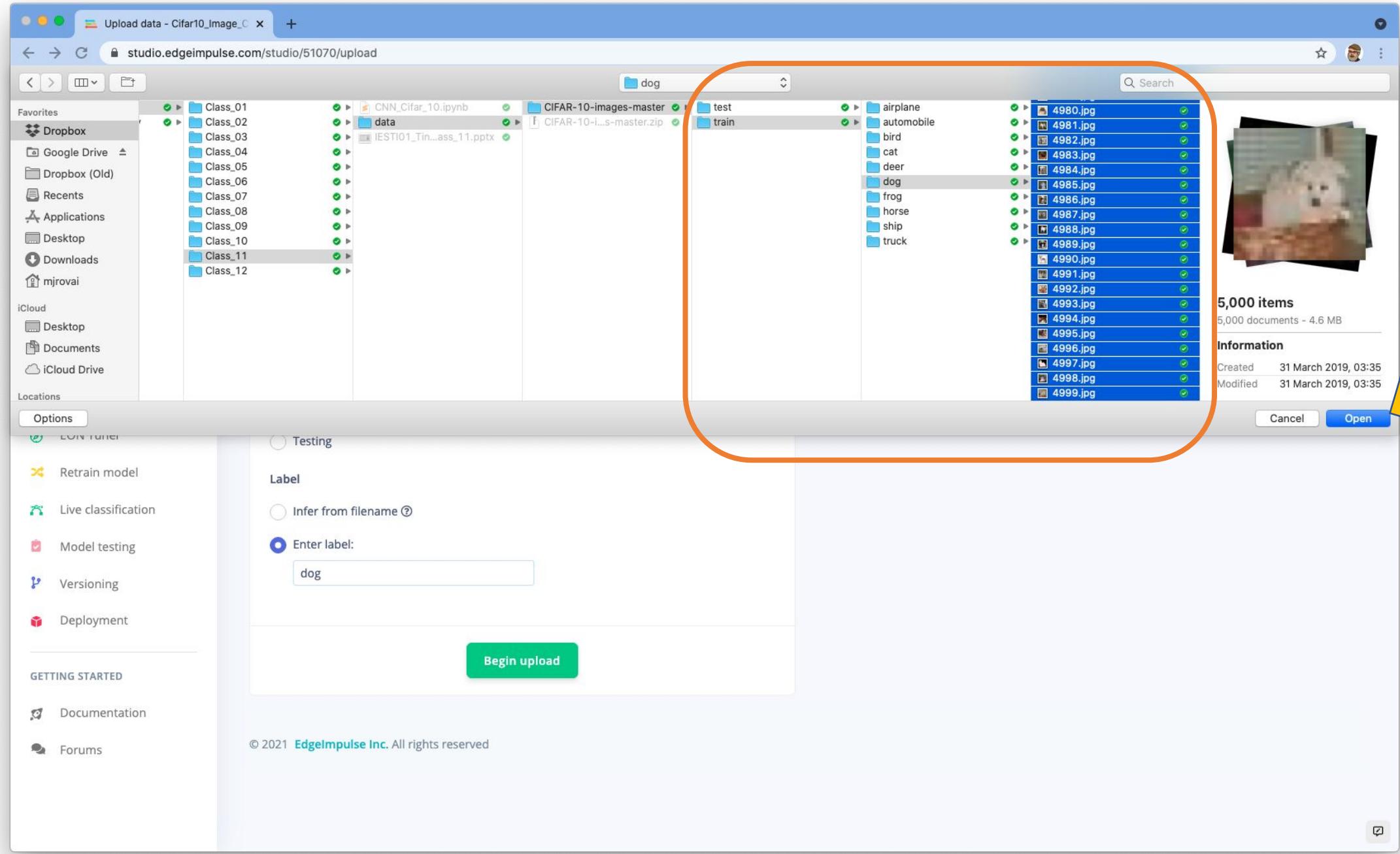
Infer from filename ?

Enter label: 

dog

Begin upload

© 2021 EdgeImpulse Inc. All rights reserved



Collect Data

Upload data - Cifar10_Image_C

stUDIO.edgeimpulse.com/studio/51070/upload

EDGE IMPULSE

MJRoBot (Marcelo Rovai)

Dashboard

Devices

Data acquisition

Impulse design

- Create impulse
- Image
- NN Classifier

EON Tuner

Retrain model

Live classification

Model testing

Versioning

Deployment

GETTING STARTED

Documentation

Forums

UPLOAD DATA (CIFAR10_IMAGE_CLASSIFICATION)

Upload existing data

You can upload existing data to your project in the [Data Acquisition Format](#) (CBOR, JSON, CSV), or as WAV, JPG or PNG files.

Select files

5000 files

Upload into category

Automatically split between training and testing ?

Training

Testing

Label

Infer from filename ?

Enter label:

dog

Begin upload



© 2021 EdgeImpulse Inc. All rights reserved

The screenshot shows the Edge Impulse web studio interface for a project titled "Cifar10_Image_Classification". A blue arrow on the left points to the "Data acquisition" section of the sidebar, which is labeled "Collect Data". A yellow arrow at the top points to the browser's address bar, which displays the URL "studio.edgeimpulse.com/studio/51070/acquisition/training?page=1#".

EDGE IMPULSE

Dataset Data explorer Data sources | CSV Wizard

DATA COLLECTED
12,002 items

TRAIN / TEST SPLIT
83% / 17%

Collect data

Connect a device to start building your dataset.

Dataset

Training (10,000) Test (2,002)

Apply filters

By label

cat (5000)

dog (5000)

By name

Enter a sample name

By signature validity

Valid & invalid signatures

Enabled & disabled samples

Enabled & disabled samples

Delete (0) Edit labels (0) Move to test set (0) Enable (0) Disable (0)

SAMPLE NAME LABEL ADDED

4999.jpg.2hfb34u0	dog	Oct 09 2021, 11:1...
4997.jpg.2hfb34n1	dog	Oct 09 2021, 11:1...
4991.jpg.2hfb34mm	dog	Oct 09 2021, 11:1...
4993.jpg.2hfb34n8	dog	Oct 09 2021, 11:1...

RAW DATA
4999.jpg.2hfb34u0

Metadata

No metadata.

The screenshot shows the Edge Impulse web studio interface. The left sidebar contains a navigation menu with various project management and development tools. The main content area is titled "Data explorer" and provides instructions on how to generate a data explorer for a Cifar10_Image_Classification project. It lists three options: "Using a pretrained visual model" (selected), "Using your trained impulse", and "Using the preprocessing blocks in your impulse". Below this, it discusses dimensionality reduction techniques, specifically "t-SNE" and "PCA". A green button at the bottom right says "Generate data explorer".

Cifar10_Image_Classification

MJRoBot (Marcelo Rovai) / Cifar10_Image_Classification

EDGE IMPULSE

Dataset Data explorer Data sources | CSV Wizard

Data explorer

The data explorer shows a complete view of all data in your project. Use it to quickly label your data, or spot outliers. [Learn more.](#)

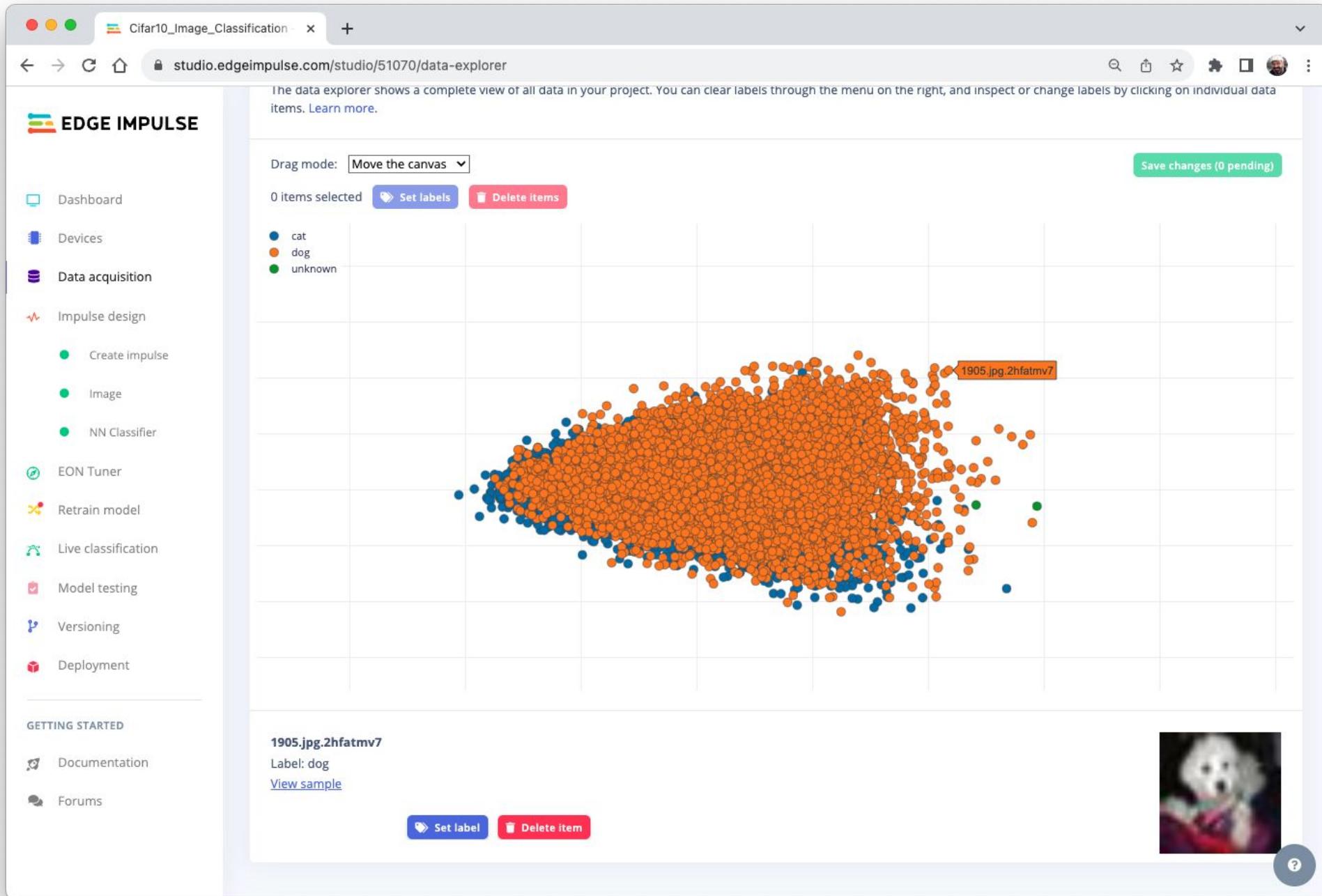
How should we generate the data explorer?

