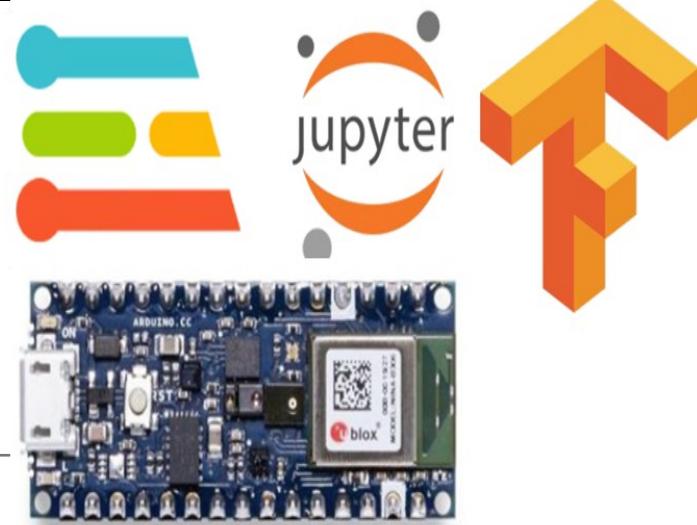
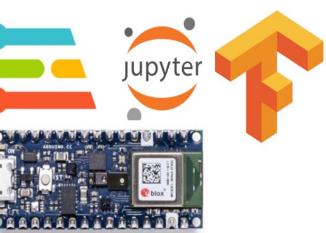


