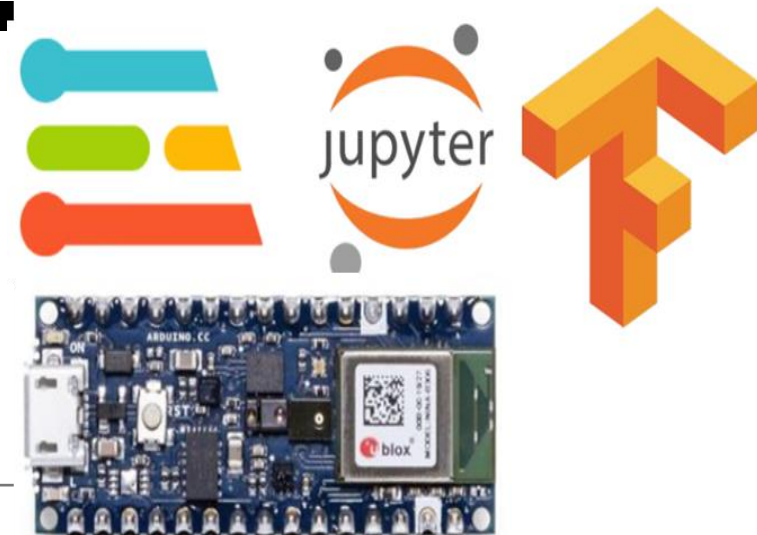


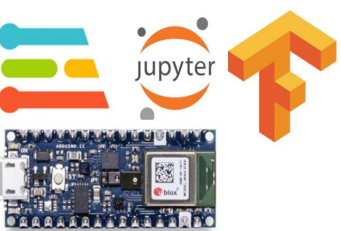


Advanced Microprocessors

OVERVIEW OF EDGE IMPULSE PLATFORM FOR MICROPROCESSORS

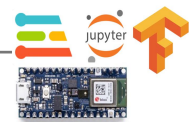
Dennis A. N. Gookyi

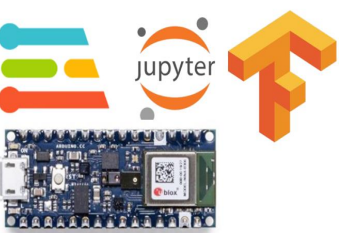




CONTENTS

❖ Introduction to Edge Impulse

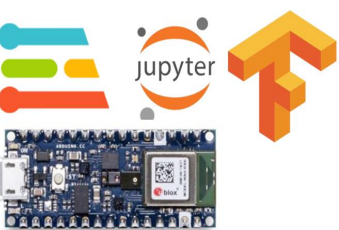




INTRODUCTION TO EDGE IMPULSE

❖ Machine Learning workflow





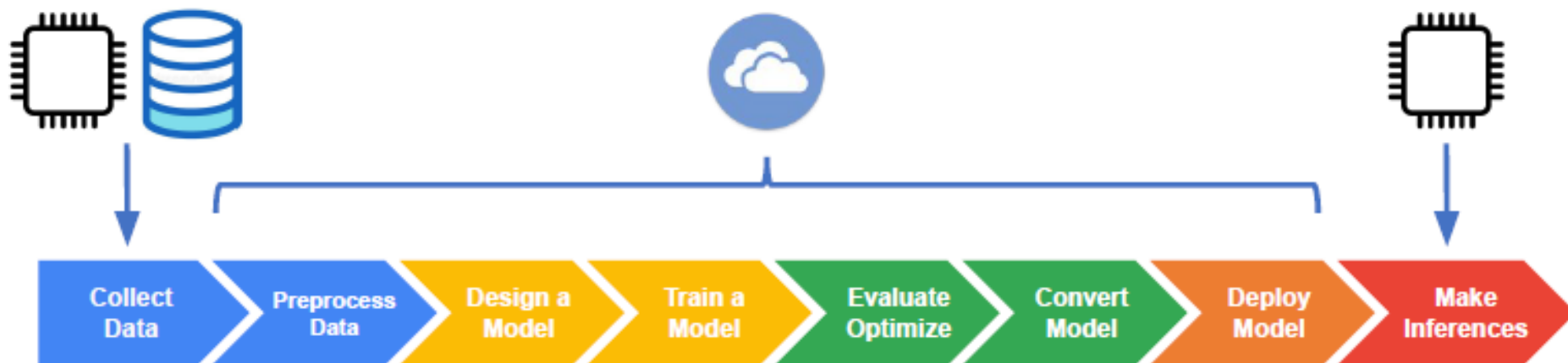
INTRODUCTION TO EDGE IMPULSE

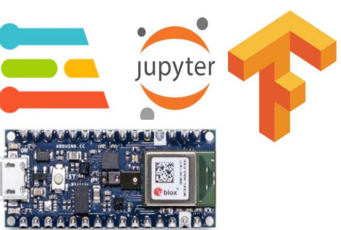
❖ Tiny Machine Learning workflow



INTRODUCTION TO EDGE IMPULSE

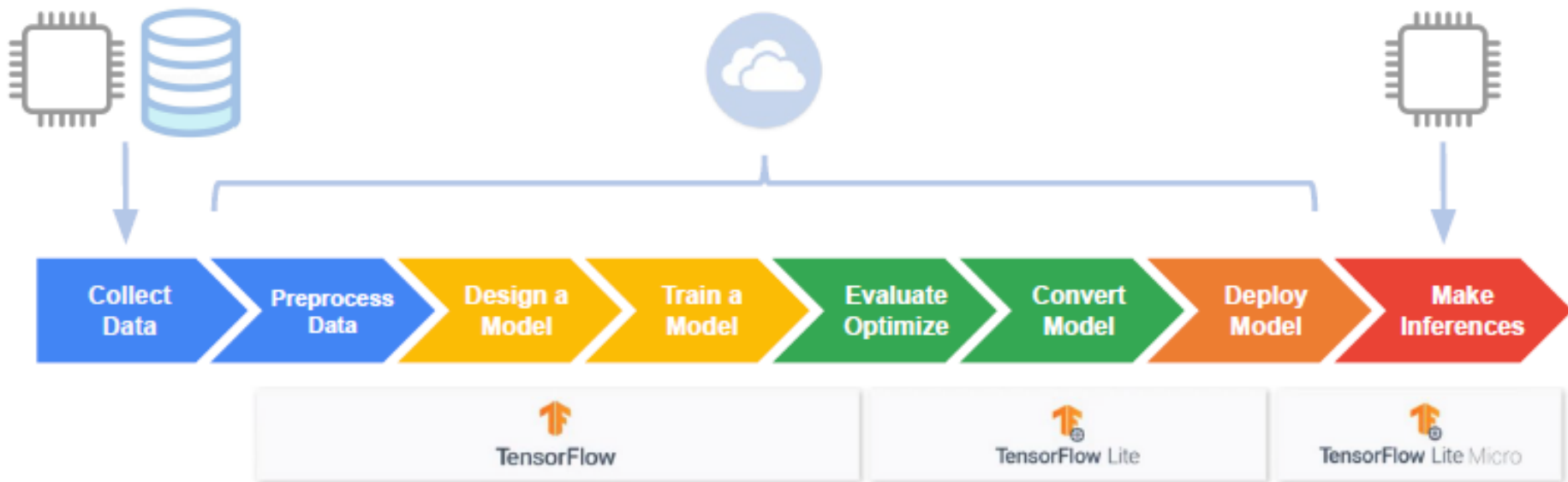
❖ Tiny Machine Learning workflow





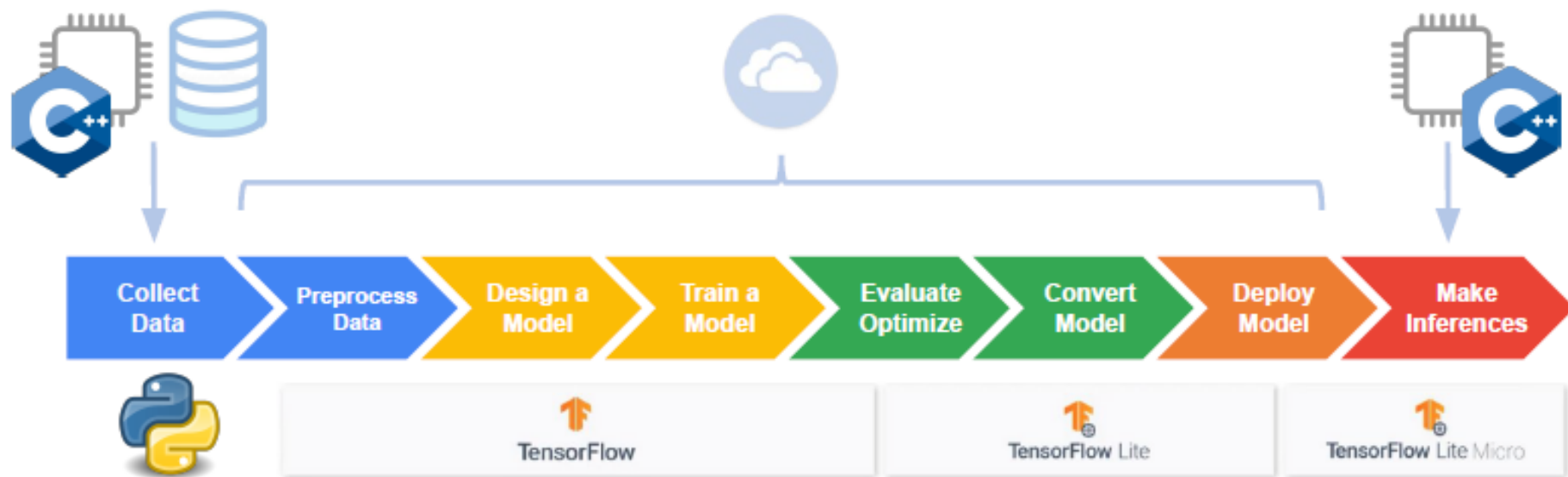
INTRODUCTION TO EDGE IMPULSE

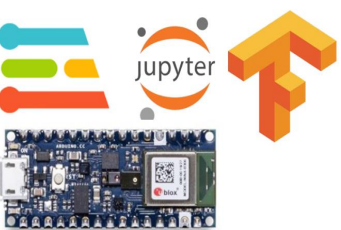
❖ Tiny Machine Learning workflow



INTRODUCTION TO EDGE IMPULSE

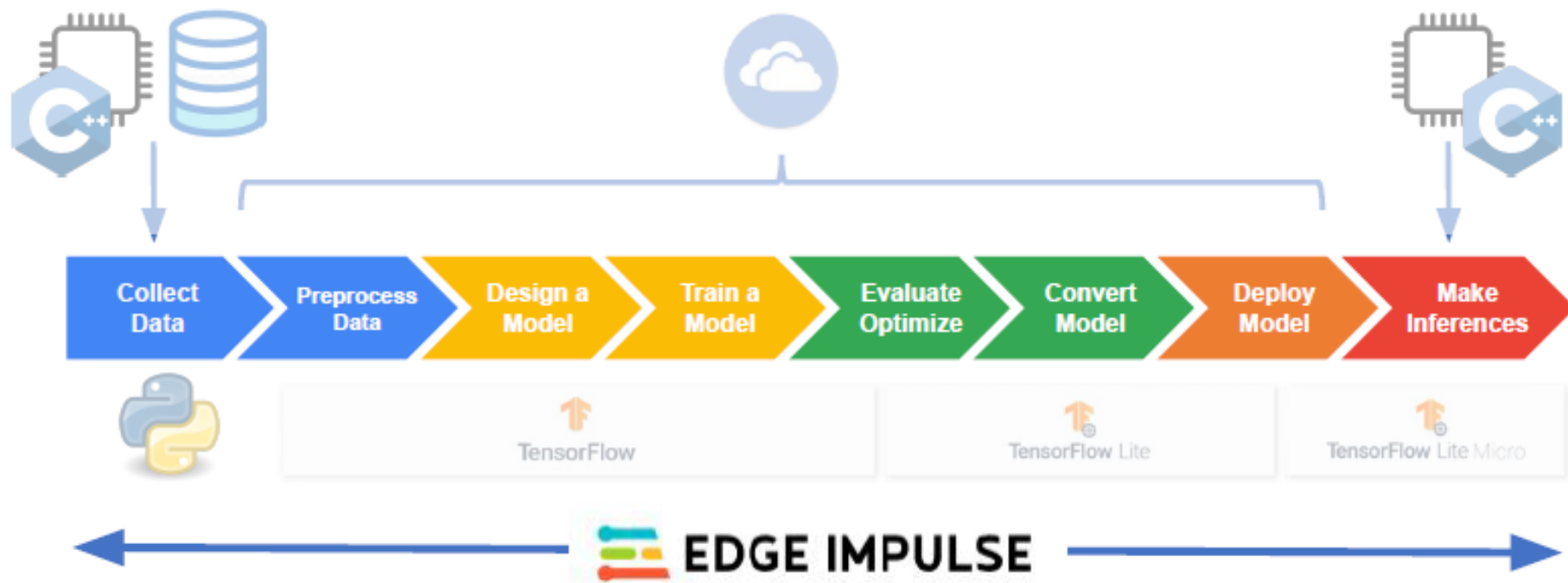
❖ Tiny Machine Learning workflow





INTRODUCTION TO EDGE IMPULSE

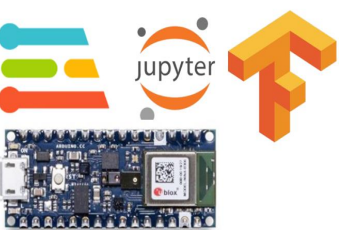
❖ Tiny Machine Learning workflow



INTRODUCTION TO EDGE IMPULSE

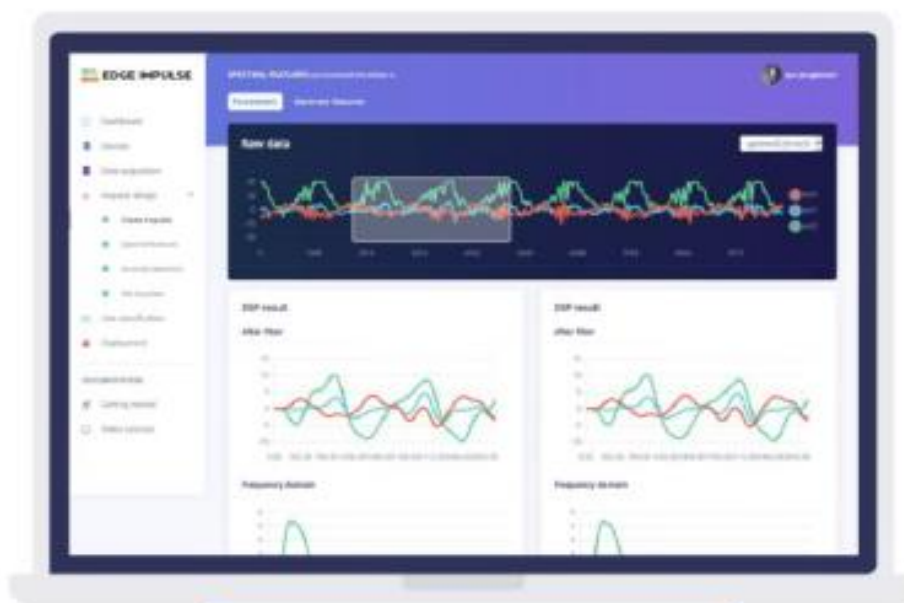
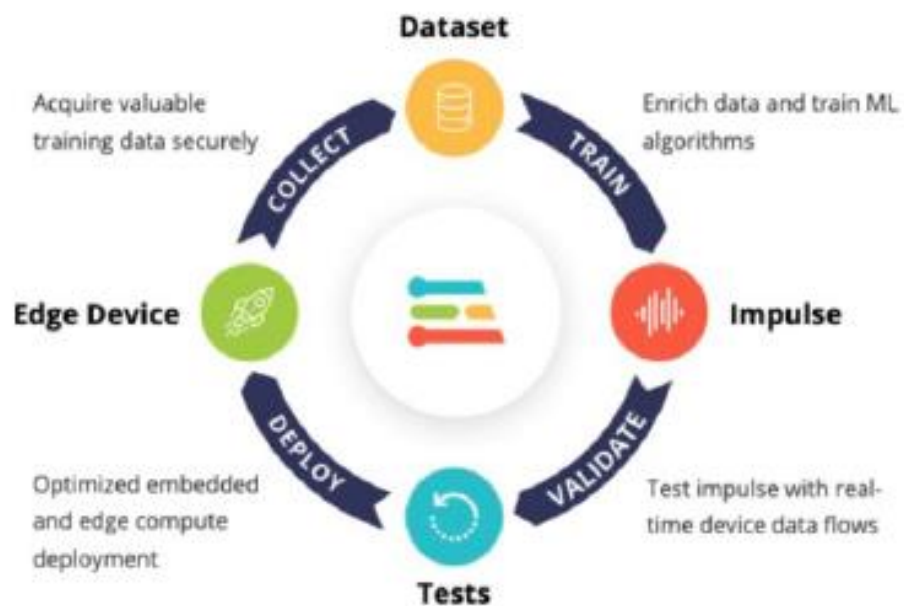
❖ Tiny Machine Learning workflow



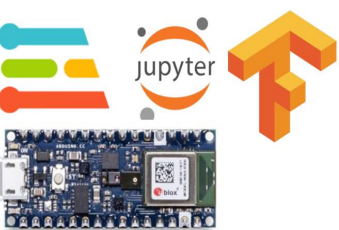


INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse



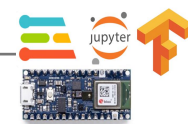
Learn more at <http://edgeimpulse.com>

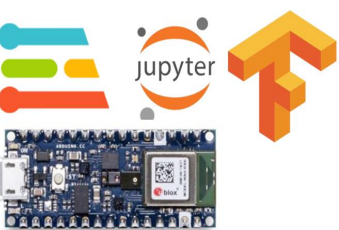


INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse

- ❑ It is a cloud service for developing machine learning models in the TinyML targeted edge devices
- ❑ This supports AutoML processing for edge platforms
- ❑ It also supports a number of boards including smartphones to deploy learning models in such devices.
- ❑ Training is done on the cloud platform and the trained model can be exported to an edge device by following a data forwarder-enabled path
- ❑ The impulse can be run on local machine with the help of the in-built C++, Node.js, Python, and Go SDKs
- ❑ Impulses are also deployable as a WebAssembly library





INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse

studio.edgeimpulse.com/studio/240311

EDGE IMPULSE

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

Getting started

Start building your dataset or validate your model's on-device performance:

- Add existing data
- Collect new data
- Upload your model

Start with a tutorial

Not sure where to start? Follow a tutorial to build your first model in just minutes!

- Motion: Gesture recognition
- Images: Object detection
- Audio: Audio classification

Sharing

Your project is private.

[Make this project public](#)

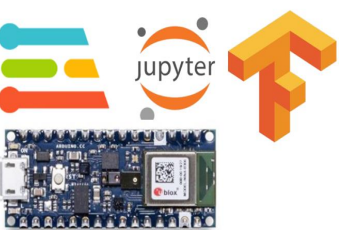
Collaborators (1/4)

- Ewura **OWNER**

Summary

DEVICES CONNECTED
0

[Continue with the wizard](#)



INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse installation guide