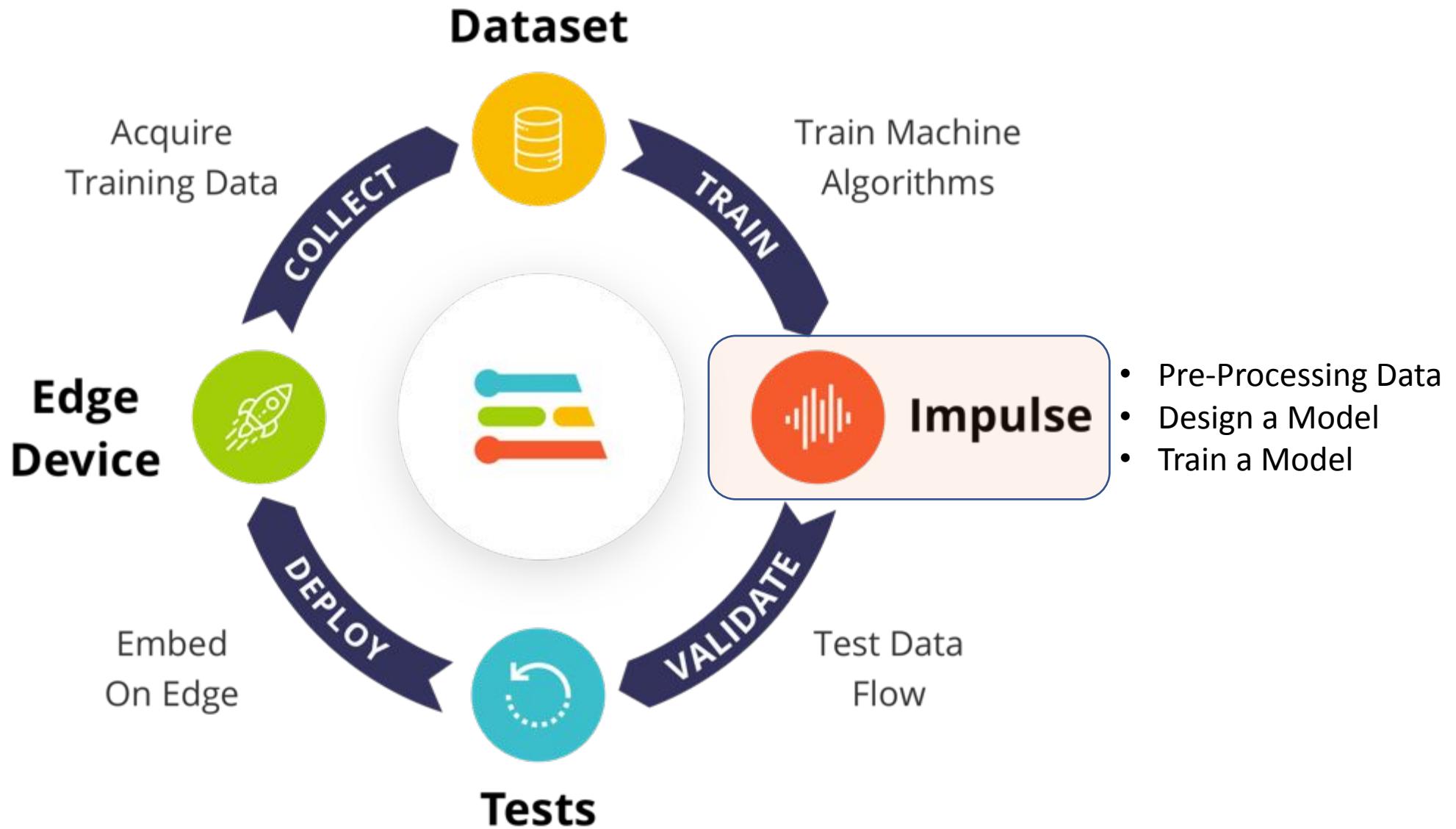
- Using a pretrained visual model
Great for most image classification projects.
- Using your trained impulse
Works great if you have collected some labeled data already and have a trained model.
- Using the preprocessing blocks in your impulse
Use this if you don't have any labels for your data yet, and thus can't train a full model.

Dimensionality reduction technique

- t-SNE
Separates best, but takes a significant amount of time on large datasets.
- PCA
Recommended for your dataset. Separates less well, but works on any dataset size.

Generate data explorer





Create impulse - Cifar10_Image

studio.edgeimpulse.com/studio/51070/create-impulse

EDGE IMPULSE

CREATE IMPULSE (CIFAR10_IMAGE_CLASSIFICATION)

An impulse takes raw data, uses signal processing to extract features, and then uses a learning block to classify new data.

Image data

Axes

Image width: 32 Image height: 32

Resize mode: Fit longest axis

For optimal accuracy with transfer learning blocks, use a 96x96 or 160x160 image size.

Image

Name: Image

Input axes: image

Classification (Keras)

Name: NN Classifier

Input features: Image

Output features: 2 (cat, dog)

Output features

2 (cat, dog)

Save impulse

GETTING STARTED

Documentation

Forums

© 2021 EdgeImpulse Inc. All rights reserved

25

Preprocess Data

The screenshot shows the Edge Impulse studio interface for a CIFAR10 IMAGE CLASSIFICATION project. The left sidebar has a blue arrow pointing right labeled "Preprocess Data". The main area displays the following components:

- Raw data:** Shows an image of a white dog. A dropdown menu next to it is set to "4999.jpg.2hfb34u0 (dog)".
- Raw features:** Displays raw binary feature data.
- Parameters:** Shows the "Image" section with a dropdown for "Color depth" set to "RGB". A yellow arrow points from this dropdown towards the "Save parameters" button. The "Save parameters" button is highlighted with an orange rounded rectangle.
- DSP result:** Shows the "Image" result with a small thumbnail of the dog image.
- Processed features:** Displays the processed feature values.
- On-device performance:** Shows processing time as 9 ms and peak RAM usage as 4 KB.

At the bottom, a copyright notice reads: © 2021 EdgeImpulse Inc. All rights reserved.

Preprocess Data

IMAGE (CIFAR10_IMAGE_CLASSIFICATION)
#1 Click to set a description for this version

Parameters **Generate features**

Training set

Data in training set 10,000 items

Classes 2 (cat, dog)

Generate features

Feature explorer (10,000 samples)

X Axis Y Axis Z Axis

Visualization layer 1 Visualization layer 2 Visualization layer 3

cat dog

8.5
8
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0

Visualization layer 3
Visualization layer 2
Visualization layer 1

On-device performance

PROCESSING TIME 9 ms.