AI

INTRODUCTION TO EDGE IMPULSE

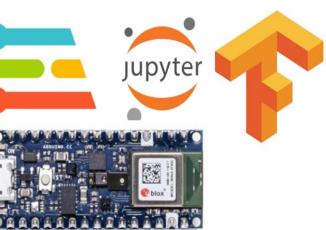
Dennis A. N. Gookyi





CONTENTS

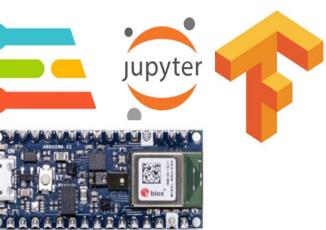
- ❖ **Introduction to Edge Impulse**



INTRODUCTION TO EDGE IMPULSE

- ❖ Machine Learning workflow

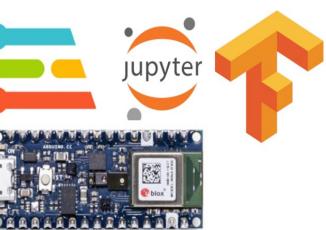




INTRODUCTION TO EDGE IMPULSE

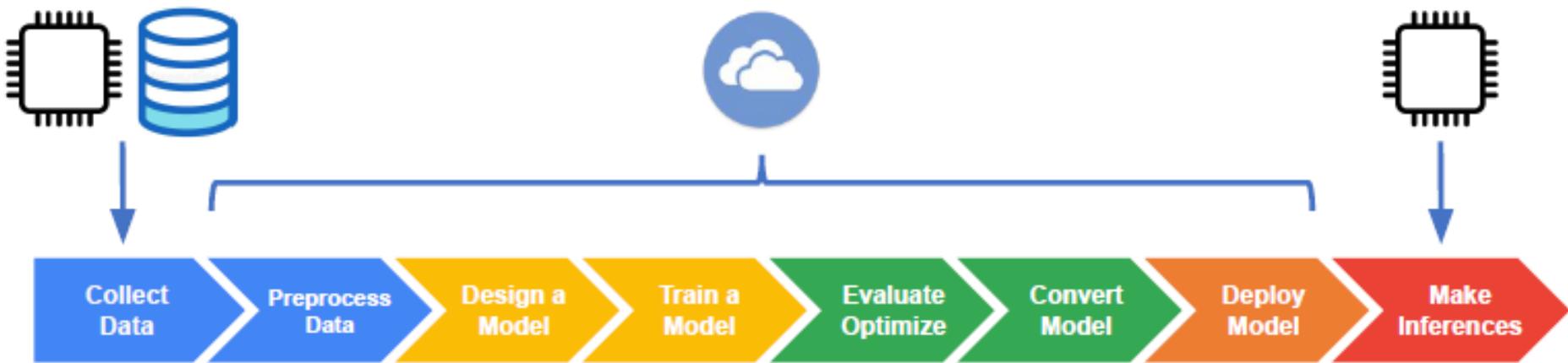
- ❖ Tiny Machine Learning workflow

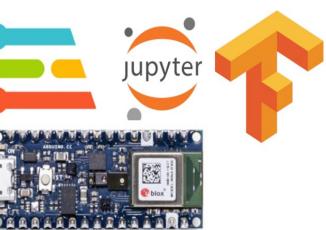




INTRODUCTION TO EDGE IMPULSE

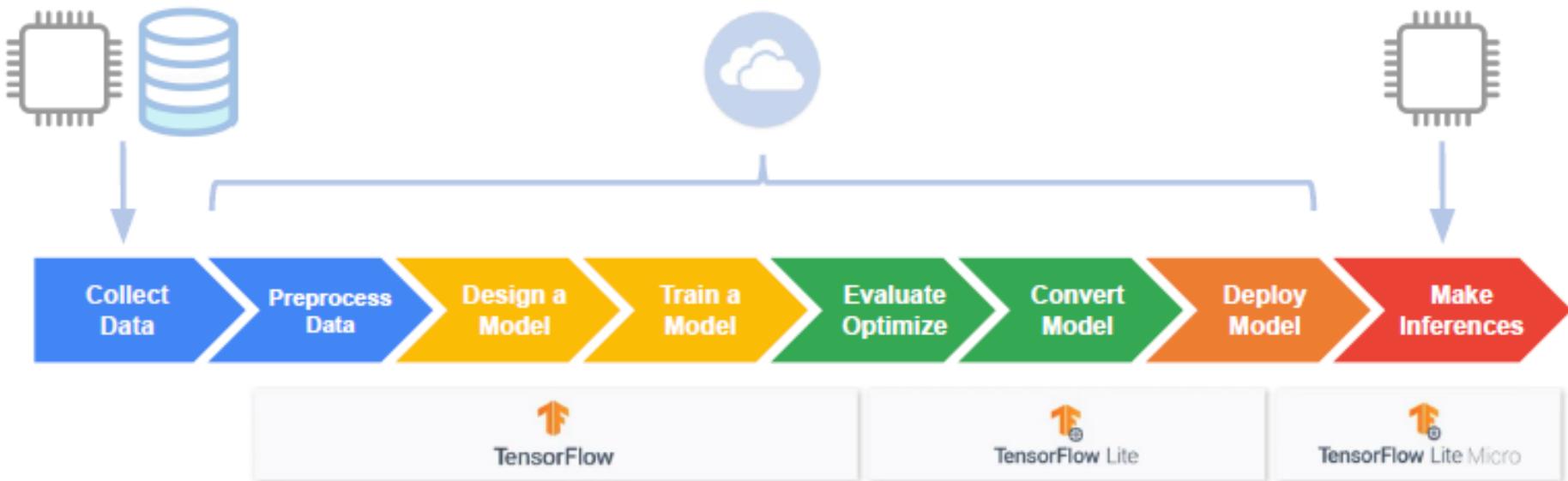
- ❖ Tiny Machine Learning workflow

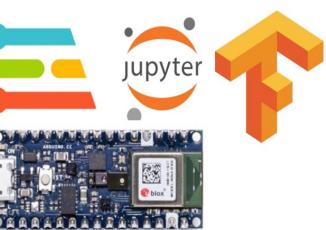