The screenshot shows a Google search for 'edge impulse.com'. The search bar contains the text 'edge impulse.com'. Below the search bar, there are tabs for 'Videos', 'Shopping', 'News', 'Images', 'FOMO', 'Arduino', 'Twitter', 'Kobe Bryant', and 'BrainChip'. The search results show 'About 22,100,000 results (0.45 seconds)'. The first result is 'Edge Impulse' with the URL 'https://www.edgeimpulse.com'. Below the result, there are links for 'Edge Impulse', 'Login', 'Documentation', 'Sign up', and 'About'. A blue box with the text '1. Search in web browser' has an arrow pointing to the search bar. Another blue box with the text '2. As a new user, click on the 'Sign up' option' has an arrow pointing to the 'Sign up' link.

Google

edge impulse.com

Videos Shopping News Images FOMO Arduino Twitter Kobe Bryant BrainChip

About 22,100,000 results (0.45 seconds)

Edge Impulse
https://www.edgeimpulse.com

Edge Impulse

Edge Impulse is the **edge** AI platform for enterprise teams building innovative products. Optimize your models and deploy to any **edge** device with ease.

Login
Maintenance window planned on June 19th 5:00am UTC (more ...)

Documentation
Devices - Dashboard - Data acquisition - Overview -

Sign up
Sign up with AMRC. Already have an account? Log in. Start ...

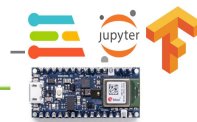
About
Edge Impulse is ushering in the future of embedded machine ...

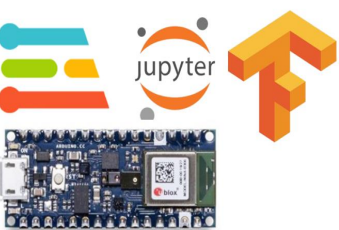
More results from edgeimpulse.com »

1. Search in web browser

2. As a new user, click on the 'Sign up' option

https://www.edgeimpulse.com





INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse installation guide

The screenshot shows the Edge Impulse sign-up page at studio.edgeimpulse.com/signup. The page has a dark blue header with the text "Start building embedded machine learning models today." and "© 2023 Edgimpulse Inc. All rights reserved." The main content area is white and contains a sign-up form. The form includes fields for "What should we call you?", "Pick a username", "Company email", "Job title (optional)", and "Password". Below these fields is a checkbox for "I accept the Privacy Policy, Terms of Service, and Responsible AI License." and a blue "Sign up" button. A link for "Already have an account? Log in" is at the bottom. Three numbered callouts are present: 3. "Fill the form with your requested details" points to the form fields; 4. "Tick to accept" points to the checkbox; 5. "Click to Sign up" points to the "Sign up" button.

studio.edgeimpulse.com/signup

Sign up

What should we call you?

Pick a username

Company email

Job title (optional)

Password

☐ I accept the Privacy Policy, Terms of Service, and Responsible AI License.

Sign up

Already have an account? [Log in](#)

3. Fill the form with your requested details

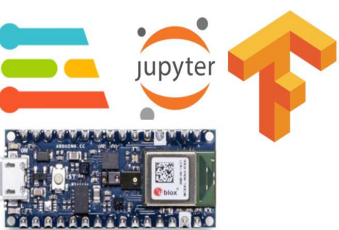
4. Tick to accept

5. Click to Sign up

Start building embedded machine learning models today.

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INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse installation guide

studio.edgeimpulse.com/studio/signup-success

EDGE IMPULSE

Sign up successful!

Thanks **Ewura!**

You have successfully signed up for Edge Impulse.

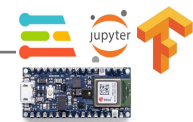
[Click here to build your first ML model!](#)

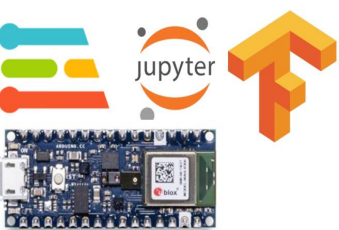
[Re-send activation email](#)

6. Click to start a new project

Start building embedded machine learning models today.