PEAK RAM USAGE 4 KB

© 2021 EdgeImpulse Inc. All rights reserved

colab.research.google.com

CNN_Cifar_10.ipynb

File Edit View Insert Runtime Tools Help

+ Code + Text Copy to Drive Connect GPU

10 plt.show()

model accuracy

accuracy

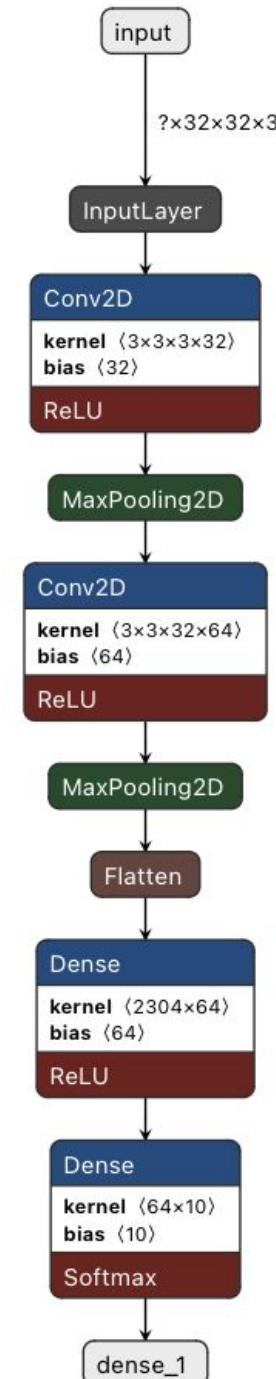
epoch

{x}

Evaluate Model

```
[ ] 1 print("Train data: ", model.evaluate(train_images, train_labels)[1])
2 print("Eval data: ", model.evaluate(val_images, val_labels)[1])
3 print("Test data: ", model.evaluate(test_images, test_labels)[1])
```

1407/1407 [=====] - 6s 4ms/step - loss: 0.2313 - accuracy: 0.9199
Train data: 0.9198889136314392
157/157 [=====] - 1s 4ms/step - loss: 1.2736 - accuracy: 0.6920
Eval data: 0.6919999718666077
313/313 [=====] - 1s 4ms/step - loss: 1.3474 - accuracy: 0.6807
Test data: 0.6807000041007996



Design a Model

Train a Model

Cifar10_Image_Classification

#2 ▾ Model - Same as done in class (IESTI01) ★ Primary version

Target: Arduino Nicla Vision (Cortex-M7 480MHz)

Neural Network settings

Training settings

- Number of training cycles: 10
- Learning rate: 0.0005

Advanced training settings

- Validation set size: 20 %
- Split train/validation set on metadata key
- Batch size: 32
- Auto-balance dataset:
- Profile int8 model:

Neural network architecture

- Input layer (3,072 features)
- 2D conv / pool layer (32 filters, 3 kernel size, 1 layer)
- 2D conv / pool layer (64 filters, 3 kernel size, 1 layer)
- Flatten layer
- Dense layer (64 neurons)
- Add an extra layer
- Output layer (2 classes)

Start training

Training output CPU (0)

Model

Model version: Quantized (int8)

Last training performance (validation set)

- ACCURACY: 74.4%
- LOSS: 0.56

Confusion matrix (validation set)

	CAT	DOG
CAT	80.6%	19.4%
DOG	32.1%	67.9%
F1 SCORE	0.76	0.72

Feature explorer (full training set)

- cat - correct
- dog - correct
- cat - incorrect
- dog - incorrect

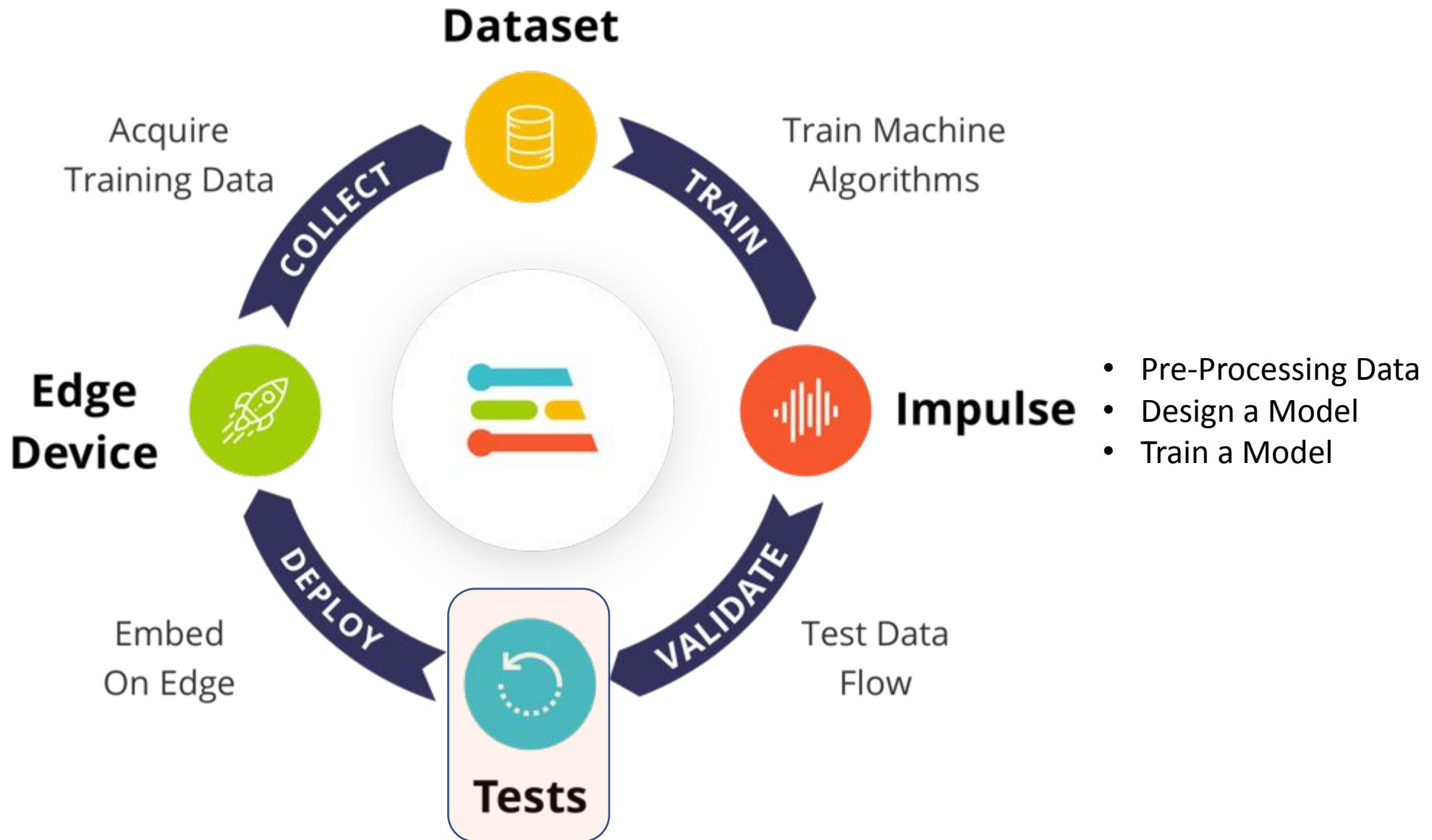
On-device performance

- INFERENCING TIME: 93 ms.
- PEAK RAM USAGE: 44.7K
- FLASH USAGE: 308.2K

Visualization layer 1

Visualization layer 2

Visualization layer 3



Model testing - Cifar10_Image... Upload data - Cifar10 Classific... | +

studio.edgeimpulse.com/studio/51070/validation

EDGE IMPULSE

- Dashboard
- Devices
- Data acquisition
- Impulse design
 - Create impulse
 - Image
 - NN Classifier
- EON Tuner
- Retrain model
- Live classification
 - Model testing
 - Versioning
- Deployment

Evaluate Optimize

Test data

Set the 'expected outcome' for each sample to the desired outcome to automatically score the impulse.

SAMPLE NAME	EXPECTED OUTCOME	LENGTH	ACCURACY	RESULT	
testing.2hfe5uat	testing	-	1 cat	⋮	
0999.jpg.2hfb7a...	cat	-	100%	1 cat	⋮
0997.jpg.2hfb7a...	cat	-	100%	1 cat	⋮
0998.jpg.2hfb7a...	cat	-	100%	1 cat	⋮
0996.jpg.2hfb7a...	cat	-	0%	1 uncertain	⋮
0993.jpg.2hfb7a...	cat	-	100%	1 cat	⋮
0995.jpg.2hfb7a...	cat	-	0%	1 dog	⋮
0991.jpg.2hfb7a...	cat	-	100%	1 cat	⋮
0994.jpg.2hfb7a...	cat	-	100%	1 cat	⋮
0992.jpg.2hfb7a...	cat	-	100%	1 cat	⋮
0990.jpg.2hfb79...	cat	-	100%	1 cat	⋮
0988.jpg.2hfb79...	cat	-	100%	1 cat	⋮
0985.jpg.2hfb79...	cat	-	0%	1 uncertain	⋮

Model testing output

Classifying data for NN classifier...
 Copying features from processing blocks...
 Copying features from DSP block...
 Copying features from DSP block OK
 Copying features from processing blocks OK

Classifying data for float32 model...
 Scheduling job in cluster...
 Job started
 Classifying data for NN Classifier OK