INTRODUCTION TO EDGE IMPULSE

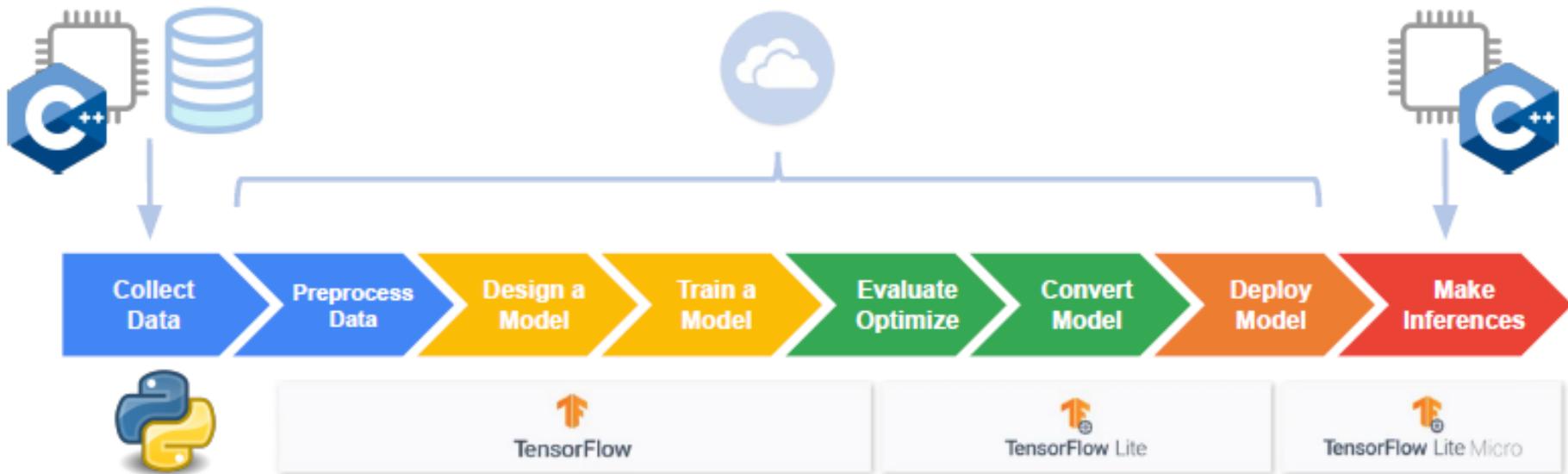
- ❖ Tiny Machine Learning workflow

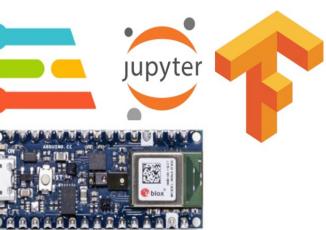




INTRODUCTION TO EDGE IMPULSE

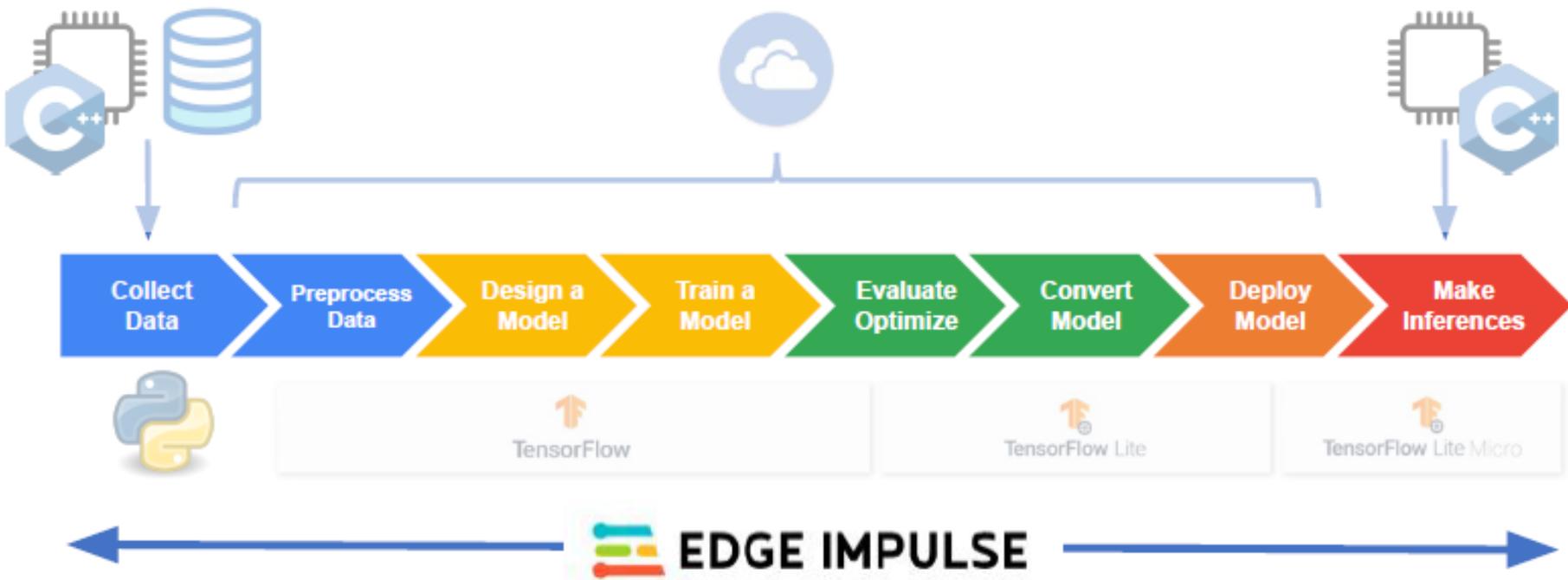
- ❖ Tiny Machine Learning workflow

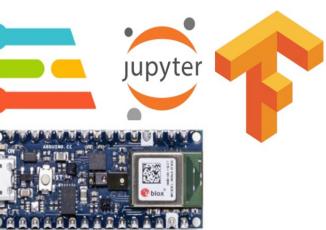




INTRODUCTION TO EDGE IMPULSE

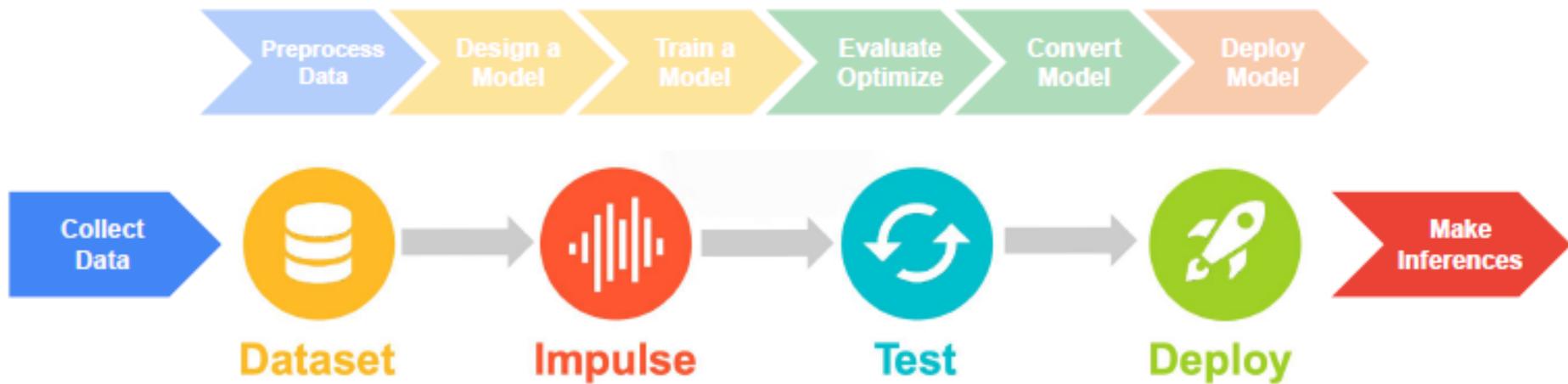
- ❖ Tiny Machine Learning workflow

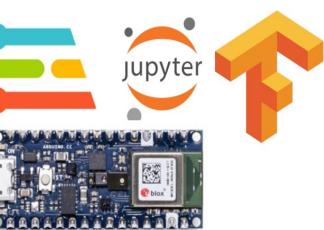




INTRODUCTION TO EDGE IMPULSE

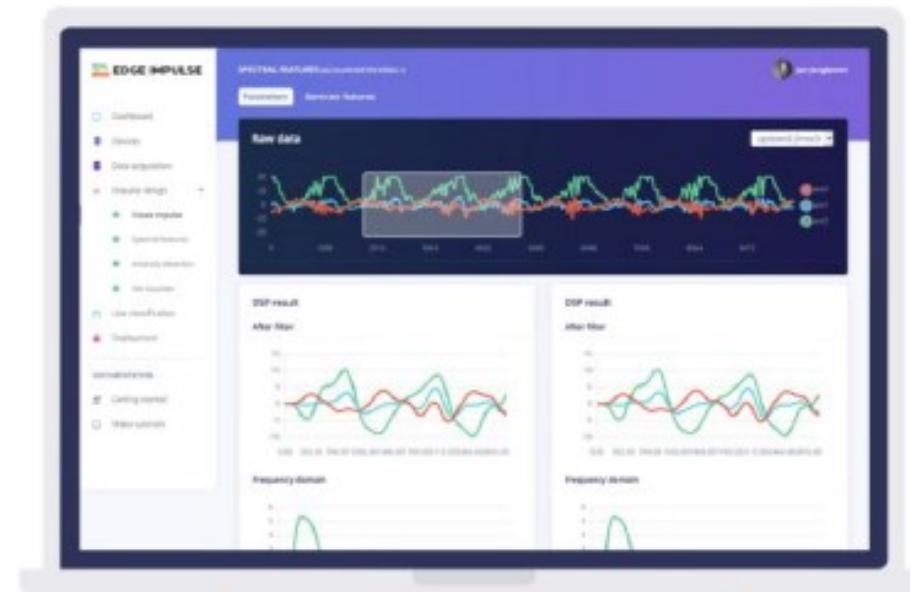
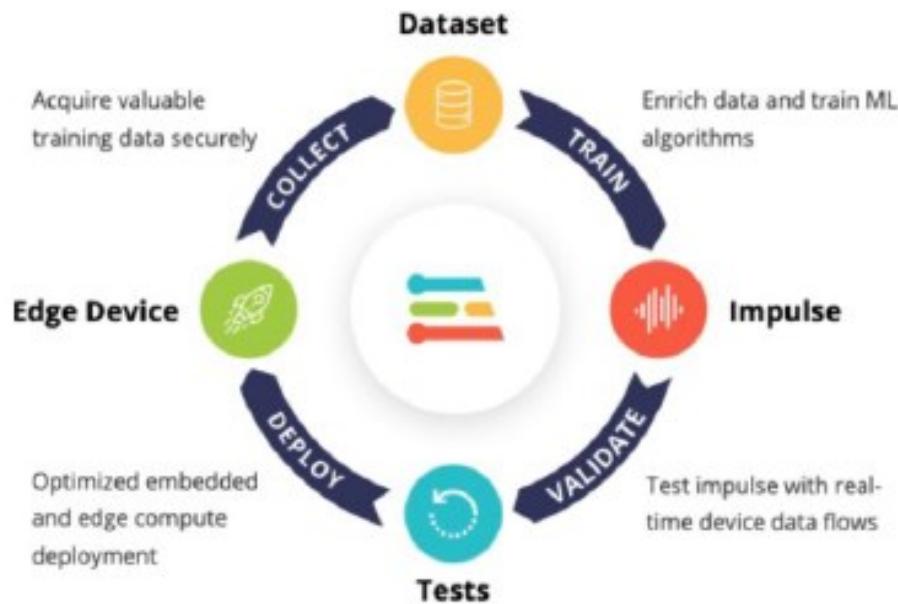
- ❖ Tiny Machine Learning workflow