© 2023 EdgeImpulse Inc. All rights reserved



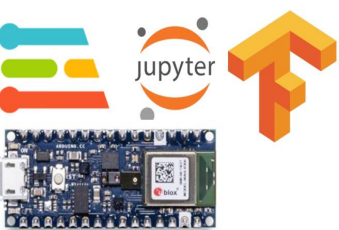


INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse installation guide

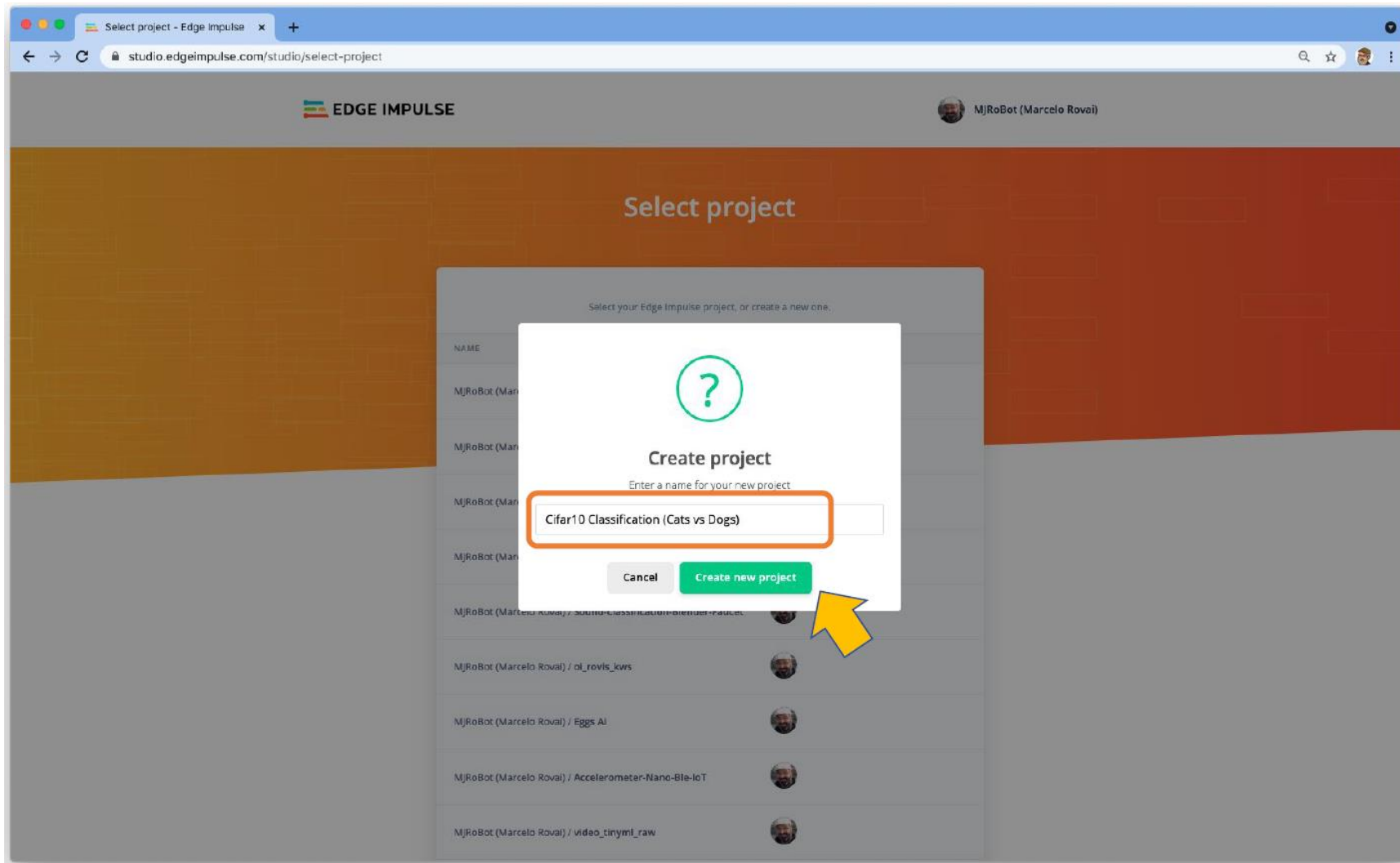
The screenshot displays the Edge Impulse Studio web interface in a browser window. The address bar shows the URL `studio.edgeimpulse.com/studio/240311`. The page title is "Ewura / Ara2bay-project-1". A sidebar on the left lists navigation options: Dashboard, Devices, Data acquisition, Impulse design (with a sub-option "Create impulse"), EON Tuner, Retrain model, Live classification, Model testing, Versioning, and Deployment. The main content area features a "Project info" tab and a large white modal window with the text "Welcome" and a bell icon. Below this, it says "You're only minutes away from making your devices feel, hear and see the real world using machine learning!". A prominent blue button reads "Let's build your first model in 5 minutes!". Below the button, it says "Or, continue to your project". At the bottom of the modal, there is a section titled "Start building your dataset or validate your model's on-device performance:" followed by two placeholder boxes. To the right of these boxes, it says "Your project is private." and a button labeled "Make this project public".

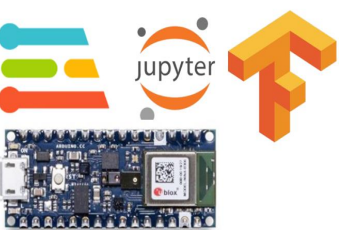




INTRODUCTION TO EDGE IMPULSE

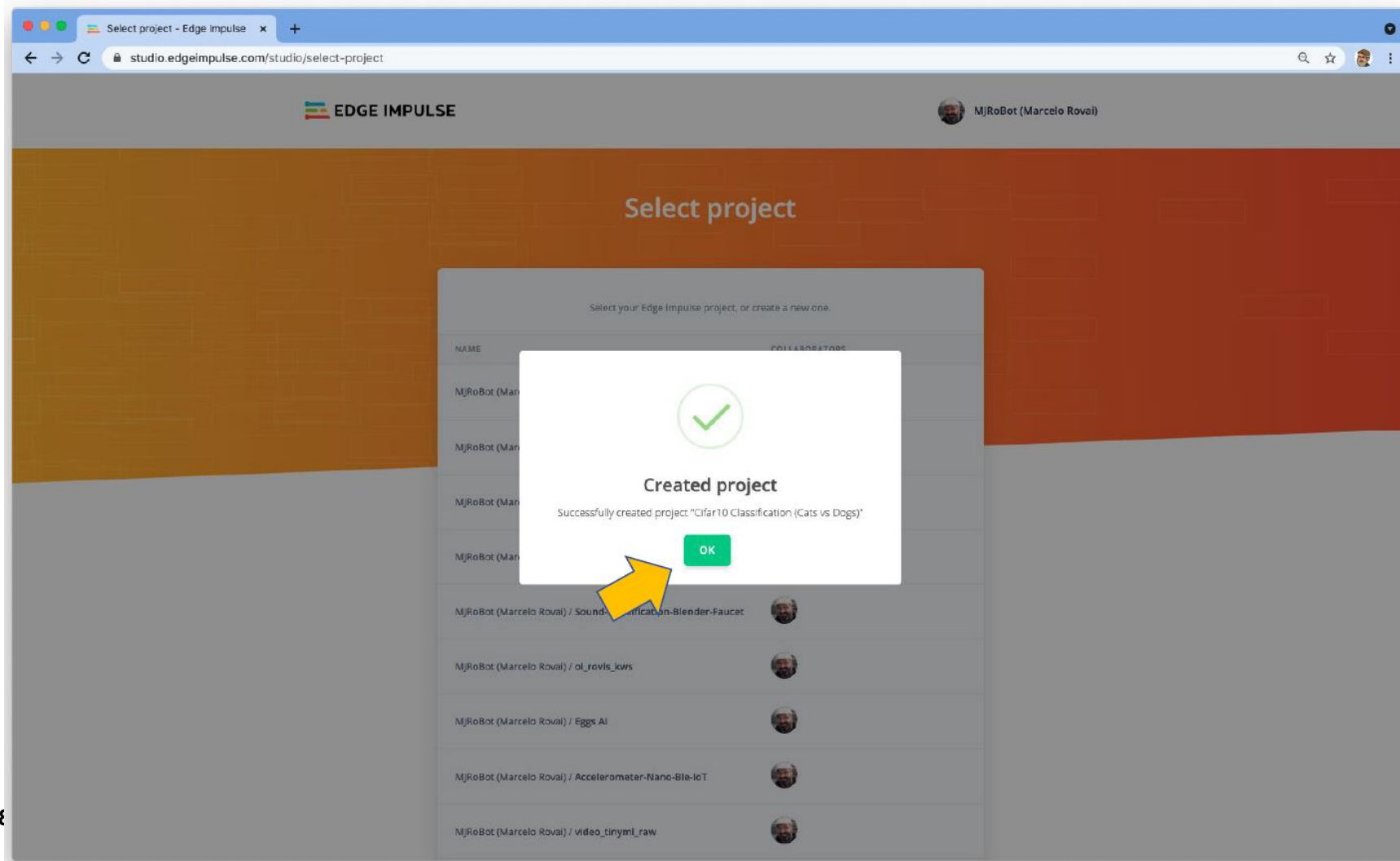
❖ Edge Impulse example: Cifar Cats vs Dogs

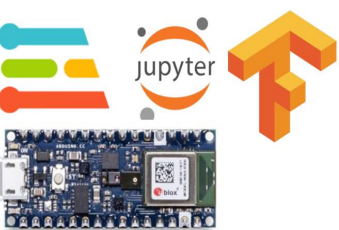




INTRODUCTION TO EDGE IMPULSE


❖ Edge Impulse example: Cifar Cats vs Dogs








INTRODUCTION TO EDGE IMPULSE


❖ Edge Impulse example: Cifar Cats vs Dogs


 **EDGE IMPULSE**


 Dashboard


 Devices


 Data acquisition


 Impulse design


 Create impulse

 EON Tuner

 Retrain model


 Live classification


 Model testing




Getting started

Start building your dataset or validate your model's on-device performance:



Add existing data



Collect new data



Upload your model

Start with a tutorial

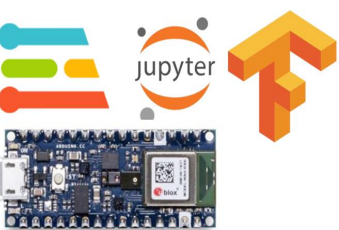
Not sure where to start? Follow a tutorial to build your first model in just minutes!