Job completed

Model testing results

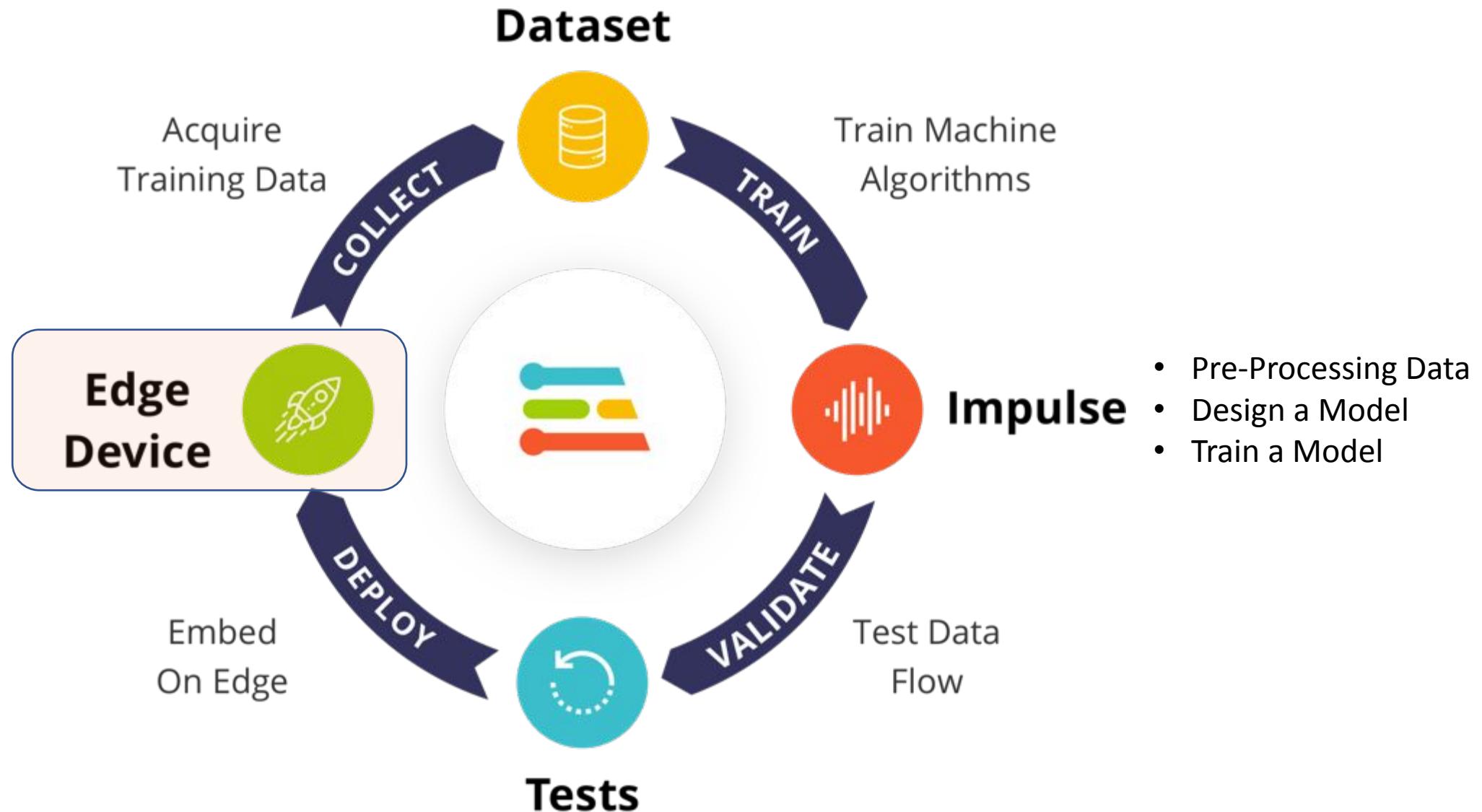
ACCURACY **64.95%** %

	CAT	DOG	UNCERTAIN
CAT	67.7%	16%	16.3%
DOG	21.2%	62.2%	16.6%
F1 SCORE	0.72	0.70	

Feature explorer ⓘ

Legend:

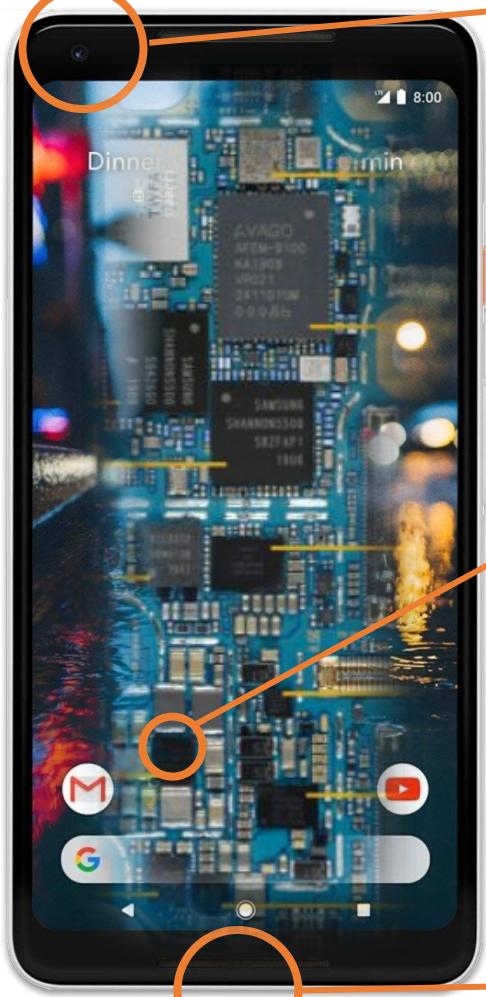
- cat - correct
- dog - correct
- cat - incorrect
- dog - incorrect
- testing



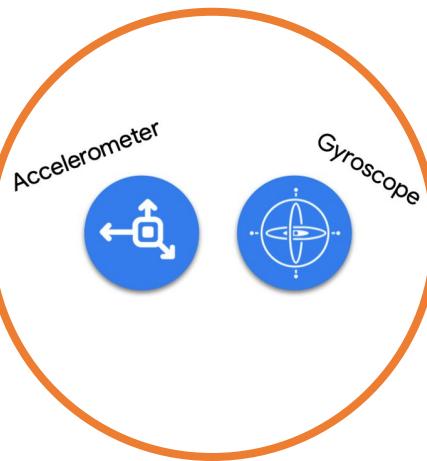
Edge Device



& Sensors



Camera



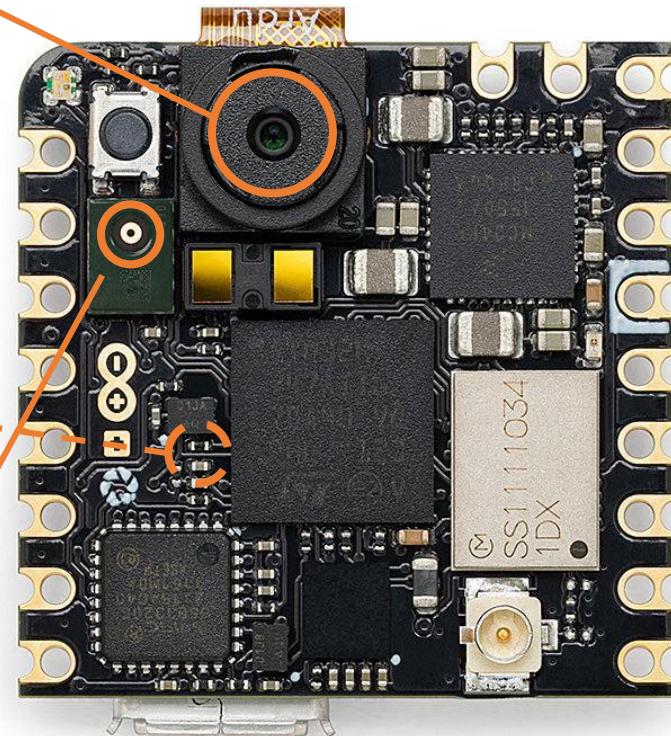
Accelerometer



Gyroscope



Microphone



Deploy Model

The screenshot shows the Edge Impulse studio deployment interface. On the left, a sidebar lists various project management and development tools. The main area is titled "Configure your deployment" and "Run this model". It includes sections for "DEFAULT DEPLOYMENT" (C++ library), "MODEL OPTIMIZATIONS" (with an "Enable EON™ Compiler" toggle), and tables comparing "Quantized (int8)" and "Unoptimized (float32)" performance metrics. A large orange arrow highlights the "Run this model" section, which features a QR code and a "Launch in browser" button. To the right, a smaller inset image shows a hand holding a smartphone displaying the same QR code, with a computer monitor in the background also showing the Edge Impulse interface.

Configure your deployment

You can deploy your impulse to any device. This makes the model run without an internet connection, minimizes latency, and runs with minimal power consumption. [Read more](#).

Search deployment options

DEFAULT DEPLOYMENT

C++ library

A portable C++ library with no external dependencies, which can be compiled with any modern C++ compiler.

MODEL OPTIMIZATIONS

Model optimizations can increase on-device performance but may reduce accuracy.