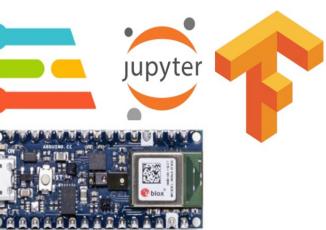


INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse



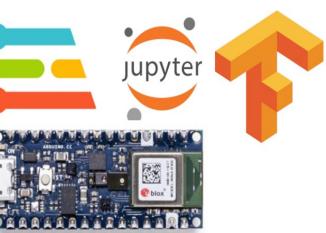
Learn more at <http://edgeimpulse.com>



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

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)

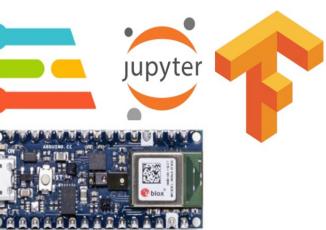
Ewura OWNER

Summary

DEVICES CONNECTED 0

Continue with the wizard

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INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse installation guide

Google

edge impulse.com

X

Microphone icon



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 ...

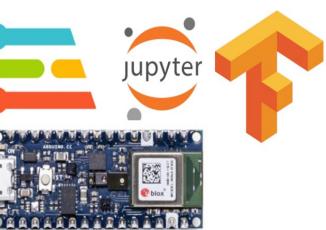
[More results from edgeimpulse.com »](#)

<https://www.edgeimpulse.com>

1. Search in web browser

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



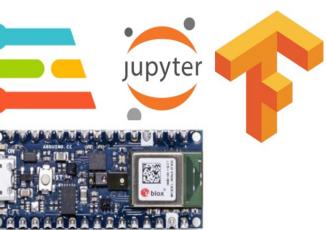


INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse installation guide

The screenshot shows the Edge Impulse sign-up page at studio.edgeimpulse.com/signup. The page has a white header with the URL and a guest user icon. The main content area has a dark blue background with white text. On the left, there's a 'Sign up' form with fields for name, username, company email, job title, and password. Below the form is a checkbox for accepting terms and conditions. At the bottom left is a 'Sign up' button and a link to log in if you already have an account. On the right, there's a large call-to-action text: 'Start building embedded machine learning models today.' At the bottom, there's a copyright notice: '© 2023 EdgImpulse Inc. All rights reserved'. Three orange callout boxes with black outlines are overlaid on the page:

3. Fill the form with your requested details
4. Tick to accept
5. Click to Sign up



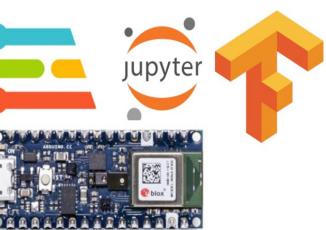
INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse installation guide

The screenshot shows a web browser window for the Edge Impulse studio. The URL in the address bar is `studio.edgeimpulse.com/studio/signup-success`. The page content includes:

- The Edge Impulse logo.
- A success message: "Sign up successful!".
- A greeting: "Thanks **Ewura!**".
- A message: "You have successfully signed up for Edge Impulse.".
- An orange button with the text "Click here to build your first ML model!".
- A link labeled "Re-send activation email".
- A blue callout box containing the text "6. Click to start a new project".
- A large white graphic element on the right side.
- The text "Start building embedded machine learning models today.".
- The copyright notice "© 2023 EdgeImpulse Inc. All rights reserved".
- The Edge Impulse logo again.

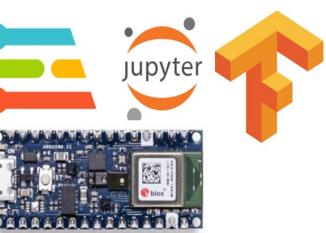
A blue arrow points from the text "6. Click to start a new project" to the "Click here to build your first ML model!" button.



INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse installation guide

The screenshot shows the Edge Impulse Studio interface. On the left is a sidebar with various project management and development tools: Dashboard, Devices, Data acquisition, Impulse design, Create impulse (selected), EON Tuner, Retrain model, Live classification, Model testing, Versioning, and Deployment. The main area displays a "Welcome" screen with a large "Welcome" text and a pie chart icon. It says, "You're only minutes away from making your devices feel, hear and see the real world using machine learning!" Below this is a blue button with the text "Let's build your first model in 5 minutes!". To the right of the button, it says "Or, continue to your project". At the bottom of the main area, it says "Start building your dataset or validate your model's on-device performance:". In the bottom right corner, it says "Your project is private." and has a "Make this project public" button. The top bar shows the URL "studio.edgeimpulse.com/studio/240311", the user "Ewura / Ara2bay-project-1", and a "Guest" status.

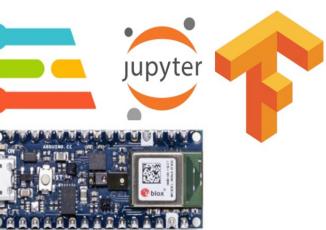


INTRODUCTION TO EDGE IMPULSE

- ❖ Edge Impulse example: Cifar Cats vs Dogs

The screenshot shows the Edge Impulse Studio interface. At the top, there's a navigation bar with a back arrow, forward arrow, refresh icon, and a search bar containing the URL `studio.edgeimpulse.com/studio/select-project`. On the right side of the nav bar are icons for user profile, search, star, and more. Below the nav bar, the main title is "Select project". A central modal window is open, titled "Create project". Inside the modal, there's a large question mark icon, a text input field containing "Cifar10 Classification (Cats vs Dogs)", and two buttons at the bottom: "Cancel" and "Create new project". A yellow arrow points from the bottom right towards the "Create new project" button. In the background, a list of existing projects is visible, such as "MjRobot (Marcelo Rovai) / sound-classification-blender-fauna", "MjRobot (Marcelo Rovai) / oil_roris_kwrs", "MjRobot (Marcelo Rovai) / Eggs AI", "MjRobot (Marcelo Rovai) / Accelerometer-Nano-Ble-IoT", and "MjRobot (Marcelo Rovai) / video_tinyml_raw". Each project entry has a small thumbnail and a circular profile picture next to it.

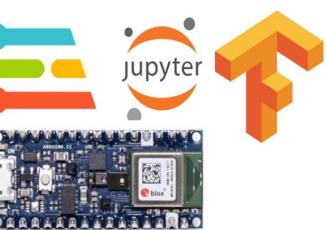




INTRODUCTION TO EDGE IMPULSE

- ❖ Edge Impulse example: Cifar Cats vs Dogs

The screenshot shows a web browser window for the Edge Impulse Studio at studio.edgeimpulse.com/studio/select-project. The main page has a header with the Edge Impulse logo and a user profile for 'MjRoBot (Marcelo Rovai)'. Below the header, a large orange section titled 'Select project' contains a list of existing projects. A modal dialog box is centered over the list, displaying a green checkmark icon and the text 'Created project' followed by 'Successfully created project: "Cifar10 Classification (Cats vs Dogs)"'. A yellow arrow points from the bottom left towards the 'OK' button of the dialog. The background list includes projects like 'MjRoBot (Marcelo Rovai) / Sounds-Recognition-Blender-Faucet', 'MjRoBot (Marcelo Rovai) / ol_revis_lws', 'MjRoBot (Marcelo Rovai) / Eggs AI', and 'MjRoBot (Marcelo Rovai) / Accelerometer-Nano-Ble-IoT'.



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

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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

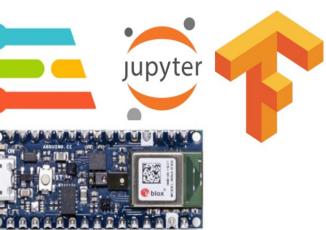
Not sure where to start? Follow a tutorial to build your first model in just minutes!