Motion: Gesture recognition


Images: Object detection

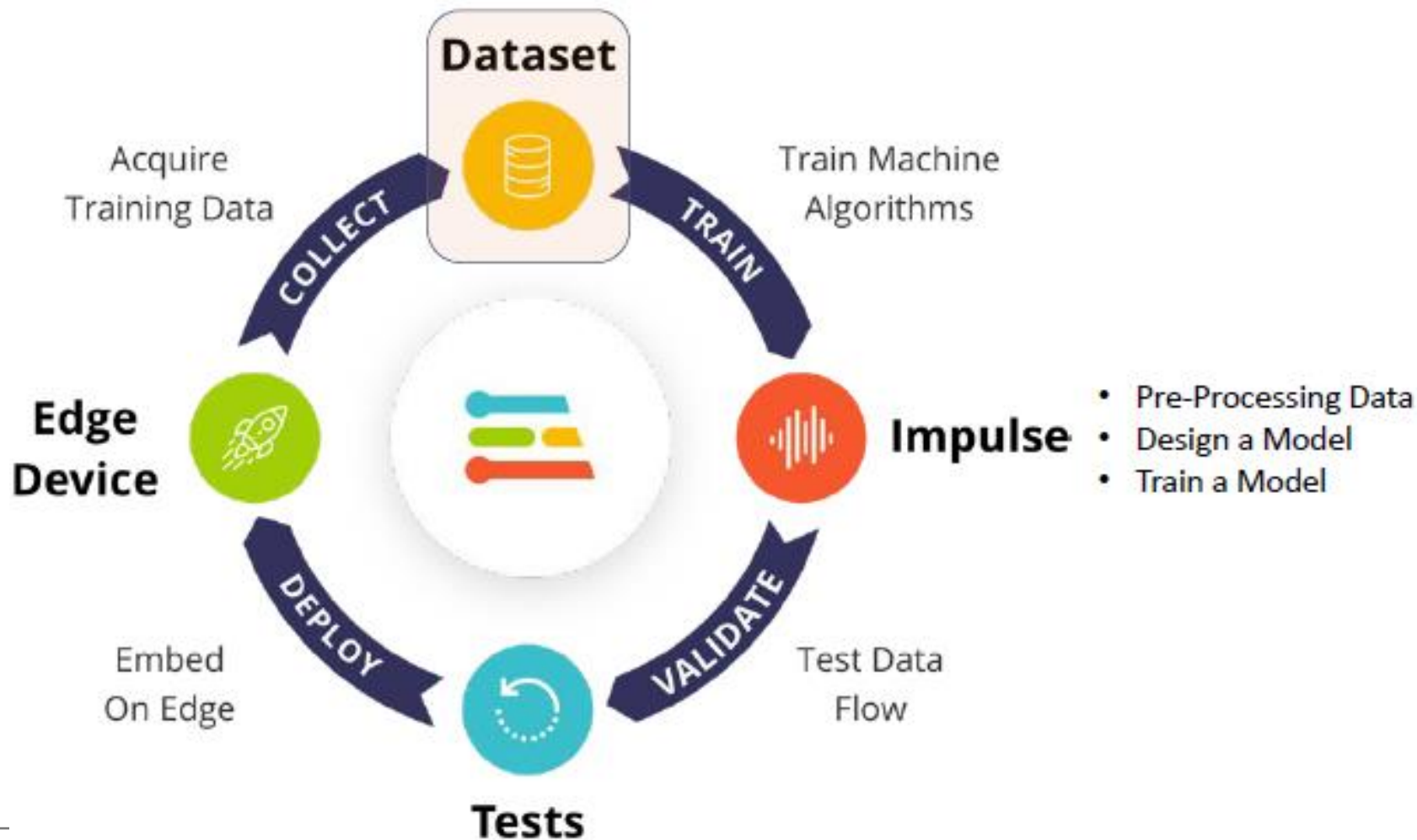

Audio: Audio classification

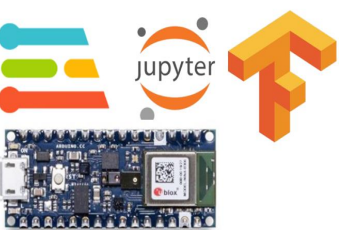




INTRODUCTION TO EDGE IMPULSE

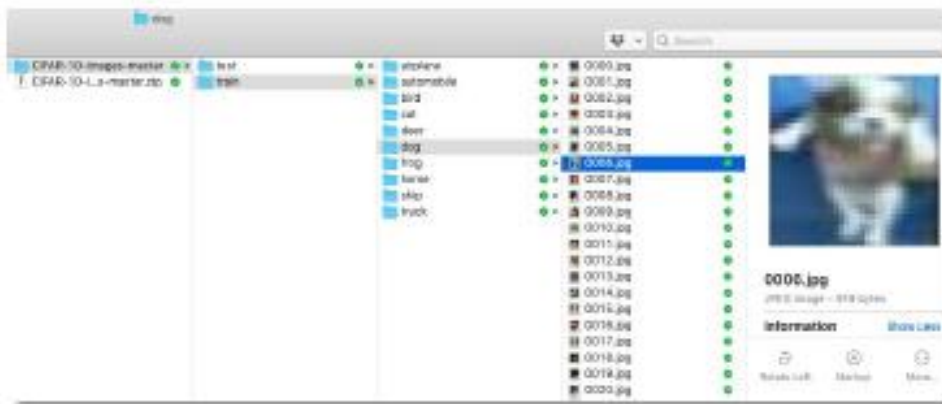
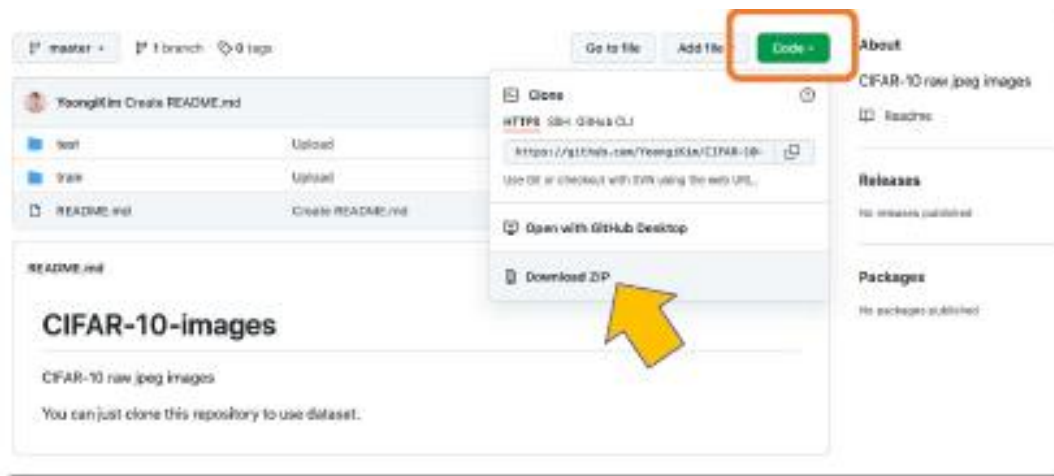
❖ Edge Impulse example: Cifar Cats vs Dogs

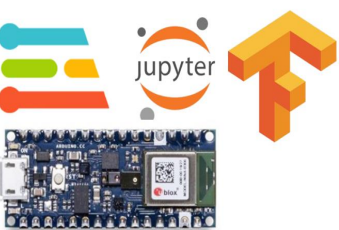




INTRODUCTION TO EDGE IMPULSE


- ❖ Edge Impulse example: Cifar Cats vs Dogs
 - Download: <https://github.com/YoongiKim/CIFAR-10-images>








INTRODUCTION TO EDGE IMPULSE


❖ Edge Impulse example: Cifar Cats vs Dogs


 **EDGE IMPULSE**


 Dashboard


 Devices


 Data acquisition


 Impulse design


 Create impulse

 EON Tuner

 Retrain model


 Live classification


 Model testing




Getting started

Start building your dataset or validate your model's on-device performance:



Add existing data



Collect new data



Upload your model

Start with a tutorial

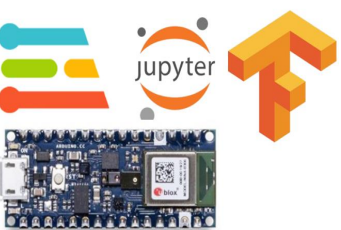
Not sure where to start? Follow a tutorial to build your first model in just minutes!


Motion: Gesture recognition


Images: Object detection


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INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs

EDGE IMPULSE

- Dashboard
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- Data acquisition
- Impulse design
- Create impulse
- EON Tuner
- Retrain model
- Live classification
- Model testing

Dennis / Cifar_Dogs_vs_

Dataset

Data explorer

Data sources

CSV Wizard

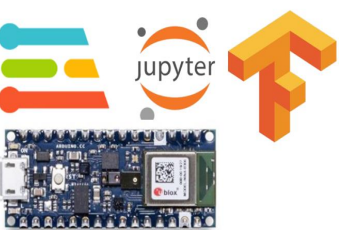
Dataset



Add data

Start building your dataset by adding some data.

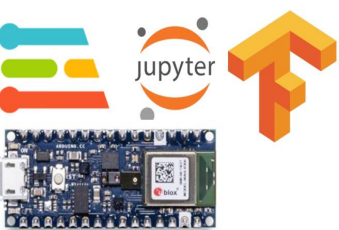
+ Add data



INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs

The screenshot shows the Edge Impulse web interface. On the left is a sidebar with navigation links: Dashboard, Devices, Data acquisition, Impulse design, Create impulse, EON Tuner, Retrain model, Live classification, and Model testing. The main area displays a 'Dataset' card with a 'Dataset' tab selected. A modal window titled 'Add existing data' is open, featuring two options: 'Upload data' (highlighted with a red rectangle) and 'Add storage bucket'. Below the modal, the text 'Add data' and 'Start building your dataset by adding some data.' is visible, along with a blue '+ Add data' button.



INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs

You can upload existing data to your project in the [Data](#) / datasets with labels in various formats. When you include

EDGE IMPULSE

- Dashboard
- Devices
- Data acquisition
- Impulse design
- Create impulse
- EON Tuner
- Retrain model
- Live classification
- Model testing

Try Enterprise Free

Get access to high job lib
and training on GPUs

Upload mode

☐ Select individual files ?

☒ Select a folder ?

Select files

No file chosen

Upload into category

☐ Automatically split between training and testing ?

☒ Training

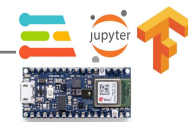
☐ Testing

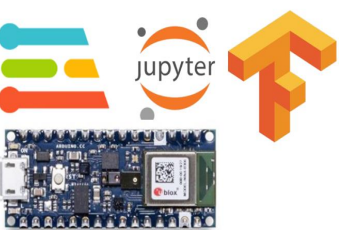
Label

☐ Infer from filename ?

☐ Leave data unlabeled ?

☒ Enter label:





INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs

EDGE IMPULSE

- Dashboard
- Devices
- Data acquisition
- Impulse design
- Create impulse
- EON Tuner
- Retrain model
- Live classification
- Model testing

Try Enterprise Free

Get access to high job list and training on GPUs

You can upload existing data to your project in the [Data](#) / datasets with labels in various formats. When you include

Upload mode

☐ Select individual files ?

☒ Select a folder ?

Select files

Choose Files No file chosen

Upload into category

☐ Automatically split between training and testing ?

☒ Training

☐ Testing

Label

☐ Infer from filename ?

☐ Leave data unlabeled ?

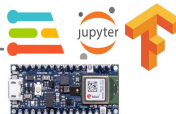
☒ Enter label:

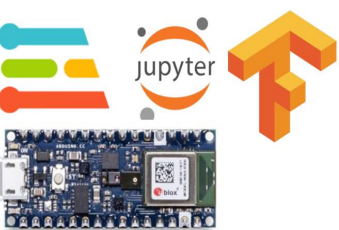
Dog

« GCTU - AI » Datasets » CIFAR-10-images-master » train

Search train

older	Name	Date modified	Type	Size
	airplane	1/16/2024 9:09 AM	File folder	
	automobile	1/16/2024 9:11 AM	File folder	
	bird	1/16/2024 9:13 AM	File folder	
	cat	1/16/2024 9:14 AM	File folder	
	deer	1/16/2024 9:16 AM	File folder	
	dog	1/16/2024 9:18 AM	File folder	
	frog	1/16/2024 9:20 AM	File folder	
	horse	1/16/2024 9:22 AM	File folder	
	ship	1/16/2024 9:24 AM	File folder	





INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs

☐ Select individual files ?

☒ Select a folder ?

Select files

Choose Files 5000 files

Upload into category

☐ Automatically split between training and testing ?

☒ Training

☐ Testing

Label

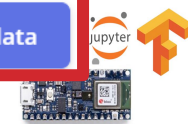
☐ Infer from filename ?

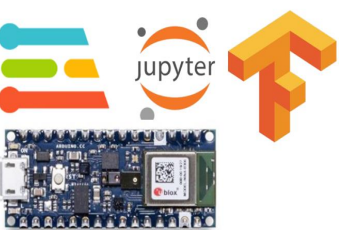
☐ Leave data unlabeled ?

☒ Enter label:

Dog

Upload data





INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs

- Upload Dog test data, Cat train data, and Cat test data using the same method

☐ Select individual files ?

☒ Select a folder ?

Select files

5000 files

Upload into category

☐ Automatically split between training and testing ?

☒ Training

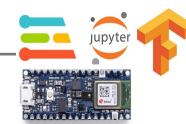
☐ Testing

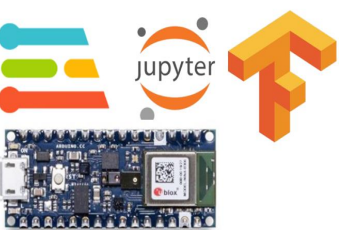
Label

☐ Infer from filename ?

☐ Leave data unlabeled ?