Enable EON™ Compiler Same accuracy, up to 50% less memory. [Learn more](#)

Quantized (int8)

	IMAGE	NN CLASSIFIER	TOTAL
LATENCY	1 ms.	93 ms.	94 ms.
RAM	4.0K	44.7K	44.7K
FLASH	-	308.2K	-
ACCURACY			-

Unoptimized (float32)

	IMAGE	NN CLASSIFIER	TOTAL
LATENCY	1 ms.	206 ms.	207 ms.
RAM	4.0K	163.4K	163.4K
FLASH	-	1.1M	-
ACCURACY			64.95%

To compare model accuracy, run model testing for all available optimizations. [Run model testing](#)

Estimate for Arduino Nida Vision (Cortex-M7 480MHz) - Change target

Build

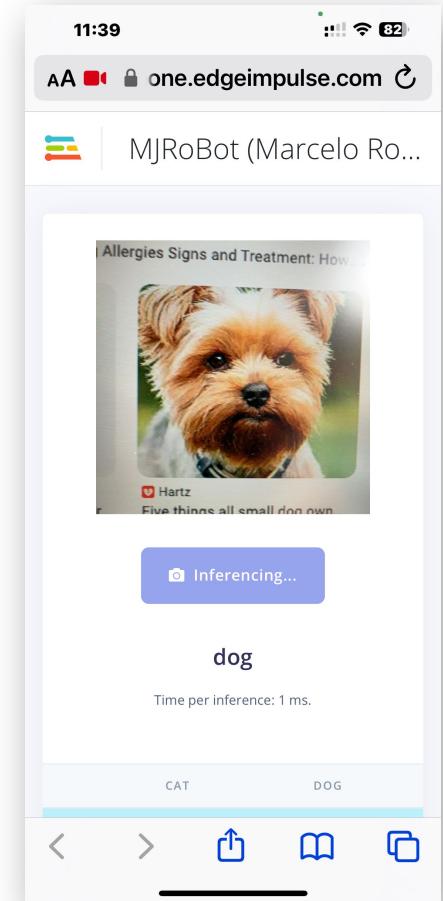
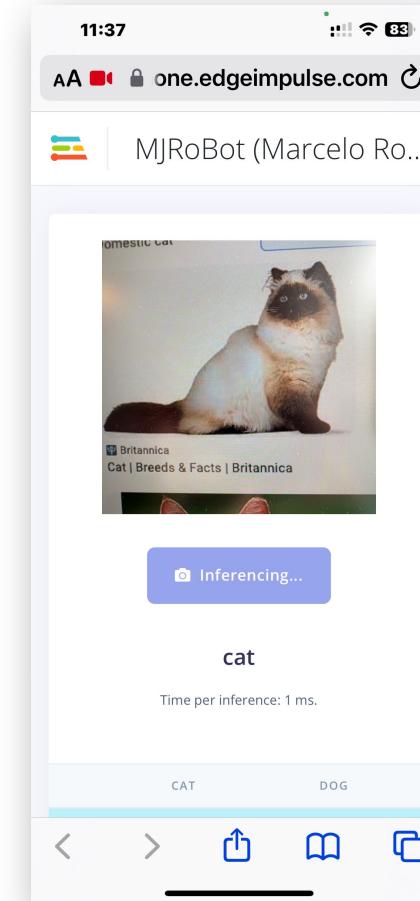
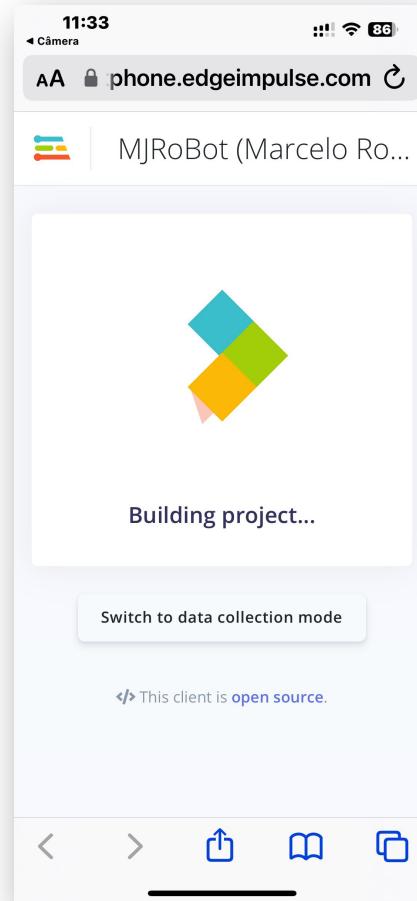
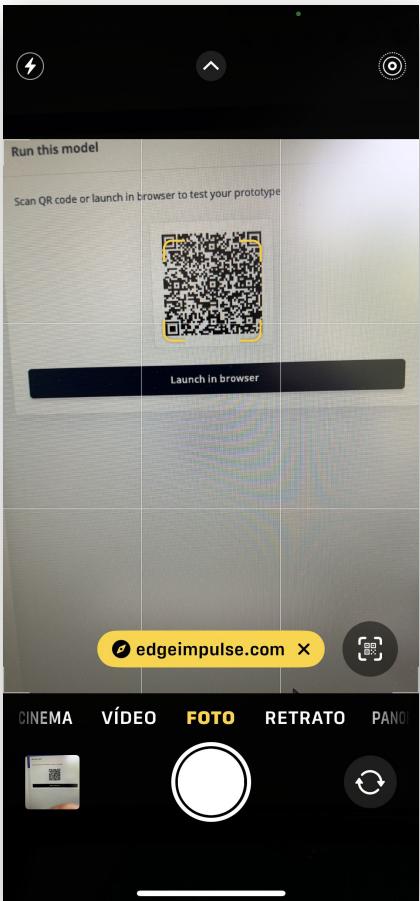
Run this model

Scan QR code or launch in browser to test your prototype

Launch in browser

WEBSITE QR CODE
Open edgeimpulse.com in Safari

Make Inferences



EI Studio “under the hood”



EDGE IMPULSE

NN CLASSIFIER (CIFAR10_IMAGE_CLASSIFICATION)

#2 ▾ Model - Same as done in class (IESTI01) ★ Primary version

Neural Network settings

Training settings

Neural network architecture

```

1 import tensorflow as tf
2 from tensorflow.keras.models import Sequential
3 from tensorflow.keras.layers import Dense, InputLayer, Dropout, Conv2D, Flatten,
4     Reshape, MaxPooling1D, MaxPooling2D, BatchNormalization, TimeDistributed
5
6 # model architecture
7 model = Sequential()
8 model.add(Conv2D(32, kernel_size=3, activation='relu', kernel_constraint=tf.keras
    .constraints.MaxNorm(1), padding='same'))
9 model.add(MaxPooling2D(pool_size=2, strides=2, padding='same'))
10 model.add(Conv2D(64, kernel_size=3, activation='relu', kernel_constraint=tf.keras
    .constraints.MaxNorm(1), padding='same'))
11 model.add(MaxPooling2D(pool_size=2, strides=2, padding='same'))
12 model.add(Flatten())
13 model.add(Dense(64, activation='relu',
    activity_regularizer=tf.keras.regularizers.l1(0.0001)))
14 model.add(Dense(classes, activation='softmax', name='y_pred'))
15
16 # this controls the learning rate
17 opt = Adam(lr=0.0005, beta_1=0.9, beta_2=0.999)
18 # this controls the batch size, or you can manipulate the tf.data.Dataset objects
19 # yourself
20 BATCH_SIZE = 32
21 train_dataset = train_dataset.batch(BATCH_SIZE, drop_remainder=False)
22 validation_dataset = validation_dataset.batch(BATCH_SIZE, drop_remainder=False)
23 callbacks.append(BatchLoggerCallback(BATCH_SIZE, train_sample_count))
24
25 # train the neural network
26 model.compile(loss='categorical_crossentropy', optimizer=opt, metrics=['accuracy'])

```

Start training

Training output

Model

Model version: ⓘ Quantized (int8)

Last training performance (validation set)

ACCURACY 74.4% LOSS 0.56

Confusion matrix (validation set)