Motion: Gesture recognition

Images: Object detection

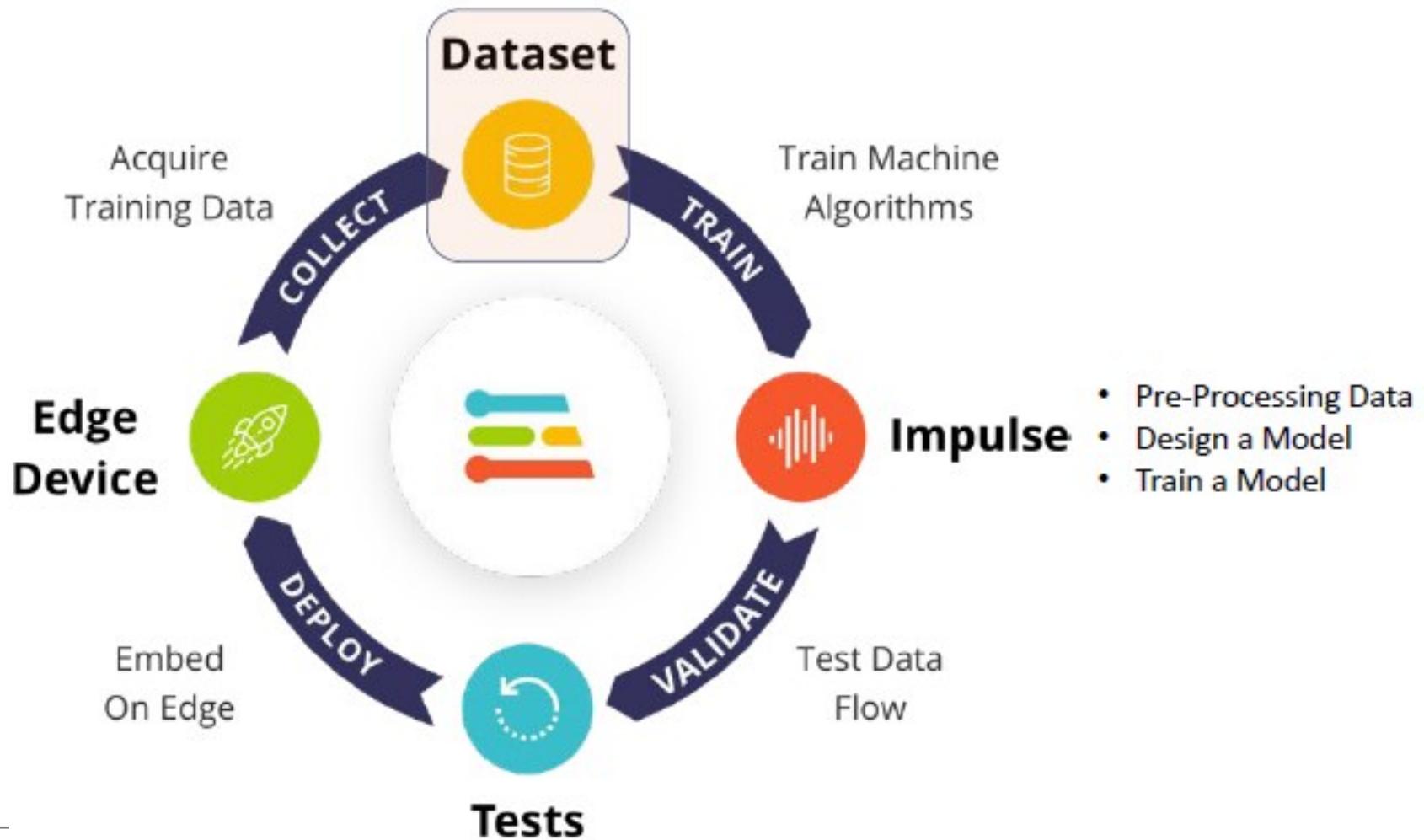
Audio: Audio classification

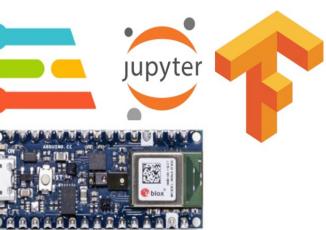




INTRODUCTION TO EDGE IMPULSE

- ❖ Edge Impulse example: Cifar Cats vs Dogs





INTRODUCTION TO EDGE IMPULSE

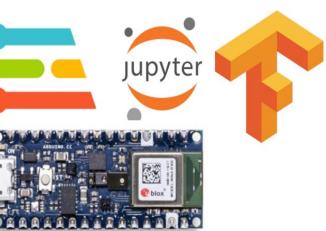
- ❖ Edge Impulse example: Cifar Cats vs Dogs
 - Download: <https://github.com/YoongiKim/CIFAR-10-images>



The screenshot shows a GitHub repository page for 'CIFAR-10-images'. At the top, there are buttons for 'Go to file', 'Add file', and 'Code'. A red box highlights the 'Code' button. Below it is a 'Clone' section with an 'HTTP(S) SSH Gitea & CLI' link. Further down are buttons for 'Open with GitHub Desktop' and 'Download ZIP'. To the right of the main content area, there are sections for 'About', 'Releases', and 'Packages', all of which are currently empty.

The screenshot shows a file explorer window displaying the contents of the 'CIFAR-10-images-master.zip' file. The left pane shows a tree view with 'train' and 'test' folders, and a list of categories: airplane, automobile, bird, cat, deer, dog, frog, horse, ship, and truck. The right pane shows a list of files under the 'train' folder, with '0006.jpg' selected. A preview of the image is shown in the bottom right corner, labeled '0006.jpg'.





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

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Getting started

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

Add existing data

Collect new data

Upload your model

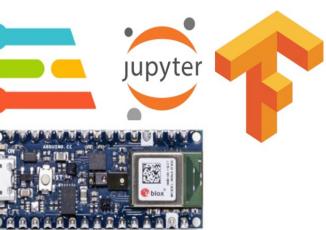
Start with a tutorial

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

The screenshot shows the Edge Impulse web interface. On the left is a sidebar with icons and text for: Dashboard, Devices, Data acquisition, Impulse design (with 'Create impulse' listed), EON Tuner, Retrain model, Live classification, and Model testing. The main area has a purple header with tabs: Dataset (which is selected and highlighted in white), Data explorer, Data sources, and CSV Wizard. The Dataset tab displays a large 'Dataset' title, a central circular icon with three vertical bars, and a 'Add data' button. Below the button is the text 'Start building your dataset by adding some data.' A red rectangular box highlights the 'Add data' button. In the top right corner of the main area, it says 'Dennis / Cifar_Dogs_vs_'. The bottom right corner features a small image of an Arduino board with a TensorFlow 'T' logo.

Dennis / Cifar_Dogs_vs_

EDGE IMPULSE

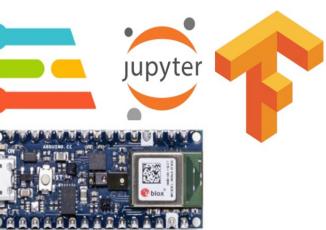
Dataset Data explorer Data sources | CSV Wizard

Dataset

Add data

Start building your dataset by adding some data.

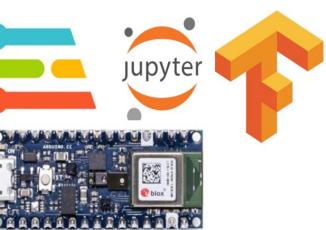
+ Add data



INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs

The screenshot shows the Edge Impulse web interface. On the left, a sidebar lists various features: Dashboard, Devices, Data acquisition, Impulse design, Create impulse, EON Tuner, Retrain model, Live classification, and Model testing. The main area is titled "Add existing data" and contains a large button labeled "Upload data" with an upward arrow icon, which is highlighted with a red box. Below this, there is another section titled "Add data" with the sub-instruction "Start building your dataset by adding some data." and a blue button labeled "+ Add data". The top right corner of the interface shows the user's name "Dennis" and the project name "Cifar Cats vs Dogs - version 1".



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 includ

Upload mode

Select individual files [?](#)
 Select a folder [?](#)

Select files

No file chosen

Upload into category

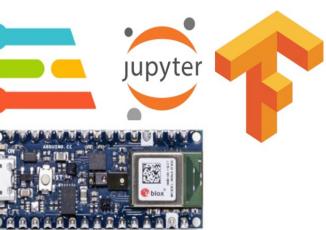
Automatically split between training and testing [?](#)
 Training
 Testing

Label

Infer from filename [?](#)
 Leave data unlabeled [?](#)
 Enter label:

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Get access to high job limits and training on GPUs





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

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

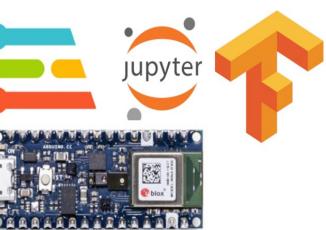
- Infer from filename [?](#)
- Leave data unlabeled [?](#)
- Enter label:

Dog

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GCTU - AI > Datasets > CIFAR-10-images-master > train			
older	Name	Date modified	Type
	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

5000 files

Upload into category

Automatically split between training and testing [?](#)

Training

Testing

Label

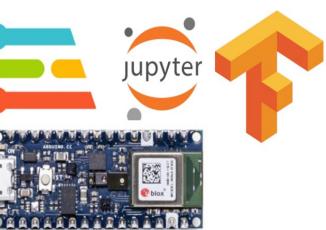
Infer from filename [?](#)

Leave data unlabeled [?](#)

Enter label:

Dog





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 ②

Select a folder ②

Select files

5000 files

Upload into category

Automatically split between training and testing ②

Training

Testing

Label

Infer from filename ②

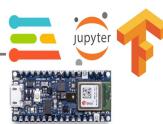
Leave data unlabeled ②

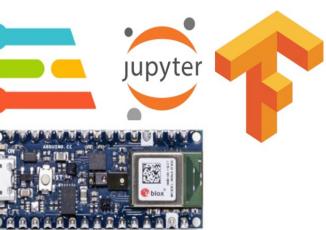
Enter label:

Dog

< Back

Upload data





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

No file chosen

Upload into category

- Automatically split between training and testing [?](#)
- Training
- Testing

Label

- Infer from filename [?](#)
- Leave data unlabeled [?](#)