☒ Enter label:





INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs

Upload data



You can upload existing data to your project in the [Data Acquisition Format](#) (CBOR, JSON, CSV), or as WAV, JPG, PNG, AVI or MP4 files. We also support uploading image datasets with labels in various formats. When you include labels during upload, we attempt to convert your dataset into a format recognized by Studio. [here](#).

Upload mode

- ☐ Select individual files ?
- ☒ Select a folder ?

Select files

Choose Files No file chosen

Upload into category

- ☐ Automatically split between training and testing ?
- ☐ Training
- ☒ Testing

Label

- ☐ Infer from filename ?
- ☐ Leave data unlabeled ?

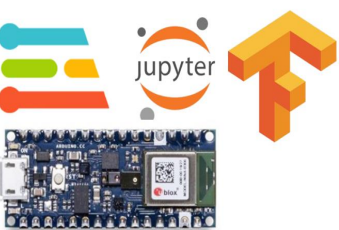
Upload output

```
[ 983/1000] Uploading 0977.jpg OK
[ 984/1000] Uploading 0979.jpg OK
[ 985/1000] Uploading 0975.jpg OK
[ 986/1000] Uploading 0986.jpg OK
[ 987/1000] Uploading 0987.jpg OK
[ 988/1000] Uploading 0983.jpg OK
[ 989/1000] Uploading 0989.jpg OK
[ 990/1000] Uploading 0988.jpg OK
[ 991/1000] Uploading 0991.jpg OK
[ 992/1000] Uploading 0990.jpg OK
[ 993/1000] Uploading 0992.jpg OK
[ 994/1000] Uploading 0993.jpg OK
[ 995/1000] Uploading 0994.jpg OK
[ 996/1000] Uploading 0995.jpg OK
[ 997/1000] Uploading 0996.jpg OK
[ 998/1000] Uploading 0997.jpg OK
[ 999/1000] Uploading 0999.jpg OK
[1000/1000] Uploading 0998.jpg OK
```

Done. Files uploaded successful: 1000. Files that failed to upload: 0.

Job completed





INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs

EDGE IMPULSE

Dennis / Cifar_Dogs_vs_Cats PERSONAL

Dataset | Data explorer | Data sources | CSV Wizard

DATA COLLECTED
12,000 items

TRAIN / TEST SPLIT
83% / 17%

Collect data

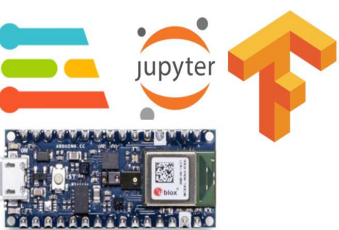
[Connect a device](#) to start building your dataset.

Dataset

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

SAMPLE NAME	LABEL	ADDED	LENGTH
4998	Cat	Today, 09:48:19	-
4999	Cat	Today, 09:48:19	-
4996	Cat	Today, 09:48:19	-
4997	Cat	Today, 09:48:19	-

RAW DATA
4998

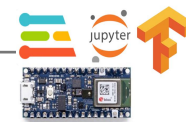


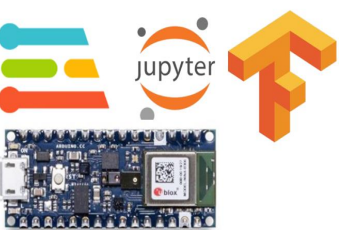
INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs

The screenshot displays the Edge Impulse web interface. On the left is a sidebar with navigation options: Dashboard, Devices, Data acquisition, Impulse design (highlighted with a red box), EON Tuner, Retrain model, Live classification, and Model testing. Below the sidebar is a 'Try Enterprise Free' banner. The main content area has a top navigation bar with 'Dataset', 'Data explorer', 'Data sources', and 'CSV Wizard'. The 'Dataset' tab is active, showing 'DATA COLLECTED 12,000 items' and 'TRAIN / TEST SPLIT 83% / 17%'. A 'Collect data' section on the right includes a 'Connect a device' button. Below this, a 'RAW DATA' section shows '4998' items and a small image of a cat. A table lists dataset items with columns for Sample Name, Label, Added, and Length.

SAMPLE NAME	LABEL	ADDED	LENGTH
4998	Cat	Today, 09:48:19	-
4999	Cat	Today, 09:48:19	-
4996	Cat	Today, 09:48:19	-
4997	Cat	Today, 09:48:19	-



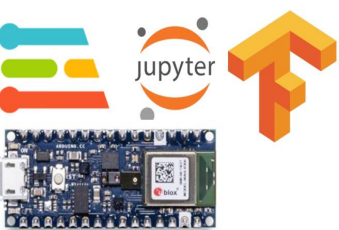


INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs

The screenshot displays the Edge Impulse web interface for configuring a machine learning model. The interface is divided into several sections:

- Image data** (red panel):
 - Input axes**: Set to `image`.
 - Image width**: Set to `32`.
 - Image height**: Set to `32`.
 - Resize mode**: Set to `Fit shortest`.
 - Info**: A note stating, "For optimal accuracy with transfer learning blocks, use a 96x96 or 160x160 image size."
- Processing blocks** (light blue dashed boxes): Two empty boxes labeled "Add a processing block" and "Add a learning block".
- Output features** (teal panel): A panel with a checkmark icon, indicating that the output features are configured.
- Save Impulse** (green button): A button to save the configured model.

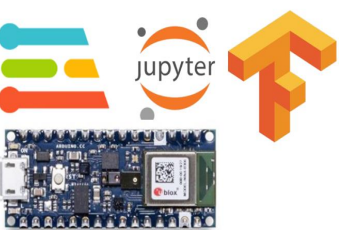


INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs

The screenshot displays the Edge Impulse web interface for configuring a machine learning model. The interface is divided into several sections:

- Image data** (red sidebar):
 - Input axes**: Set to **image**.
 - Image width**: 32
 - Image height**: 32
 - Resize mode**: **Fit shortest** (dropdown menu).
 - Visual feedback**: A diagram showing a square image being resized to fit within a square frame.
 - Info**: A note stating: "For optimal accuracy with transfer learning blocks, use a 96x96 or 160x160 image size."
- Processing blocks** (dashed box with a red border): A box containing a lightning bolt icon and the text "Add a processing block".
- Learning blocks** (dashed box): A box containing a flask icon and the text "Add a learning block".
- Output features** (teal box): A box containing a checkmark icon and the text "Output features".
- Save Impulse** (green button): A button to save the configuration.



INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs

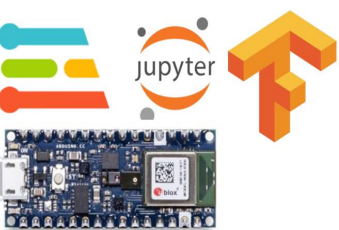
⚡ Add a processing block

Did you know? You can [bring your own DSP code](#).

DESCRIPTION	AUTHOR	RECOMMENDED
Image Preprocess and normalize image data, and optionally reduce the color depth.	Edge Impulse	★ Add
Raw Data Use data without pre-processing. Useful if you want to use deep learning to learn features.	Edge Impulse	Add

Some processing blocks have been hidden based on the data in your project. [Show all blocks anyway](#)

[Add custom block](#) [Cancel](#)

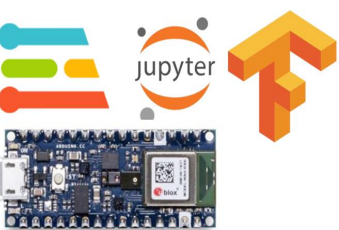


INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs

The screenshot displays the Edge Impulse web interface with the following components:

- Image data** (red panel):
 - Input axes: image
 - Image width: 32
 - Image height: 32
 - Resize mode: Fit shortest (dropdown menu)
 - Icon: A person icon with an arrow pointing to a smaller person icon.
 - Info: For optimal accuracy with transfer learning blocks, use a 96x96 or 160x160 image size.
- Image** (white panel):
 - Name: Image
 - Input axes (1): ☒ image
- Learning block** (dashed box): A red dashed box highlights a central area with a flask icon and the text "Add a learning block".
- Output features** (green panel):
 - Icon: A checkmark icon.
 - Save Impulse button



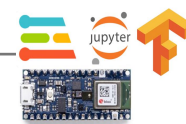
INTRODUCTION TO EDGE IMPULSE

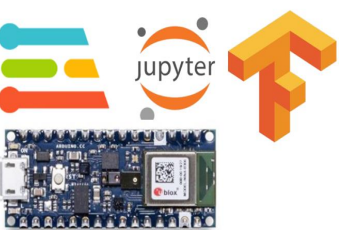
❖ Edge Impulse example: Cifar Cats vs Dogs

 Add a learning block ×

Did you know? You can [bring your own model](#) in PyTorch, Keras or scikit-learn.

DESCRIPTION	AUTHOR	RECOMMENDED
Transfer Learning (Images) Fine tune a pre-trained image classification model on your data. Good performance even with relatively small image datasets.	Edge Impulse	★ <button>Add</button>
EfficientNet B0 Transfer learning model based on efficientnetb0_notop.h5 weights. This is a much larger model than MobileNet for Linux devices and accelerators.	Community blocks	★ <button>Add</button>
Classification Learns patterns from data, and can apply these to new data. Great for categorizing movement or recognizing audio.	Edge Impulse	<button>Add</button>
Regression Learns patterns from data, and can apply these to new data. Great for predicting numeric continuous values.	Edge Impulse	<button>Add</button>
Classification - BrainChip Akida™ Learns patterns from data, and can apply these to new data. Great for categorizing movement or recognizing audio. Only works with	BrainChip	<button>Add</button>





INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs

Image data

Input axes

image

Image width

32

Image height

32

Resize mode

Fit shortest

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

Image

Name

Image

Input axes (1)

☒ image

Classification

Name

Classifier

Input features

☒ Image

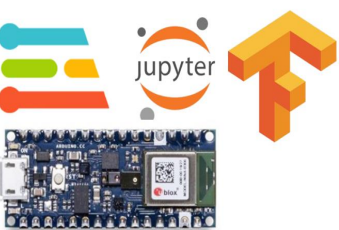
Output features

2 (Cat, Dog)

Output features

2 (Cat, Dog)

Save Impulse



INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs

EDGE IMPULSE

- Dashboard
- Devices
- Data acquisition
- Impulse design
 - Create impulse
 - Image**
 - Classifier
- EON Tuner
- Retrain model

Try Enterprise Free
Get access to high job limits and training on GPUs.

Start free trial

Raw data

Show: All I. 4998 (Cat)

Raw features

0x292826, 0x292826, 0x282725, 0x292826, 0x2a2927, 0x2b2a28, 0x2c2b29, 0x2d2c2a, ...

Parameters

Image

Color depth RGB

Save parameters

DSP result

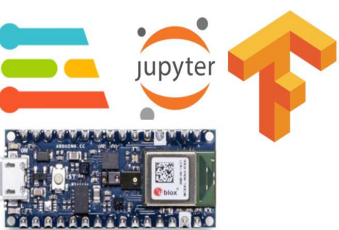
Image

Processed features

0.1608, 0.1569, 0.1490, 0.1608, 0.1569, 0.1490, 0.1569, 0.1529, 0.1451, 0.1608, ...

On-device performance

PROCESSING TIME 7 ms.	PEAK RAM USAGE 4 KB
---------------------------------	-------------------------------



INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs

#1 ▾ Click to set a description for this version

Parameters

Generate features

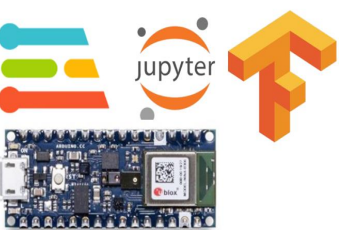
Training set

Data in training set	10,000 items
Classes	2 (Cat, Dog)

Generate features

Feature explorer

No features generated yet.



INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs

Training set

Data in training set 10,000 items

Classes 2 (Cat, Dog)

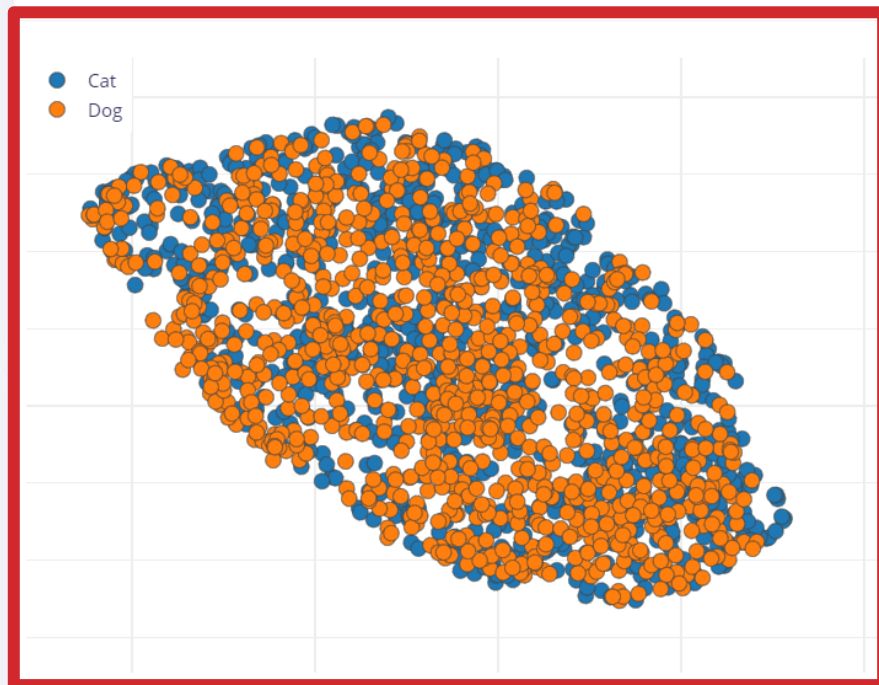
Generate features

Feature generation output

🔇 (0)

```
[ 2050/10000] Creating windows from files...  
[ 2406/10000] Creating windows from files...  
[ 2776/10000] Creating windows from files...  
[ 3164/10000] Creating windows from files...  
[ 3539/10000] Creating windows from files...  
[ 3915/10000] Creating windows from files...  
[ 4242/10000] Creating windows from files...  
[ 4598/10000] Creating windows from files...  
[ 4988/10000] Creating windows from files...  
[ 5342/10000] Creating windows from files...  
[ 5730/10000] Creating windows from files...  
[ 6107/10000] Creating windows from files...  
[ 6465/10000] Creating windows from files...  
[ 6833/10000] Creating windows from files...  
[ 7188/10000] Creating windows from files...  
[ 7545/10000] Creating windows from files...  
[ 7862/10000] Creating windows from files...
```

Feature explorer ⓘ

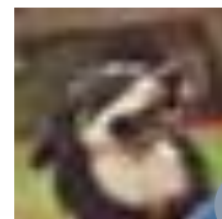


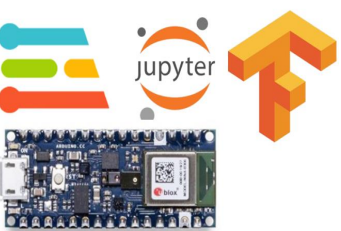
2990

Label: Dog

[View sample](#)

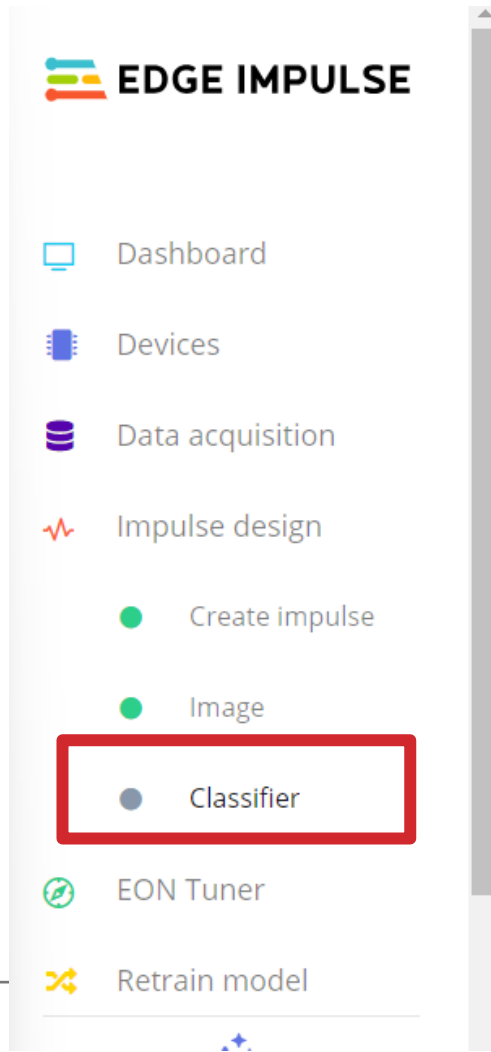
[View features](#)

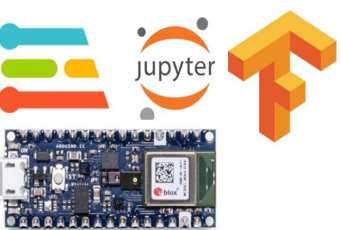




INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs





INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs

#1 ▾ Click to set a description for this version

Neural Network settings

Training settings

Number of training cycles ?

Learning rate ?

Advanced training settings



INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs

Neural network architecture



Start training

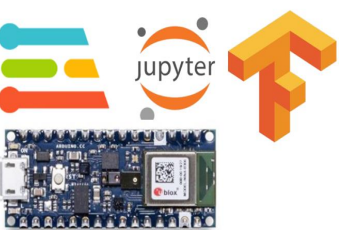
INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs

Neural network architecture



Start training



INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs

Input layer (3,072 features)

2D conv / pool layer (32 filters, 3 kernel size, 1 layer)

2D conv / pool layer (16 filters, 3 kernel size, 1 layer)

Flatten layer

Dropout (rate 0.25)

Add an extra layer

Output layer (2 classes)

Model

Model version: ?

Quantized (int8)

Last training performance (validation set)



ACCURACY
70.4%



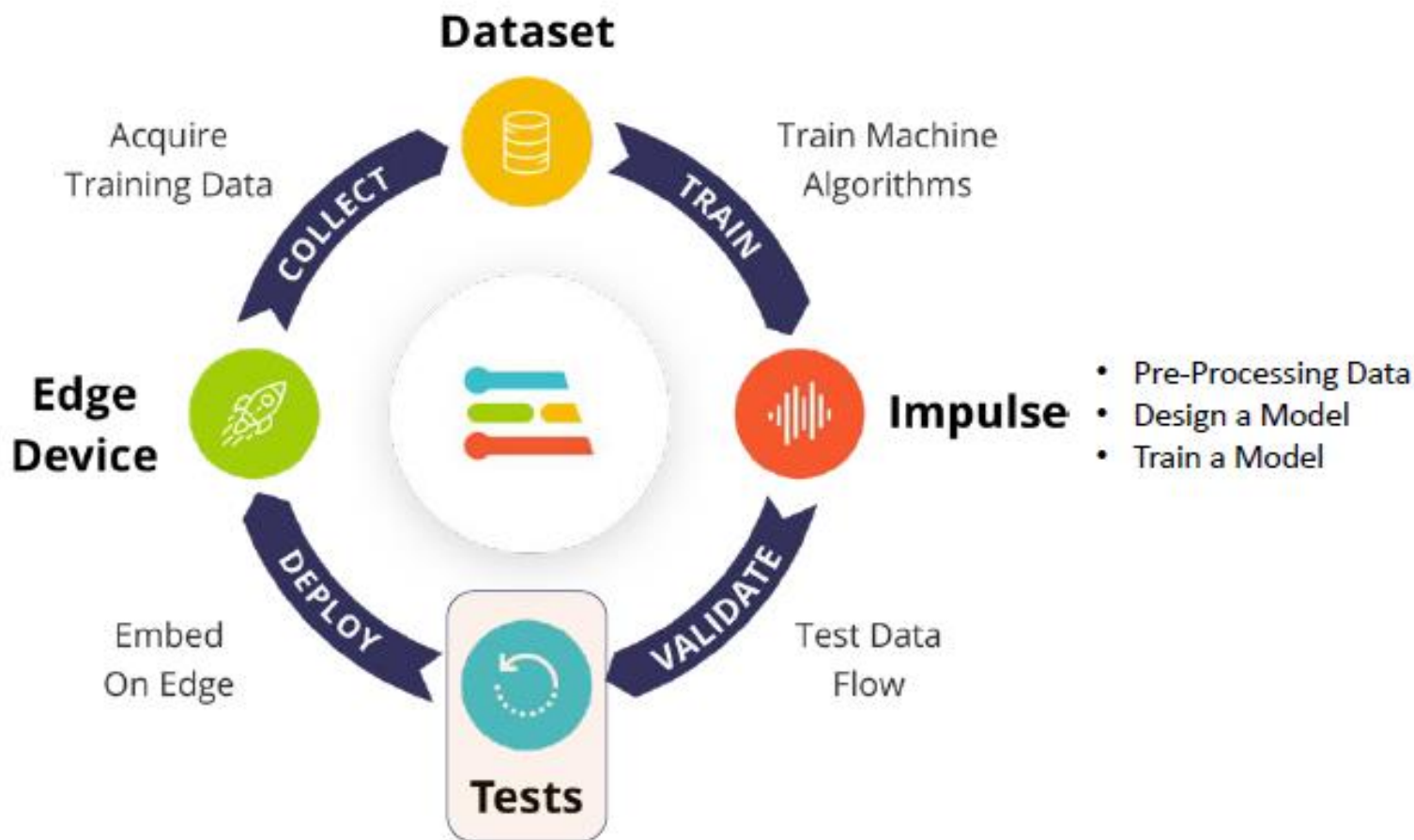
LOSS
0.57

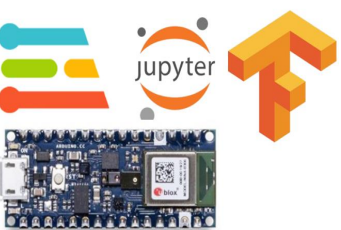
Confusion matrix (validation set)

	CAT	DOG
CAT	79.0%	21.0%
DOG	37.8%	62.2%
F1 SCORE	0.72	0.68

INTRODUCTION TO EDGE IMPULSE

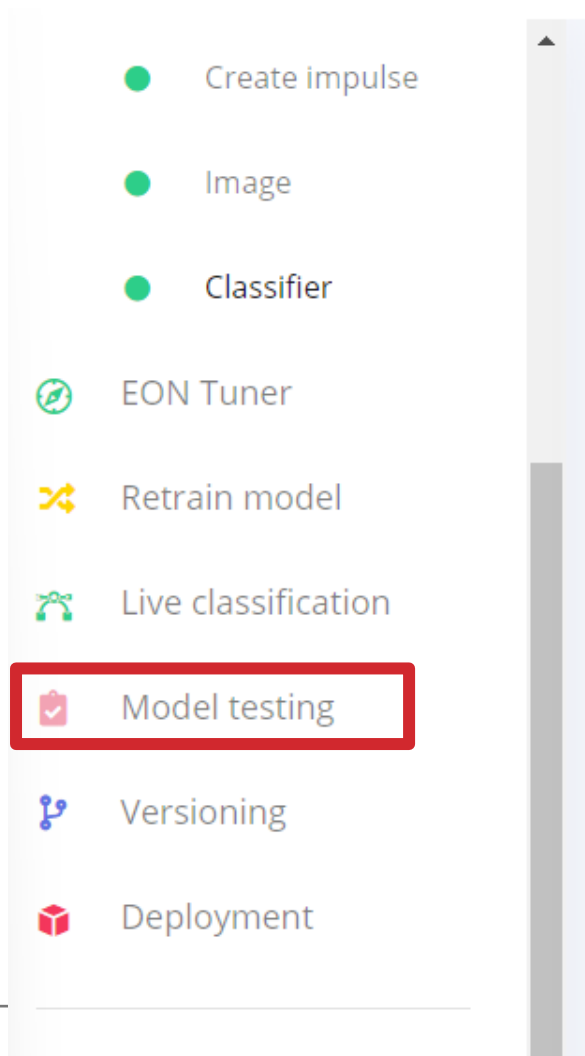
❖ Edge Impulse example: Cifar Cats vs Dogs