	CAT	DOG
CAT	80.6%	19.4%
DOG	32.1%	67.9%
F1 SCORE	0.76	0.72

Feature explorer (full training set) ⓘ

- cat - correct
- dog - correct
- cat - incorrect
- dog - incorrect

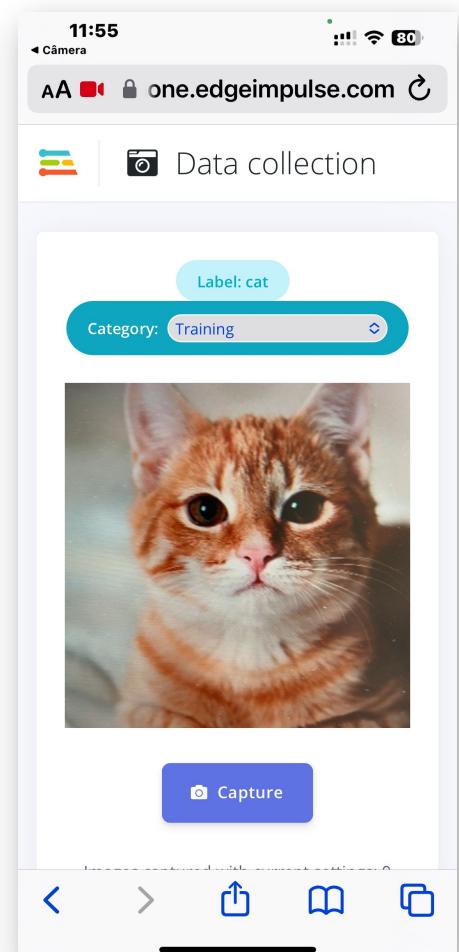
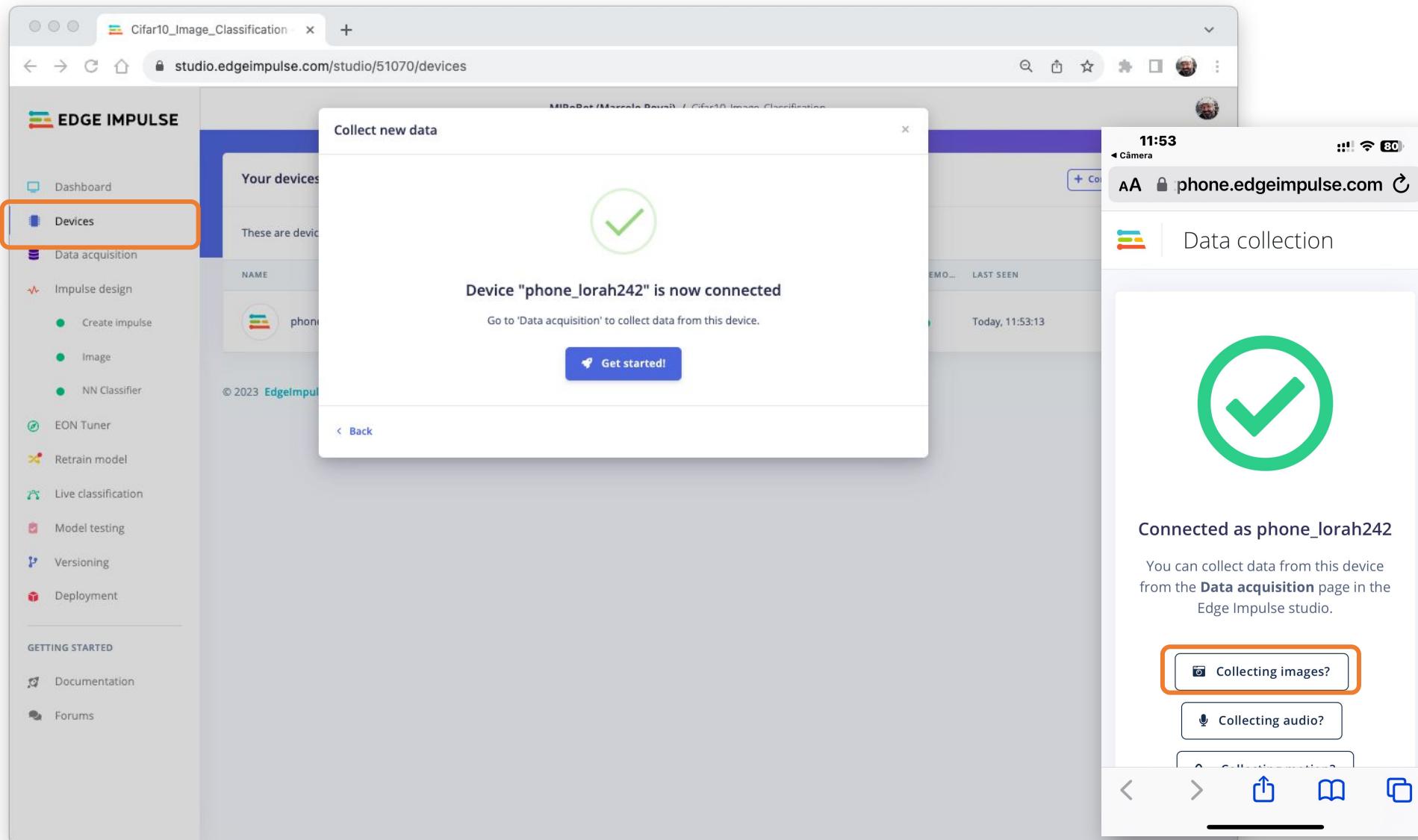
On-device performance ⓘ

INFERENCING TIME 1,048 ms. PEAK RAM USAGE 44.7K FLASH USAGE 308.2K

<https://studio.edgeimpulse.com/studio/51070/learning/keras/6#>

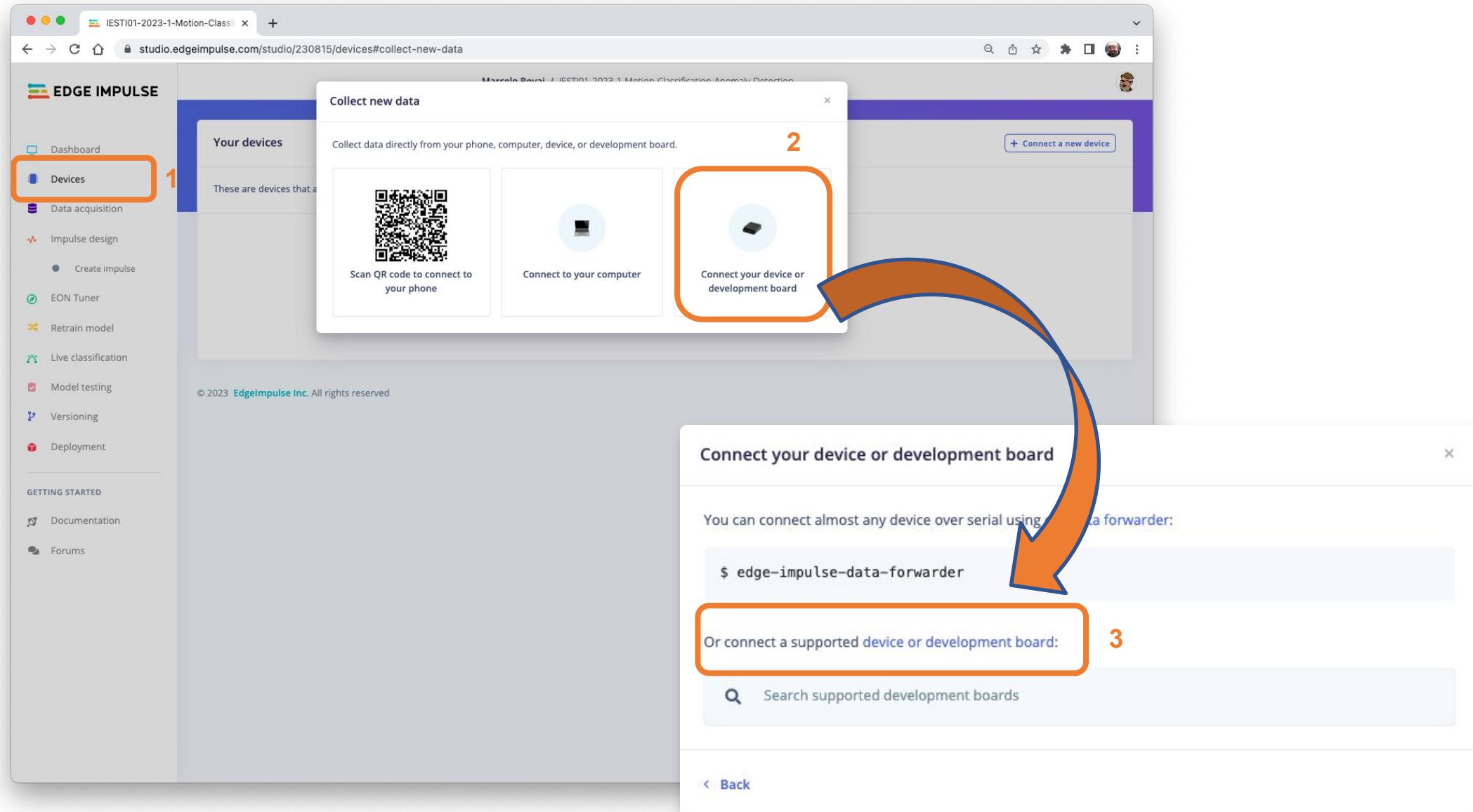
Connect device for data capture
Mobile Phone

The screenshot shows the Edge Impulse Studio interface. On the left, there's a sidebar with various options like Dashboard, Devices, Data acquisition, etc. The 'Devices' option is highlighted with an orange border and has an orange arrow pointing to it from below. The main area shows a 'Collect new data' modal with three options: 'Scan QR code to connect to your phone' (which is also highlighted with an orange border), 'Connect to your computer', and 'Connect your device or development board'. The URL in the browser bar is studio.edgeimpulse.com/studio/51070/devices#collect-new-data.