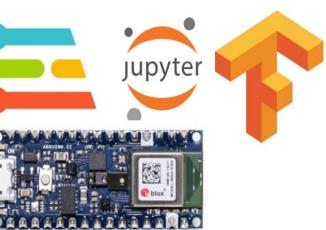
Upload output

```
[ 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



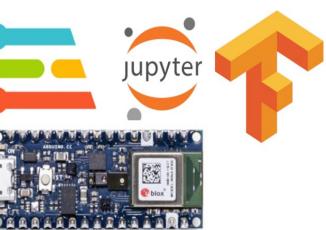


INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs

The screenshot shows the Edge Impulse web interface. On the left is a sidebar with various icons and links: Dashboard, Devices, Data acquisition, Impulse design, Create impulse, EON Tuner, Retrain model, Live classification, Model testing, and a 'Try Enterprise Free' section. The main area has a header 'Dennis / Cifar_Dogs_vs_Cats PERSONAL'. Below the header are tabs for Dataset, Data explorer, Data sources, and CSV Wizard. A red box highlights the 'Dataset' tab, which displays 'DATA COLLECTED 12,000 items' and 'TRAIN / TEST SPLIT 83% / 17%' with a pie chart icon. The 'Dataset' table lists four samples: 4998, 4999, 4996, and 4997, all labeled 'Cat'. To the right is a 'Collect data' panel with a 'Connect a device' button and a preview section showing 'RAW DATA 4998' and a blurred image of a cat.

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	-

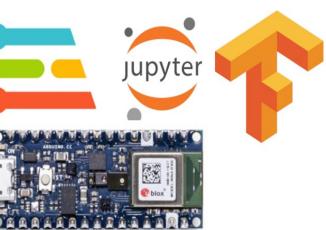


INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs

The screenshot shows the Edge Impulse web interface. On the left, a sidebar menu includes: Dashboard, Devices, Data acquisition, **Impulse design** (which is selected and highlighted with a red border), Create impulse, EON Tuner, Retrain model, Live classification, Model testing, and Try Enterprise Free. The main area displays a dataset for 'Cifar_Dogs_vs_Cats'. Key statistics shown are 12,000 items collected, with a train/test split of 83% / 17%. The dataset table lists four samples (4998, 4999, 4996, 4997) all labeled as 'Cat'. A 'Collect data' section prompts to connect a device. A preview window shows raw data ID 4998 and a blurred image of a cat.

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 shows the 'Image data' configuration section of the Edge Impulse interface. It includes fields for 'Image width' (32) and 'Image height' (32), a 'Resize mode' dropdown set to 'Fit shortest', and a note about optimal accuracy for transfer learning blocks. To the right, there are dashed boxes for adding processing and learning blocks, and a green 'Output features' section with a checkmark and a 'Save Impulse' button.

Image data

Input axes
image

Image width 32 **Image height** 32

Resize mode
Fit shortest →

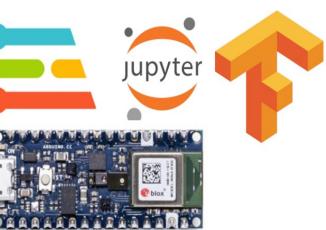
For optimal accuracy with transfer learning blocks, use a 96x96 or 160x160 image size.

Add a processing block

Add a learning block

Output features ✓

Save Impulse



INTRODUCTION TO EDGE IMPULSE

- ❖ Edge Impulse example: Cifar Cats vs Dogs

The screenshot shows the Edge Impulse builder interface. On the left, a sidebar titled "Image data" contains settings for "Input axes" (image), "Image width" (32), "Image height" (32), and "Resize mode" (Fit shortest). A note at the bottom of this sidebar suggests using 96x96 or 160x160 image size for optimal accuracy with transfer learning blocks. The main workspace is divided into two sections: "Add a processing block" (highlighted with a red box) and "Add a learning block". Both sections have a circular icon with a lightning bolt or flask symbol. To the right is a green "Output features" section with a checkmark icon. At the bottom right is a green "Save Impulse" button.

Image data

Add a processing block

Add a learning block

Output features

Save Impulse

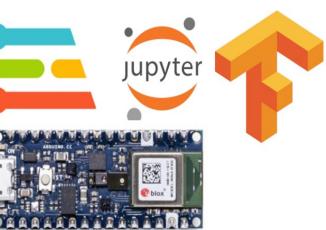
Input axes
image

Image width
32

Image height
32

Resize mode
Fit shortest

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



INTRODUCTION TO EDGE IMPULSE

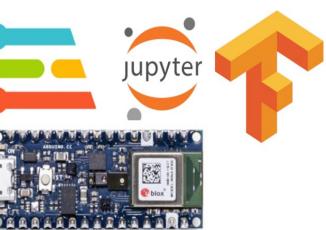
❖ Edge Impulse example: Cifar Cats vs Dogs

The screenshot shows the Edge Impulse processing block catalog. A modal dialog box is open at the top, titled "Add a processing block" with a lightning bolt icon. Below it, a message says "Did you know? You can bring your own DSP code." The main catalog area has three columns: DESCRIPTION, AUTHOR, and RECOMMENDED. The first item in the list is highlighted with a red border:

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

At the bottom of the catalog, there is a message: "Some processing blocks have been hidden based on the data in your project. Show all blocks anyway".

At the very bottom of the screen, there is a navigation bar with icons for "Add custom block" and "Cancel".

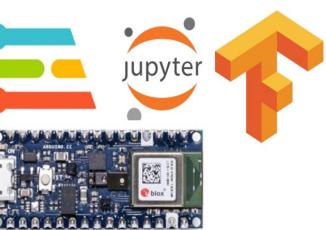


INTRODUCTION TO EDGE IMPULSE

- ❖ Edge Impulse example: Cifar Cats vs Dogs

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

- Image data** (orange card):
 - Input axes**: image
 - Image width**: 32
 - Image height**: 32
 - Resize mode**: Fit shortest
 - A note: **i** For optimal accuracy with transfer learning blocks, use a 96x96 or 160x160 image size.
- Image** (white card):
 - Name**: Image
 - Input axes (1)**: image
- Add a learning block** (red-bordered box): A dashed box indicating where to add a learning block, containing a flask icon.
- Output features** (green card):
 - Save Impulse** button



INTRODUCTION TO EDGE IMPULSE

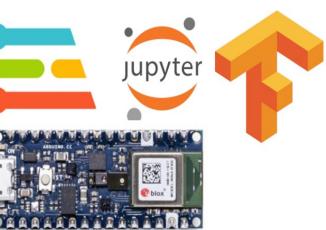
❖ Edge Impulse example: Cifar Cats vs Dogs

⚠ 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 ★	Add
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 ★	Add
Classification Learns patterns from data, and can apply these to new data. Great for categorizing movement or recognizing audio.	Edge Impulse	Add
Regression Learns patterns from data, and can apply these to new data. Great for predicting numeric continuous values.	Edge Impulse	Add
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	Add



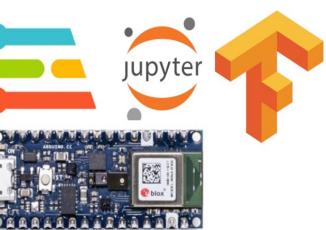


INTRODUCTION TO EDGE IMPULSE

- ❖ Edge Impulse example: Cifar Cats vs Dogs

The screenshot shows the Edge Impulse builder interface with four stages:

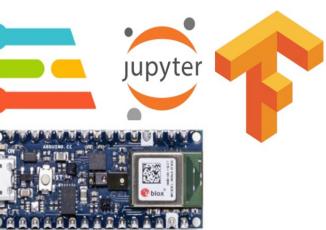
- Image data:** Set to "image".
 - Input axes:** "image".
 - Image width:** 32.
 - Image height:** 32.
 - Resize mode:** "Fit shortest".
 - Note:** "For optimal accuracy with transfer learning blocks, use a 96x96 or 160x160 image size."
- Image:** Set to "Image".
 - Name:** Image.
 - Input axes (1):** "image" (checked).
- Classification:** Set to "Classifier".
 - Name:** Classifier.
 - Input features:** "Image" (checked).
 - Output features:** 2 (Cat, Dog).
- Output features:** 2 (Cat, Dog).
 - Save Impulse** button (highlighted with a red border).



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❖ Edge Impulse example: Cifar Cats vs Dogs

The screenshot shows the Edge Impulse web interface. On the left, a sidebar menu includes options like Dashboard, Devices, Data acquisition, Impulse design, Create impulse (which is selected and highlighted with a red box), Image (also highlighted with a red box), Classifier, EON Tuner, Retrain model, and Try Enterprise Free. Below the sidebar is a 'Start free trial' button. The main workspace is titled 'Raw data' and shows a small image of a dark, textured object. To the right of the image are sections for 'Raw features' (listing hex values like 0x292826, 0x292826, 0x282725, etc.), 'Parameters' (with 'Color depth' set to 'RGB'), and 'DSP result' (showing an 'Image' thumbnail). At the bottom right are performance metrics: 'PROCESSING TIME 7 ms.', 'PEAK RAM USAGE 4 KB', and a question mark icon. A 'Save parameters' button is located at the bottom of the 'Parameters' section.



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

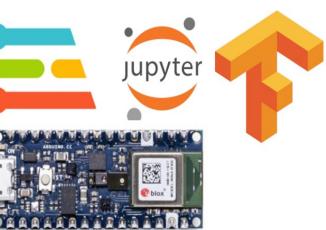
Data in training set 10,000 items

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)

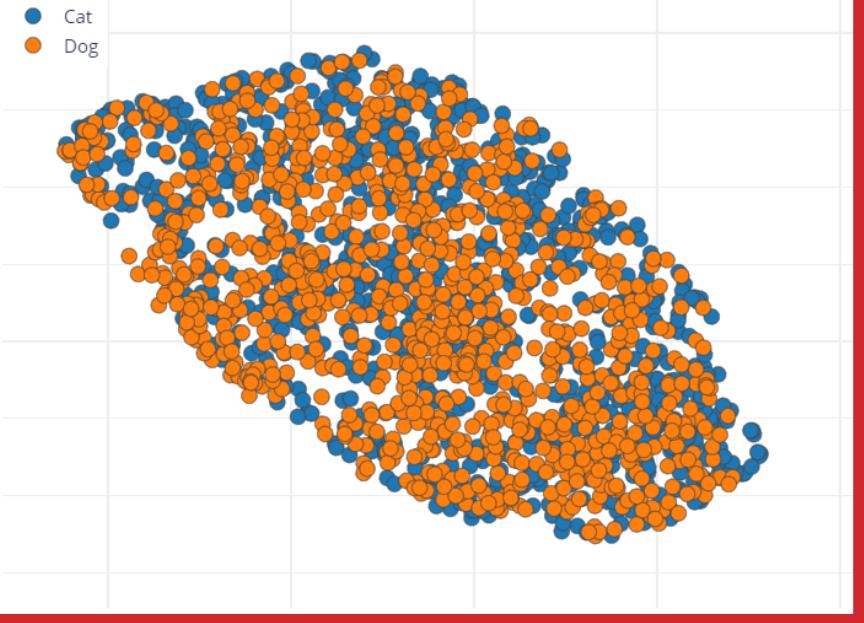
Generate features

Feature generation output