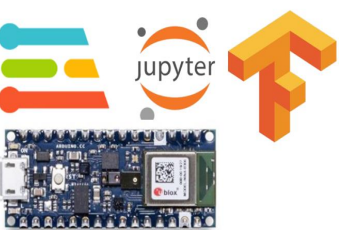




INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs





INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs

Test data

 Classify all

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

SAMPLE NA...	EXPECTED OUT...	LENG...	ACCURACY	RESULT
--------------	-----------------	---------	----------	--------

0998	Cat	-		...
------	-----	---	--	-----

0999	Cat	-		...
------	-----	---	--	-----

0997	Cat	-		...
------	-----	---	--	-----

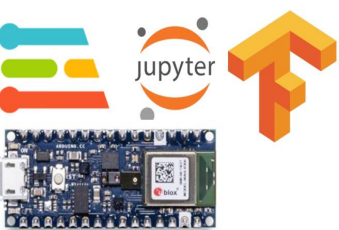
0996	Cat	-		...
------	-----	---	--	-----

0995	Cat	-		...
------	-----	---	--	-----

0994	Cat	-		...
------	-----	---	--	-----

Model testing output

 (0) ▼



INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs

Test data

Classify all

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

SAMPLE NAME	EXPECTED OUT	LENGTH	ACCURACY	RESULT	
0998	Cat	-	100%	1 Cat	...
0999	Cat	-	0%	1 uncertain	...
0997	Cat	-	100%	1 Cat	...
0996	Cat	-	100%	1 Cat	...
0995	Cat	-	0%	1 Dog	...
0994	Cat	-	100%	1 Cat	...

Model testing output

(0)

```
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...
Container image pulled!
Job started
INFO: Created TensorFlow Lite XNNPACK delegate for CPU.
Classifying data for Classifier OK
```

Job completed

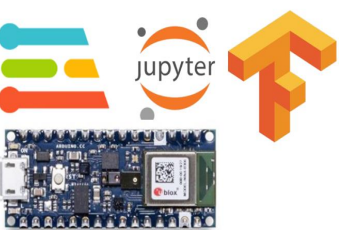
Model testing results



ACCURACY
55.10%

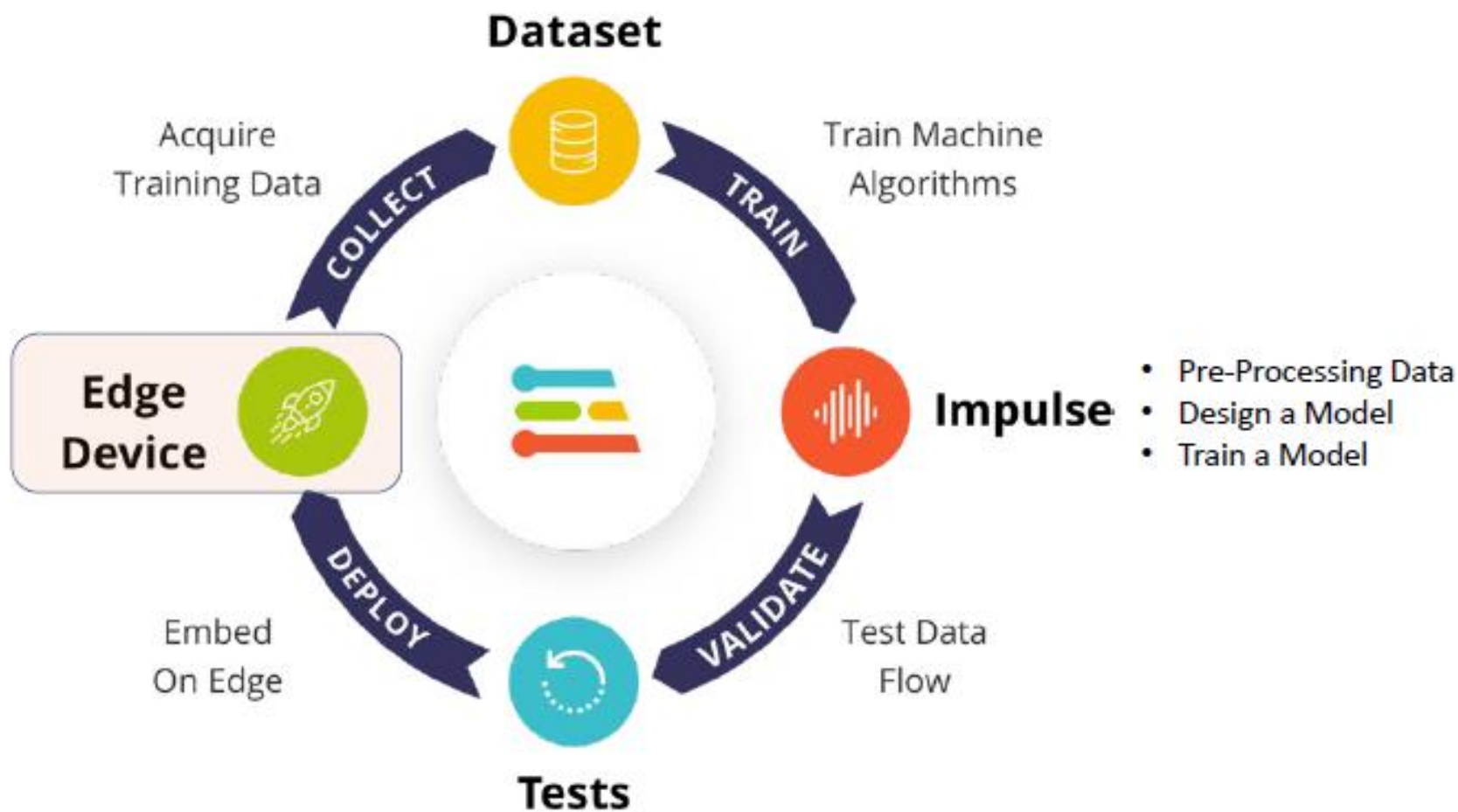
	CAT	DOG	UNCERTAIN
CAT	60.8%	10.5%	28.7%
DOG	21.6%	49.4%	29%
F1 SCORE	0.67	0.62	





INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs



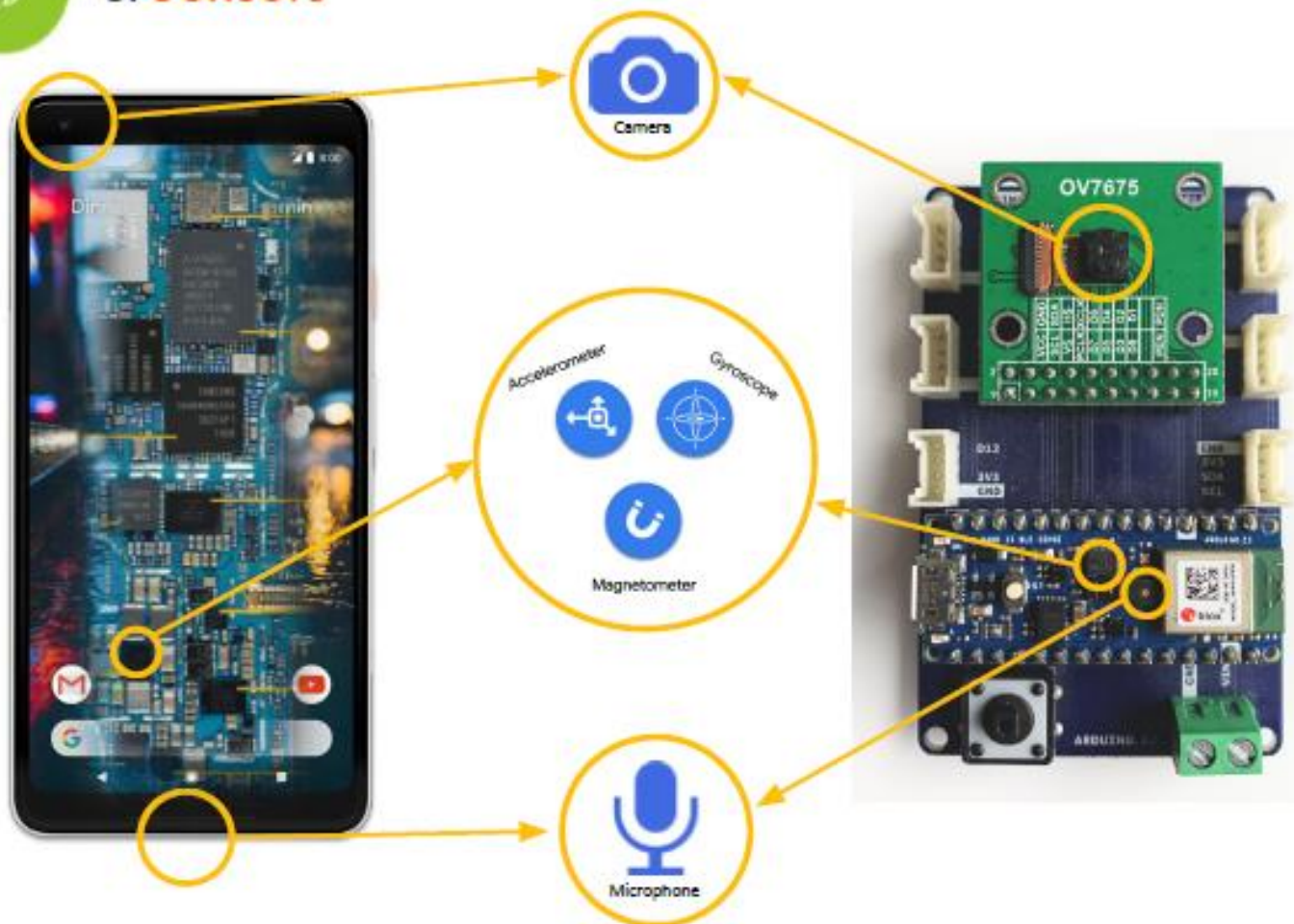
INTRODUCTION TO EDGE IMPULSE

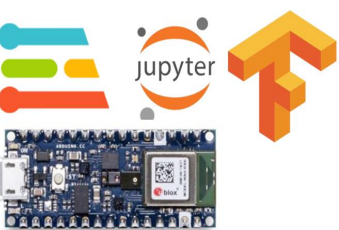
- ❖ Edge Impulse example: Cifar Cats vs Dogs

Edge
Device



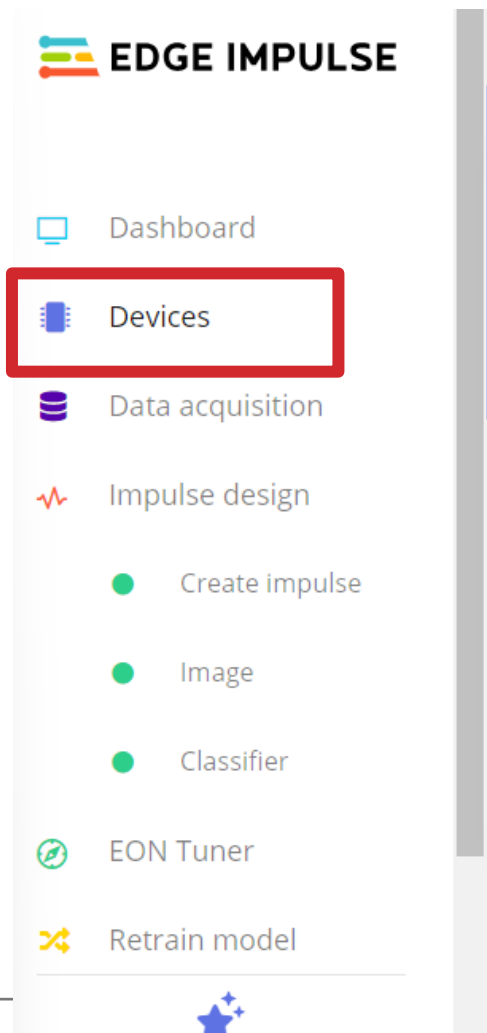
& Sensors

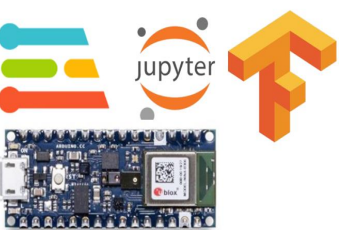




INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs





INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs

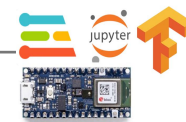
Your devices

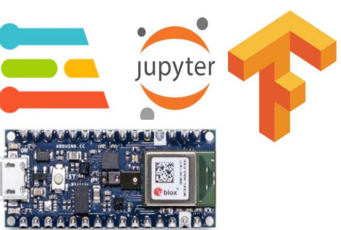
[+ Connect a new device](#)

These are devices that are connected to the [Edge Impulse remote management API](#), or have posted data to the [ingestion SDK](#).