Connect device for data capture

Supported Devices



EDGE IMPULSE

Cifar10_Image_Classification

studio.edgeimpulse.com/studio/51070/devices

Connect your device or development board

You can connect almost any device over serial using our data forwarder:

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

Or connect a supported device or development board:

Search supported development boards

- Any device running macOS
- Arducam Pico4ML TinyML Dev Kit
- Arduino Nano 33 BLE Sense
- Arduino Nicla Vision
- Arduino Nicla Voice

ARDUINO Nicla Vision

View installation docs

Devices

Dashboard

Data acquisition

Impulse design

Create impulse

Image

NN Classifier

EON Tuner

Retrain model

Live classification

Model testing

Versioning

Deployment

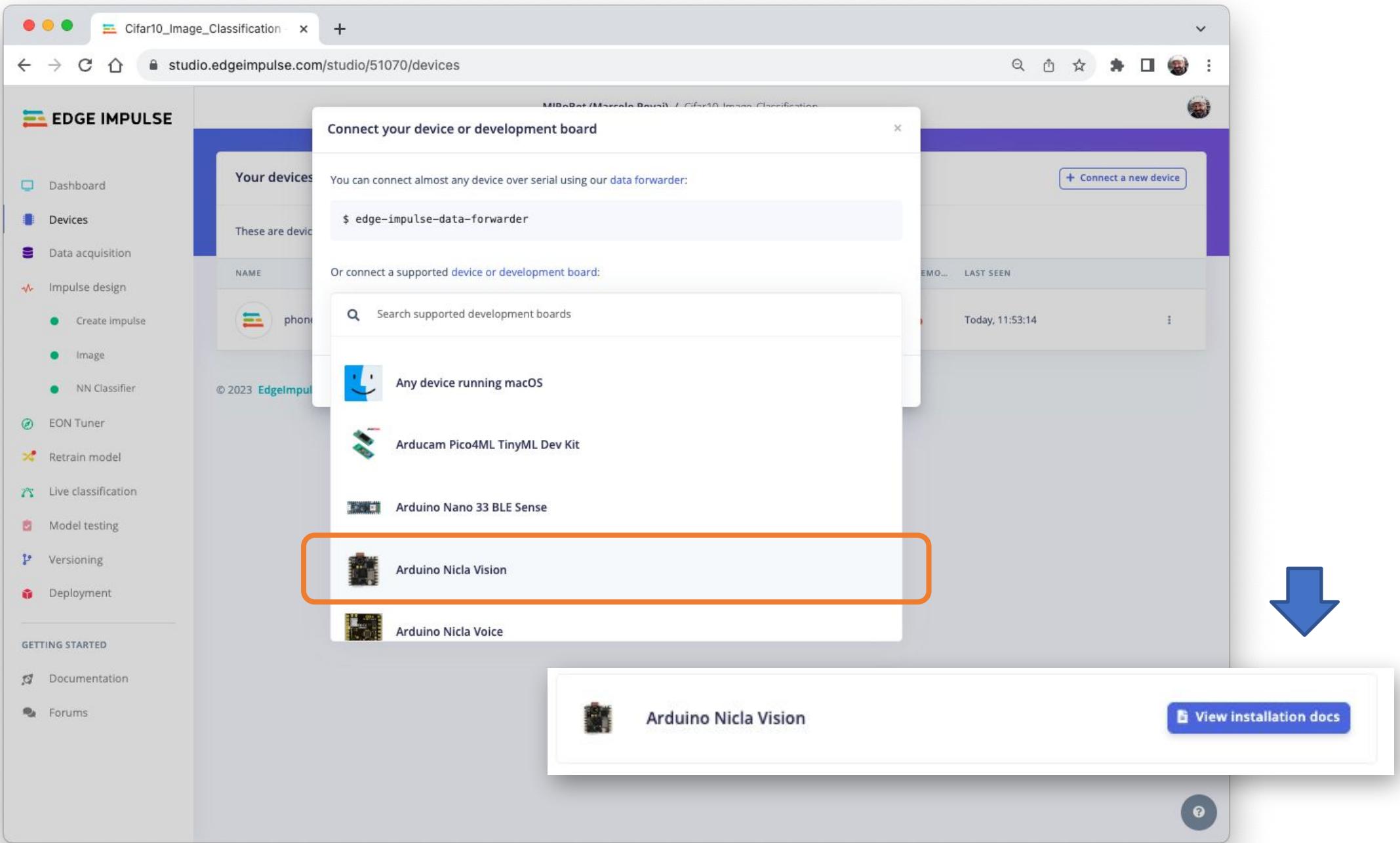
Documentation

Forums

Marco Rovito / Cifar10_Image_Classification

LAST SEEN

Today, 11:53:14



Cifar10_Image_Classification x Arduino Nicla Vision - Edge Impulse x +
docs.edgeimpulse.com/docs/development-platforms/officially-supported-mcu-targets/arduino-nicla-vision

EDGE IMPULSE Home Docs API Projects Forum Search

Getting Started >
Frequently asked questions
TUTORIALS
End-to-end tutorials >
ML & data engineering >
Advanced inferencing >
API examples >
Expert network projects 
EDGE IMPULSE STUDIO
Organization hub >
Project dashboard
Devices

Installing dependencies

To set this device up in Edge Impulse, you will need to install the following software:

1. Edge Impulse CLI.
2. Arduino CLI.
 - Here's an [instruction video for Windows](#).
 - The [Arduino website](#) has instructions for macOS and Linux.
3. On Linux:
 - GNU Screen: install for example via `sudo apt install screen`.

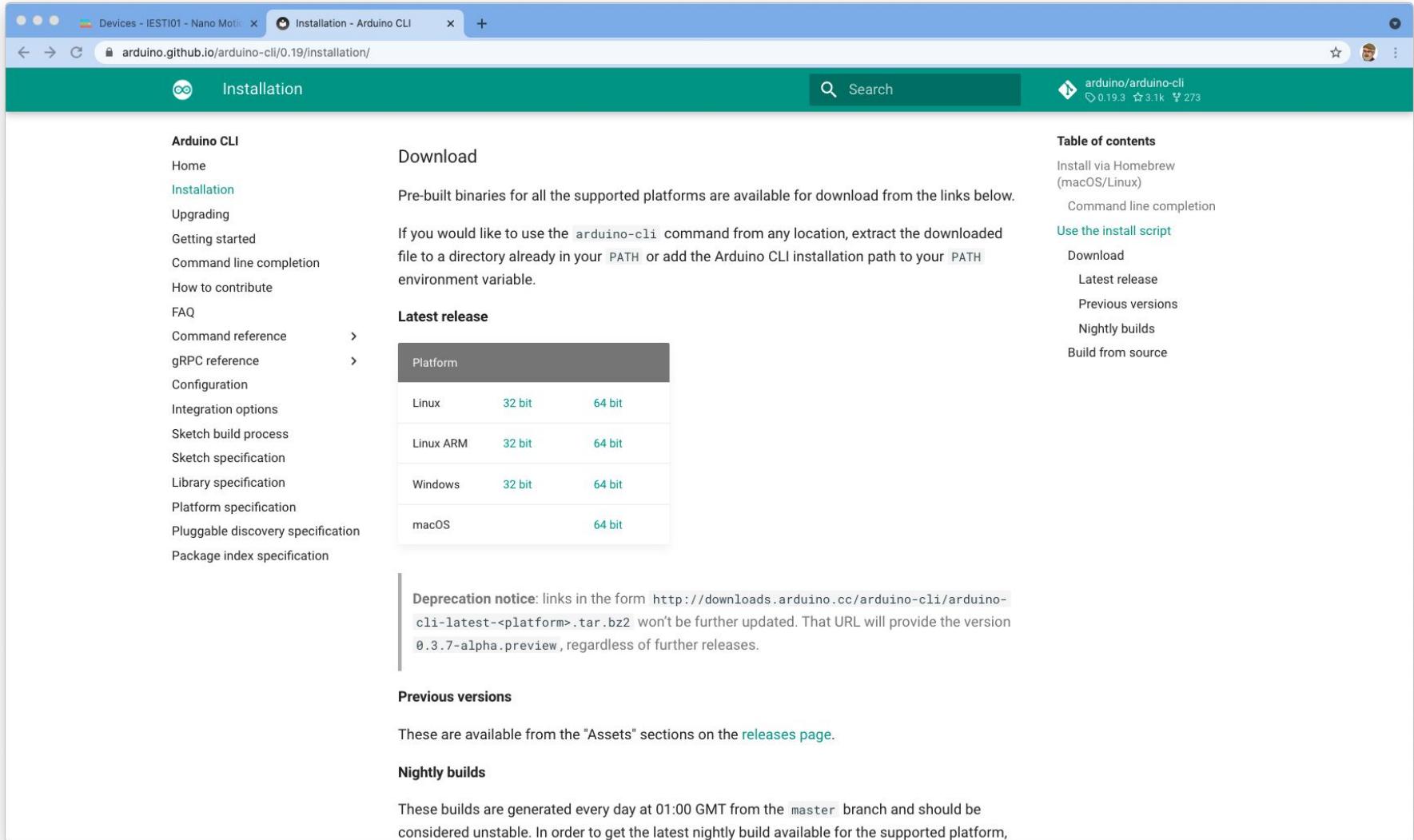
! Problems installing the CLI?
See the [Installation and troubleshooting](#) guide.