```
[ 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...
```

(0)

Feature explorer ⓘ

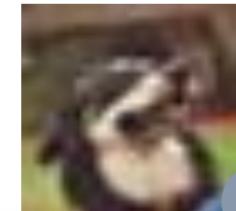


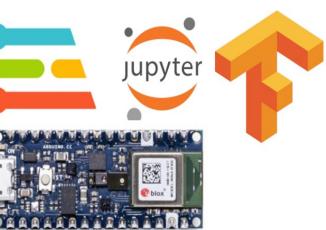
2990

Label: Dog

[View sample](#)

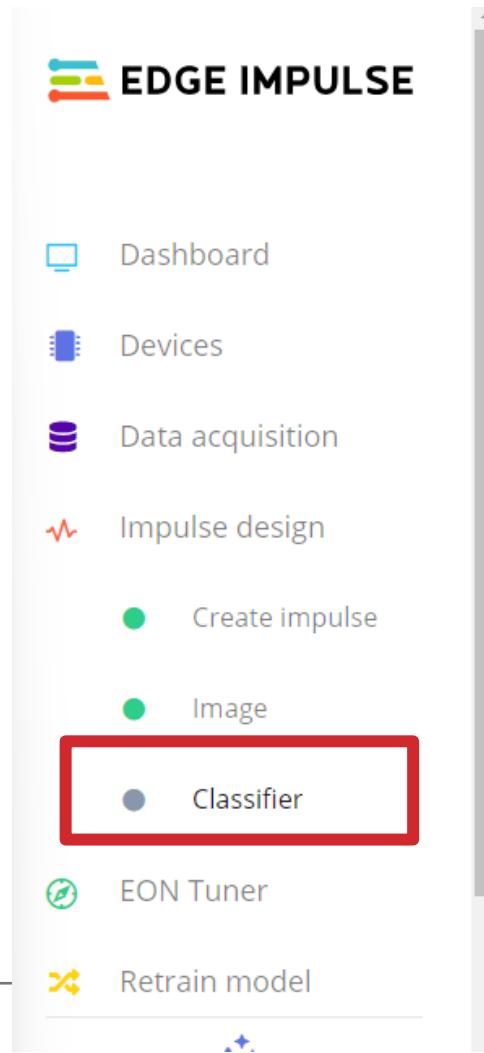
[View features](#)

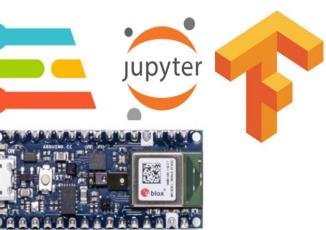




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- ❖ Edge Impulse example: Cifar Cats vs Dogs





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- ❖ Edge Impulse example: Cifar Cats vs Dogs

#1 ▾ Click to set a description for this version

Neural Network settings

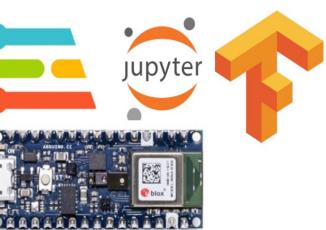
Training settings

Number of training cycles ⓘ 10

Learning rate ⓘ 0.0005

Advanced training settings





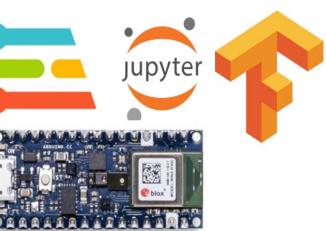
INTRODUCTION TO EDGE IMPULSE

- ❖ Edge Impulse example: Cifar Cats vs Dogs

Neural network architecture



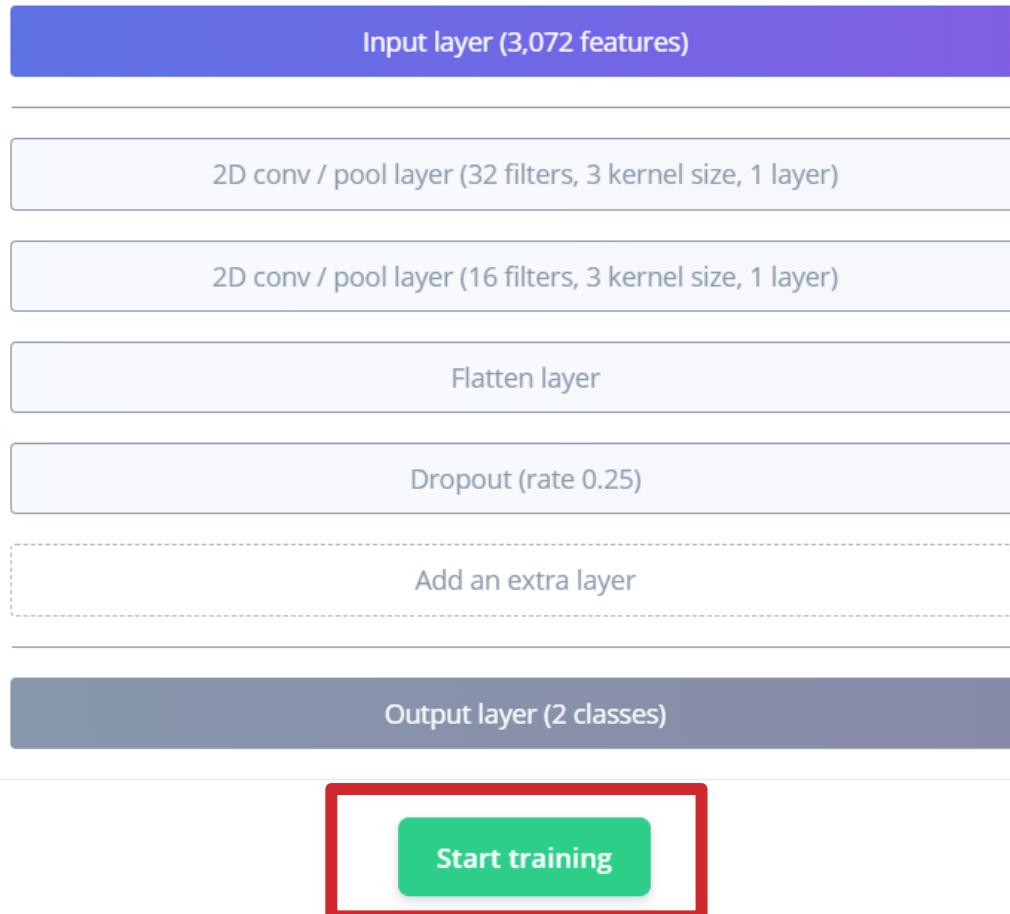
Start training

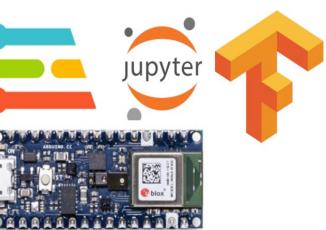


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- ❖ Edge Impulse example: Cifar Cats vs Dogs

Neural network architecture





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❖ 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)



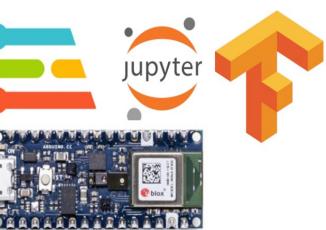
ACCURACY
70.4%



LOSS
0.57

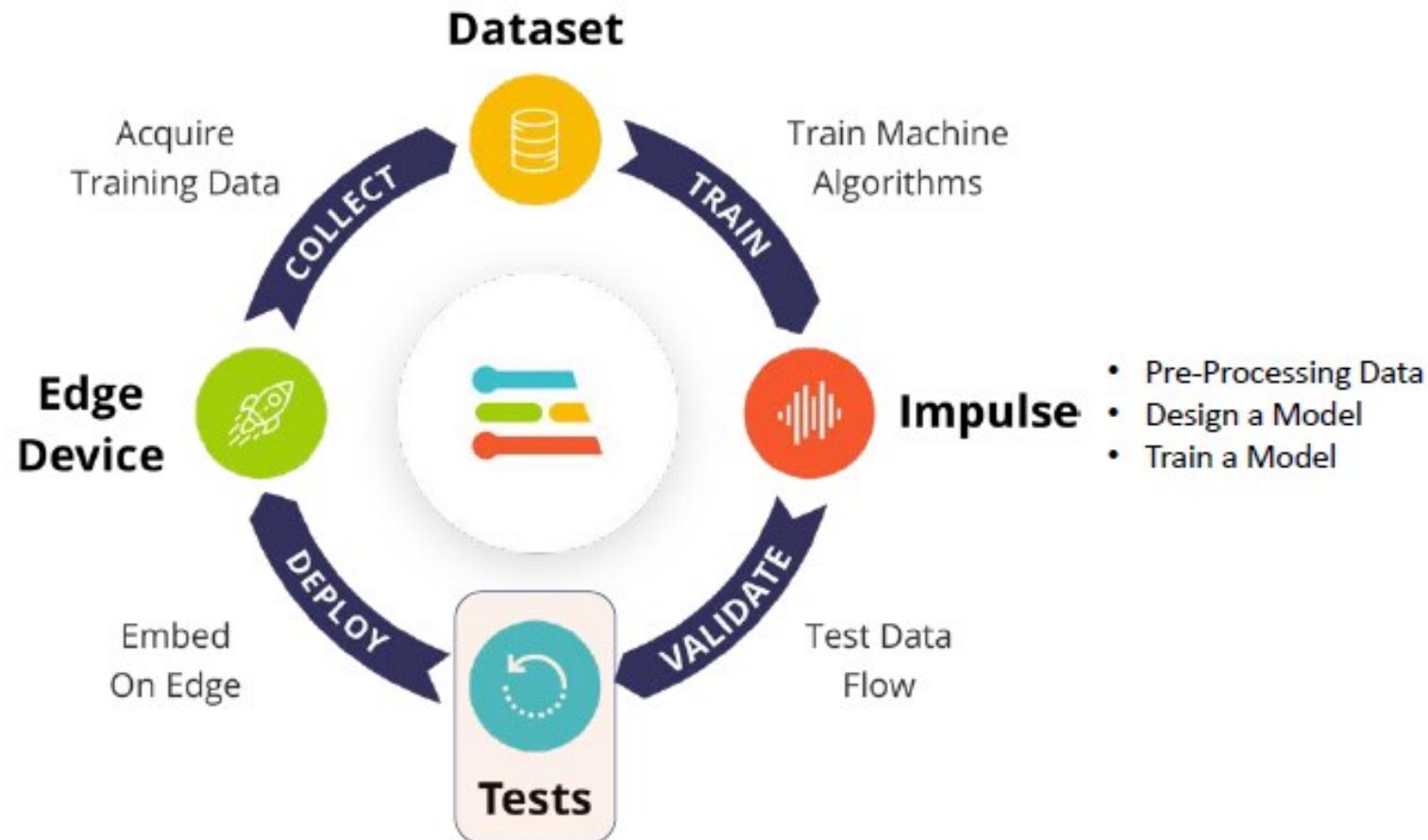
Confusion matrix (validation set)

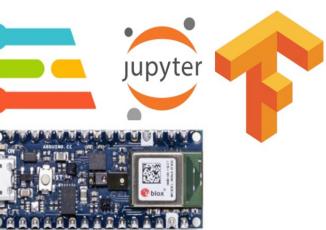
	CAT	DOG
CAT	79.0%	21.0%
DOG	37.8%	62.2%
F1 SCORE	0.72	0.68



INTRODUCTION TO EDGE IMPULSE

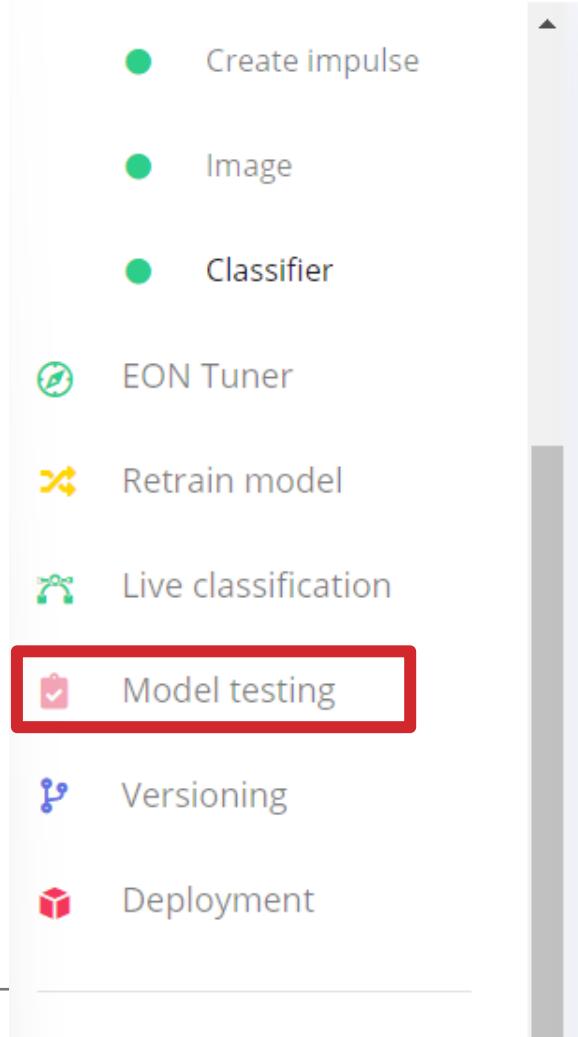
- ❖ Edge Impulse example: Cifar Cats vs Dogs

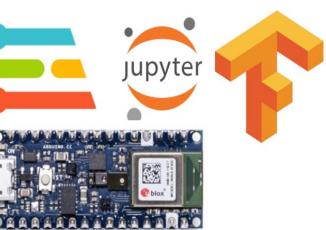




INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs





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❖ Edge Impulse example: Cifar Cats vs Dogs

Test data

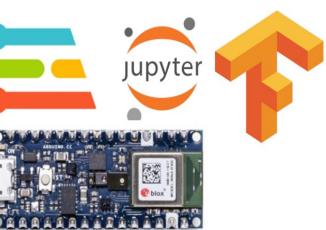
Classify all

Model testing output

(0)

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	-		...



INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs

Test data

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

SAMPLE ID	SAMPLE NAME	EXPECTED OUT	LENG	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