No devices connected yet.

[🔗 Learn how to connect a new device](#)





INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs

Collect new data



Collect data directly from your phone, computer, device, or development board.



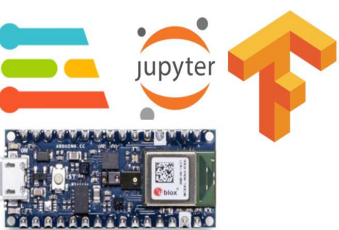
Scan QR code to connect to
your phone



Connect to your computer




Connect your device or
development board



INTRODUCTION TO EDGE IMPULSE


❖ Edge Impulse example: Cifar Cats vs Dogs


Data collection




Connected as
phone_lrg89hd0

You can collect data from this device
from the **Data acquisition** page in
the Edge Impulse studio.


 Collecting images?

 Collecting audio?

 Collecting motion?


Switch to classification mode

Collect new data

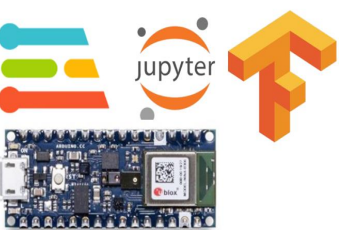


Device "phone_lrg89hd0" is now connected

Go to 'Data acquisition' to collect data from this device.


 Get started!


< Back



INTRODUCTION TO EDGE IMPULSE


❖ Edge Impulse example: Cifar Cats vs Dogs


 Data collection




Connected as
phone_lrg89hd0

You can collect data from this device from the **Data acquisition** page in the Edge Impulse studio.

 Collecting images?

 Collecting audio?


 Collecting motion?

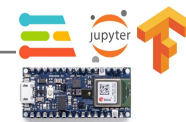
Switch to classification mode

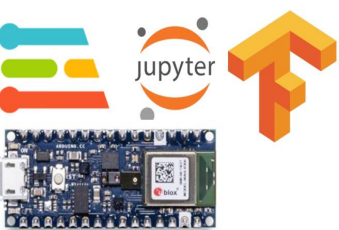
Your devices

[+ Connect a new device](#)

These are devices that are connected to the [Edge Impulse remote management API](#), or have posted data to the [ingestion SDK](#).

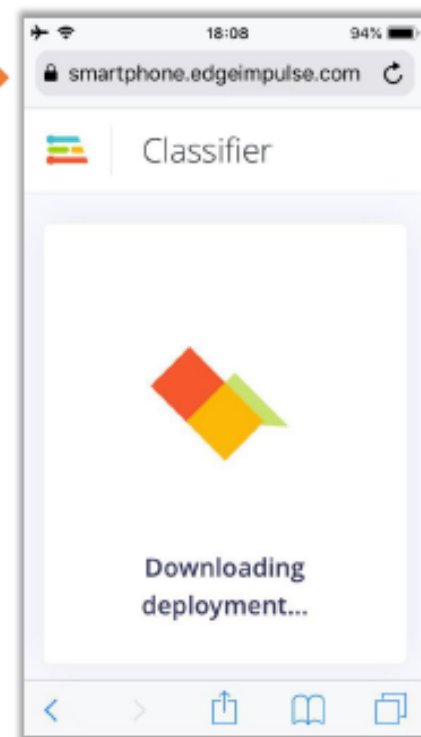
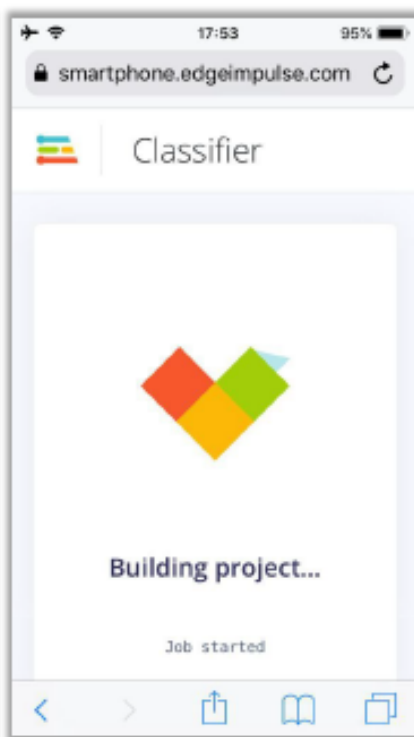
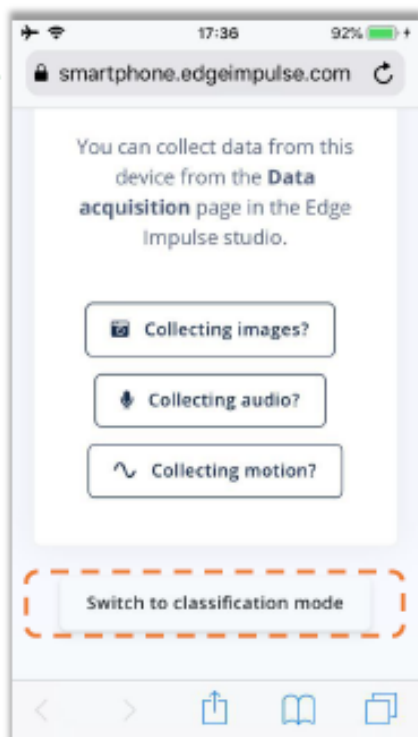
NAME	ID	TYPE	SENSORS	REMO...	LAST SEEN
 phone_lrg89hd0	phone_lrg89hd0	MOBILE_CLIENT	Accelerometer, Micropho...	●	Today, 10:47:44





INTRODUCTION TO EDGE IMPULSE

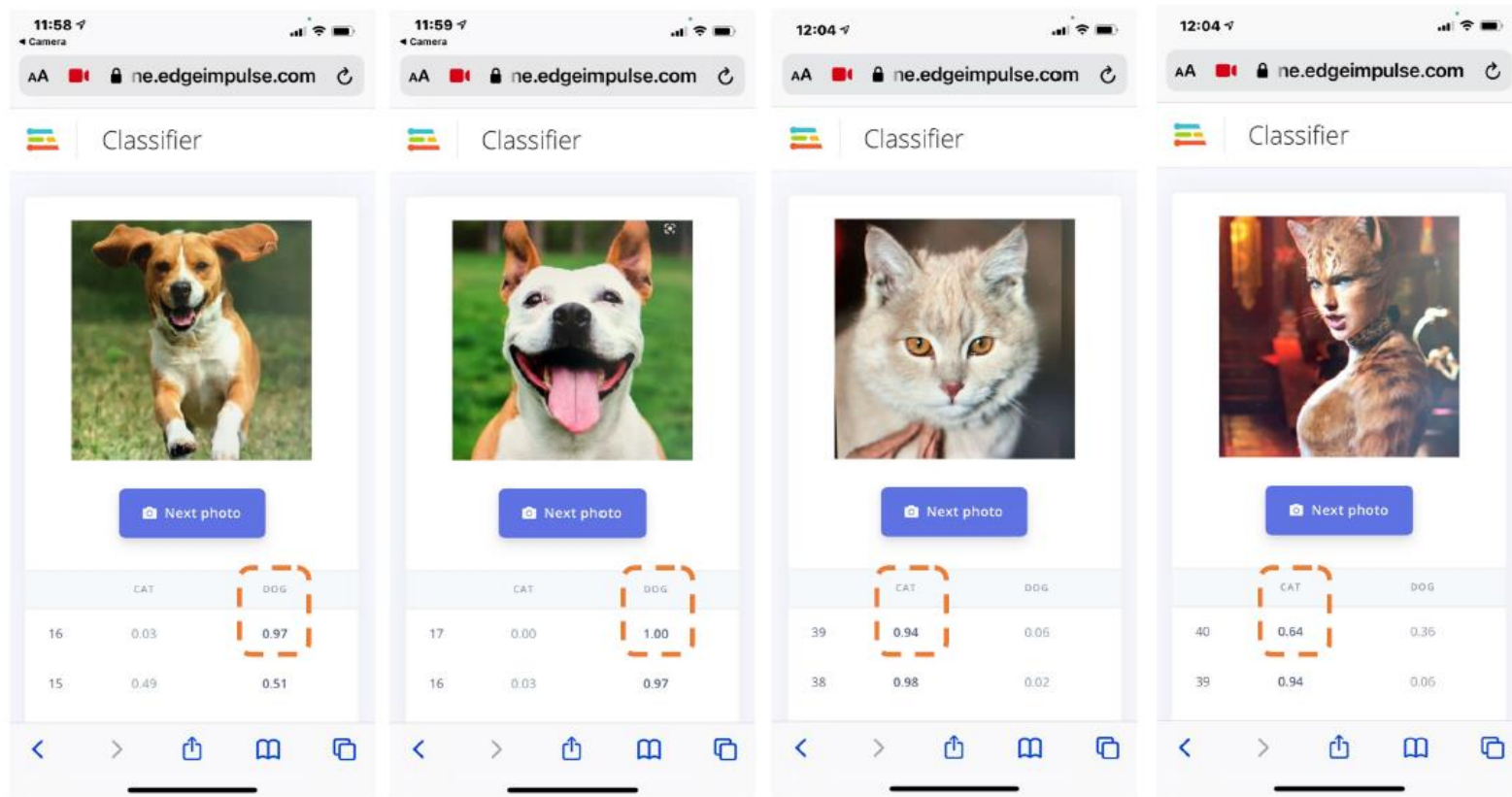
❖ Edge Impulse example: Cifar Cats vs Dogs



INTRODUCTION TO EDGE IMPULSE

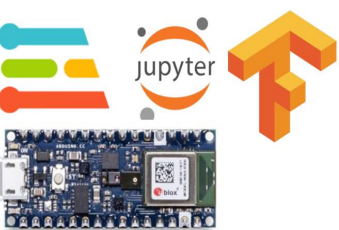
❖ Edge Impulse example: Cifar Cats vs Dogs

Make Inferences



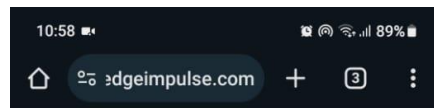
The following tables represent the classification results shown in the app screenshots:

Image	CAT	DOG
Beagle	0.03	0.97
French Bulldog	0.00	1.00
Siamese Cat	0.94	0.05
Cartoon Cat	0.64	0.36

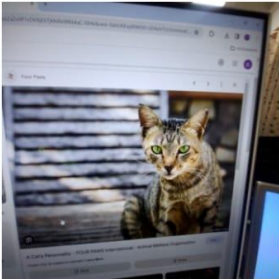


INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs



Dennis / Cifar_Dogs...



Inferencing...

Cat

Time per inference: 1 ms.

	CAT	DOG
2...	0.87	0.13
2...	0.84	0.16
2...	0.85	0.15