Connecting to Edge Impulse

(Note that the 1. Edge Impulse CLI is not necessary for Arduino Nano-33. We will use **WebUSB** instead)

Go to 2. Arduino CLI

Arduino CLI



The screenshot shows the "Installation" page for the Arduino CLI on GitHub. The URL in the address bar is arduino.github.io/arduino-cli/0.19/installation/. The page has a green header with the title "Installation". On the left, there's a sidebar with links like Home, Installation (which is active), Upgrading, Getting started, Command line completion, How to contribute, FAQ, Command reference, gRPC reference, Configuration, Integration options, Sketch build process, Sketch specification, Library specification, Platform specification, Pluggable discovery specification, and Package index specification. The main content area starts with a "Download" section, which says "Pre-built binaries for all the supported platforms are available for download from the links below." It then provides instructions for using the command line and a "Latest release" table. The table lists download links for various platforms and architectures:

Platform	32 bit	64 bit
Linux	32 bit	64 bit
Linux ARM	32 bit	64 bit
Windows	32 bit	64 bit
macOS		64 bit

Below the table, there's a "Deprecation notice" about old URLs. The page also includes sections for "Previous versions" and "Nightly builds".



See this video for Windows installation: <https://www.youtube.com/watch?v=1jMWsFER-Bc>

Arduino CLI Installation Summary

If you're on Windows:

- Unzip the .zip file to C:\Program Files\arduino-cli
- Open System Properties > Advanced > Environment Variables
- Path under "user variables" > Edit
- Add C:\Program Files\arduino-cli

If you're on macOS:

- I recommend using the curl method or homebrew shown on the installation page:
<https://arduino.github.io/arduino-cli/0.21/installation/>
- if you use the curl method, it likely installs arduino-cli to ~/bin. That might not be on your path. So, you might need to run: `export PATH=$PATH:~/bin`

IESTI01-2023-1-Motion-Classi x Arduino Nano 33 BLE Sense - +

docs.edgeimpulse.com/docs/development-platforms/officially-supported-mcu-targets/arduino-nano-33-ble-sense

Home Guides Projects Forum Q Search 8K

EDGE IMPULSE

Getting Started
Getting Started: Next Steps
API and SDK references
What is embedded ML, anyway?
Frequently asked questions

EDGE IMPULSE STUDIO

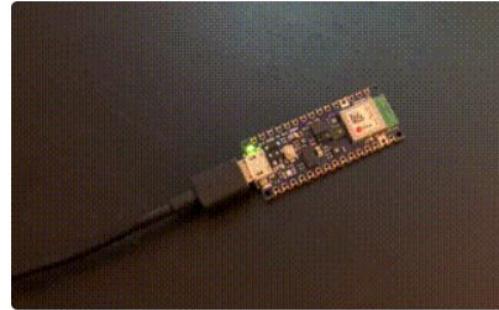
Dashboard
Devices
Data sources
Data acquisition >
Data explorer
Impulse design
Bring your own model (BYOM)
Processing blocks >
Learning blocks >
EON Timer >

Powered By GitBook

1 2 3

1. Connect the development board to your computer

Use a micro-USB cable to connect the development board to your computer. Then press RESET twice to launch into the bootloader. The on-board LED should start pulsating to indicate this.



Press RESET twice quickly to launch the bootloader on the Arduino Nano 33 BLE Sense.

2. Update the firmware

The development board does not come with the right firmware yet. To update the firmware:

1. [Download the latest Edge Impulse firmware](#), and unzip the file.
2. Open the flash script for your operating system (`flash_windows.bat` , `flash_mac.command` or `flash_linux.sh`) to flash the firmware.
3. Wait until flashing is complete, and press the RESET button once to launch the new firmware.

arduino-nano-33....zip Show All X

MacOS

```
marcelo_rovai — flash_mac.command — 138x42

Last login: Tue May 23 15:47:55 on console
/Users/marcelo_rovai/Downloads/arduino-nano-33-ble-sense\ \(18\)/flash_mac.command ; exit;
(base) marcelo_rovai@Marcelos-MacBook-Pro ~ % /Users/marcelo_rovai/Downloads/arduino-nano-33-ble-sense\ \(18\)/flash_mac.command ; exit;
You're using an untested version of Arduino CLI, this might cause issues (found: 0.31.0, expected: 0.18.x)
Finding Arduino Mbed core...
Finding Arduino Mbed OK
Finding Arduino Nano 33 BLE...
Finding Arduino Nano 33 BLE OK
Flashing board...
Device      : nRF52840-QIAA
Version     : Arduino Bootloader (SAM-BA extended) 2.0 [Arduino:IKXYZ]
Address     : 0x0
Pages       : 256
Page Size   : 4096 bytes
Total Size  : 1024KB
Planes      : 1
Lock Regions: 0
Locked      : none
Security    : false
Erase flash

Done in 0.001 seconds
Write 352560 bytes to flash (87 pages)
[=====] 100% (87/87 pages)
Done in 13.971 seconds

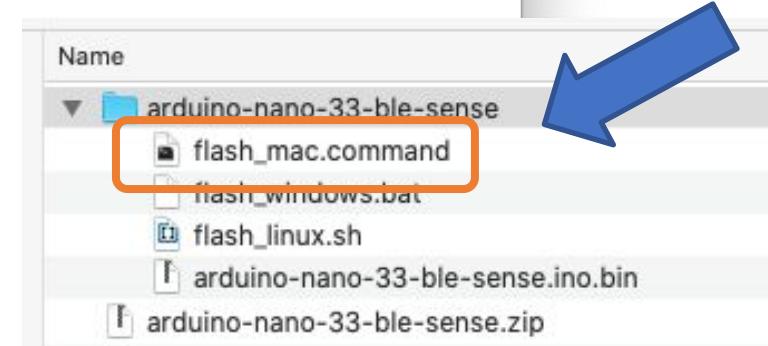
A new release of Arduino CLI is available: 0.31.0 → 0.32.2
https://arduino.github.io/arduino-cli/latest/installation/#latest-packages

Flashed your Arduino Nano 33 BLE development board.
To set up your development with Edge Impulse, run 'edge-impulse-daemon'
To run your impulse on your development board, run 'edge-impulse-run-impulse'

Saving session...
...copying shared history...
...saving history...truncating history files...
...completed.

[Process completed]
```

1. Press Nano-33 Reset button Twice
2. With Nano-33 LED Flashing:



Windows 10

```
Prompt de Comando
Microsoft Windows [versão 10.0.19041.1052]
(c) Microsoft Corporation. Todos os direitos reservados.

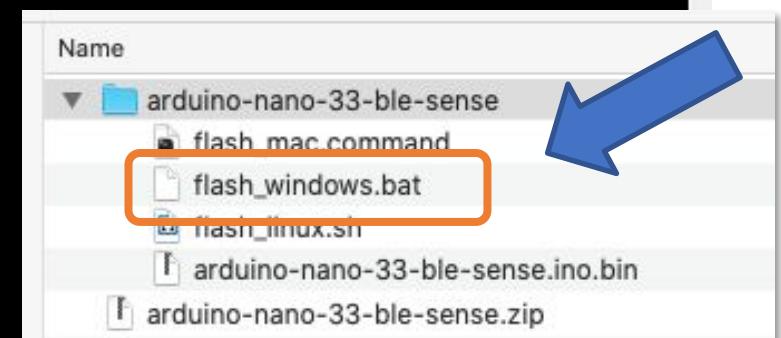
C:\Users\GUILH>arduino-cli
Arduino Command Line Interface (arduino-cli).

Usage:
  arduino-cli [command]

Examples:
  arduino-cli <command> [flags...]

Available Commands:
  board           Arduino board commands.
  burn-bootloader Upload the bootloader.
  cache           Arduino cache commands.
  compile         Compiles Arduino sketches.
  completion     Generates completion scripts
  config          Arduino configuration commands.
  core            Arduino core operations.
  daemon          Run as a daemon on port 50051
  debug           Debug Arduino sketches.
  help            Help about any command
  lib              Arduino commands about libraries.
  outdated        Lists cores and libraries that can be upgraded
  sketch          Arduino CLI sketch commands.
  update          Updates the index of cores and libraries
  upgrade         Upgrades installed cores and libraries.
  upload          Upload Arduino sketches.
  version         Shows version number of Arduino CLI.
```

1. Press Nano-33 Reset button Twice
2. With Nano-33 LED Flashing:



Windows 10

```
cmd C:\WINDOWS\system32\cmd.exe
Finding Arduino Mbed core...
arduino:mbed_nano 2.0.0      2.0.0  Arduino Mbed OS Nano Boards
Finding Arduino Mbed core OK
Finding Arduino Nano 33 BLE...
Finding Arduino Nano 33 BLE OK at COM11
arduino:mbed_nano 2.0.0      2.0.0  Arduino Mbed OS Nano Boards
Device      : nRF52840-QIAA
Version     : Arduino Bootloader (SAM-BA extended) 2.0 [Arduino:IKXYZ]
Address     : 0x0
Pages       : 256
Page Size   : 4096 bytes
Total Size  : 1024KB
Planes      : 1
Lock Regions: 0
Locked      : none
Security    : false
Erase flash

Done in 0.002 seconds
Write 525440 bytes to flash (129 pages)
[=====] 100% (129/129 pages)
Done in 22.296 seconds
Flashed your Arduino Nano 33 BLE development board
To set up your development with Edge Impulse, run 'edge-impulse-daemon'
To run your impulse on your development board, run 'edge-impulse-run-impulse'
Pressione qualquer tecla para continuar. . .
```

□ Nano-33 LED Stop Flashing

Thanks