```
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

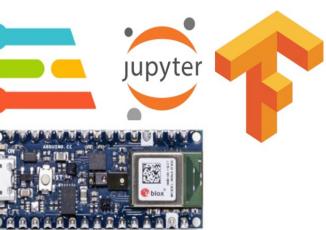
Job completed
```

Model testing results

ACCURACY
55.10%

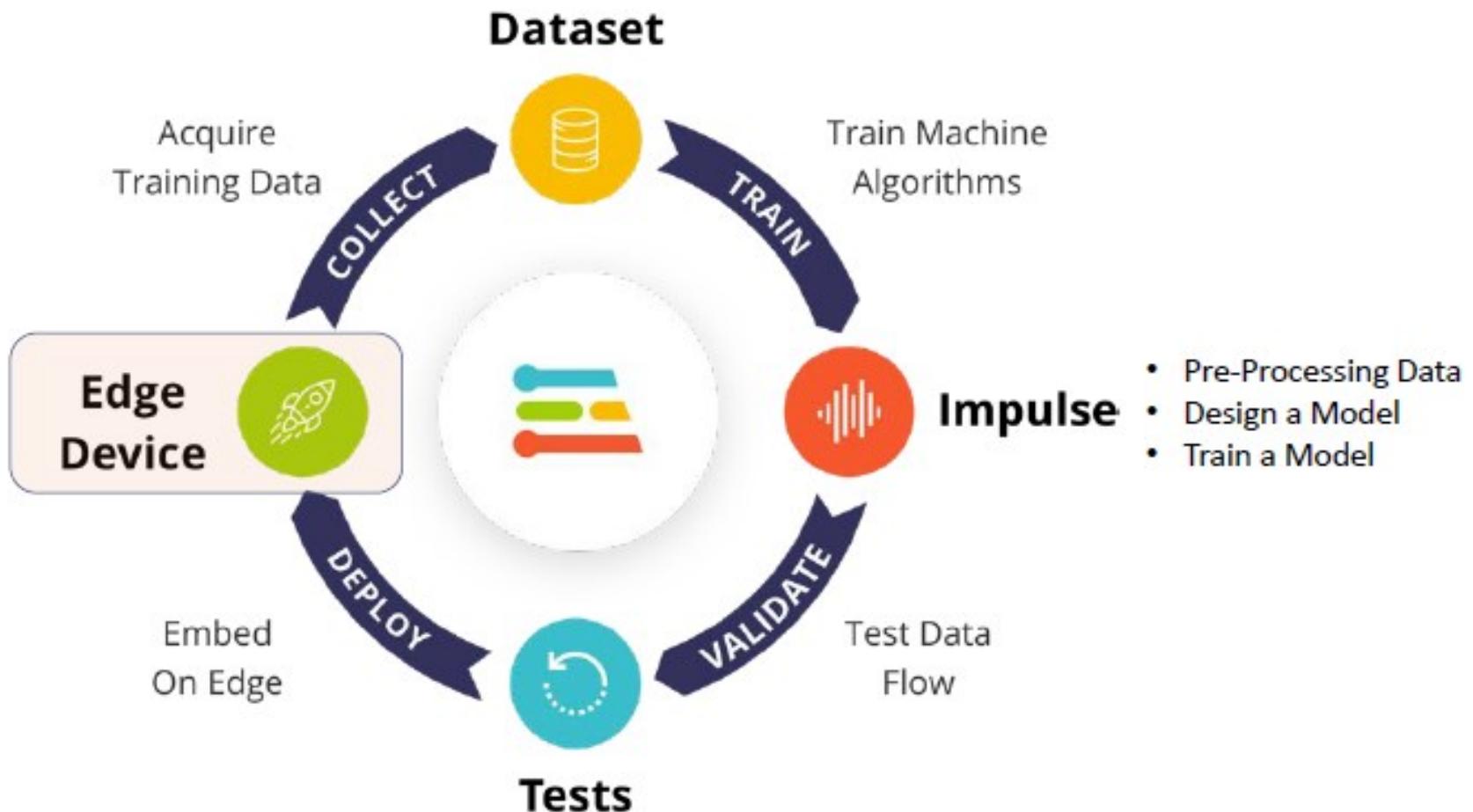
	CAT	DOG	UNCERTAIN
CAT	60.8%	10.5%	28.7%
DOG	21.6%	49.4%	29%
F1 SCORE	0.67	0.62	





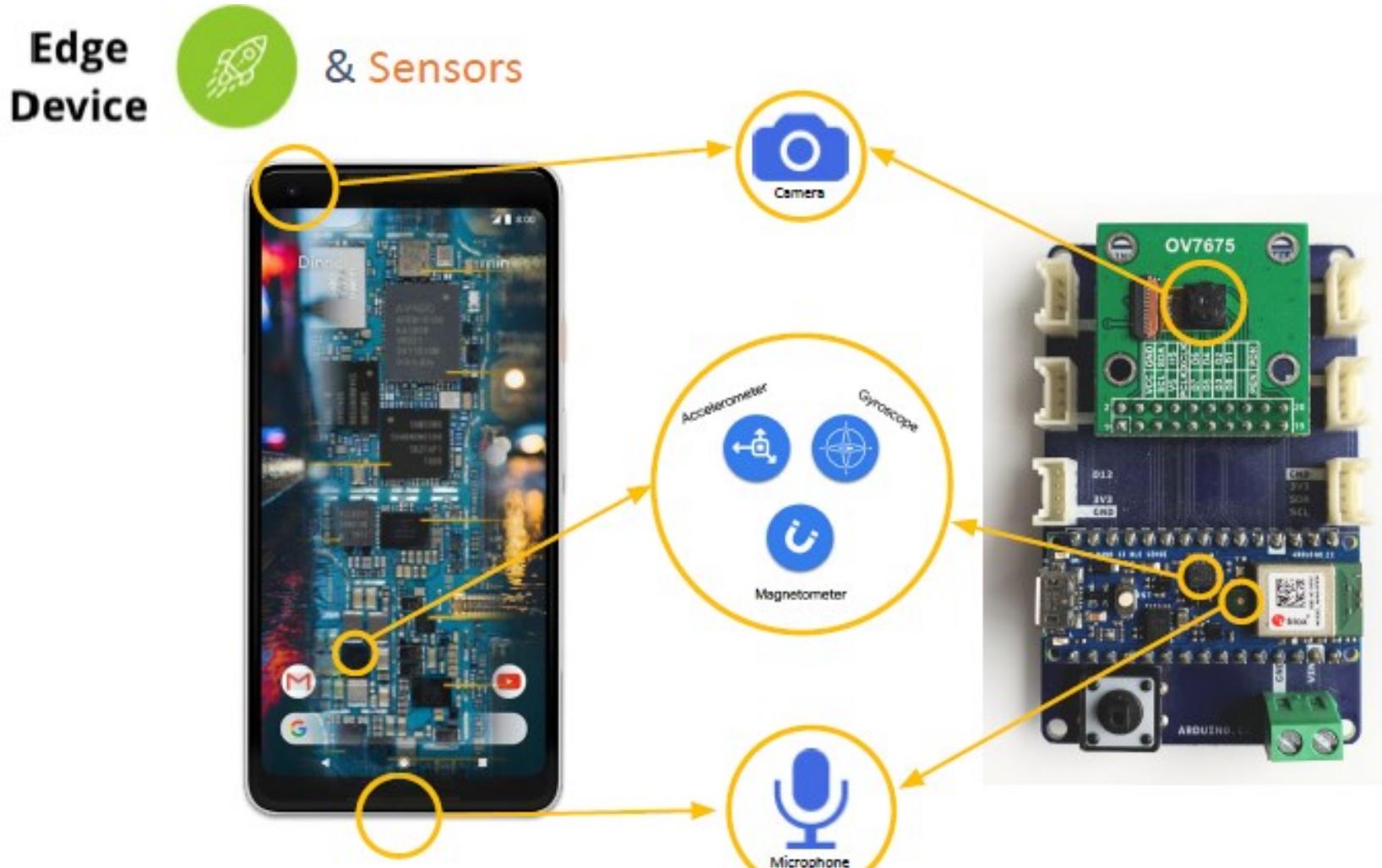
INTRODUCTION TO EDGE IMPULSE

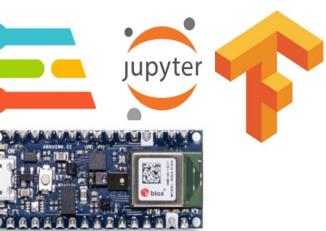
- ❖ Edge Impulse example: Cifar Cats vs Dogs



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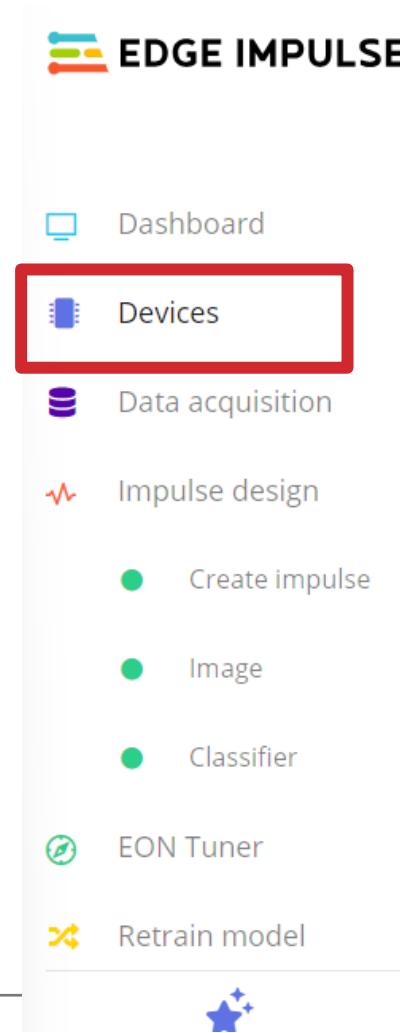
- ❖ Edge Impulse example: Cifar Cats vs Dogs

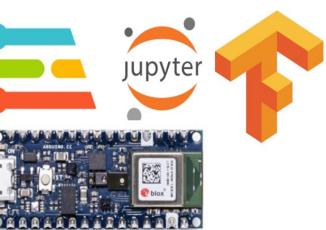




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- ❖ Edge Impulse example: Cifar Cats vs Dogs





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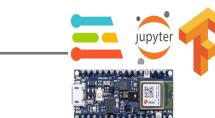
- ❖ Edge Impulse example: Cifar Cats vs Dogs

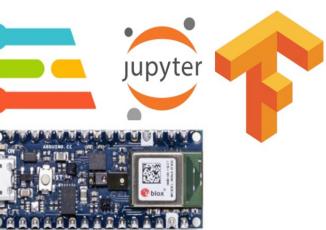
Your devices

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

X

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



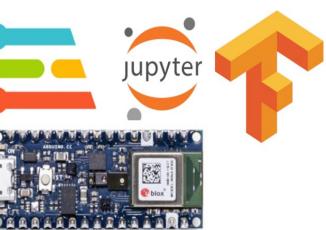
Scan QR code to connect to
your phone



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

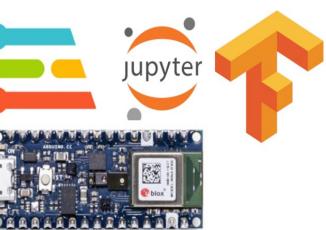
Collect new data

Device "phone_lrg89hd0" is now connected

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

Get started!

The screenshot shows the Edge Impulse Data collection interface. On the left, there's a sidebar with a 'Data collection' tab selected, showing a large green circle with a white checkmark. Below it, it says 'Connected as phone_lrg89hd0'. A note says you can collect data from this device from the 'Data acquisition' page. There are three buttons for 'Collecting images?', 'Collecting audio?', and 'Collecting motion?'. At the bottom is a 'Switch to classification mode' button. On the right, a main panel titled 'Collect new data' shows a large green circle with a white checkmark. It says 'Device "phone_lrg89hd0" is now connected' and 'Go to 'Data acquisition' to collect data from this device.' A blue 'Get started!' button is highlighted with a red rectangle. At the bottom left of this panel is a 'Back' button.



INTRODUCTION TO EDGE IMPULSE

❖ Edge Impulse example: Cifar Cats vs Dogs

Data collection

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

Connected as
phone_lrg89hd0

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

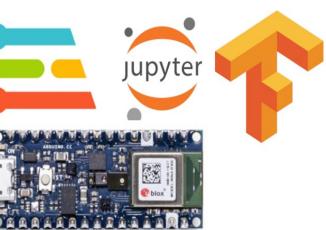
Collecting images?

Collecting audio?

Collecting motion?

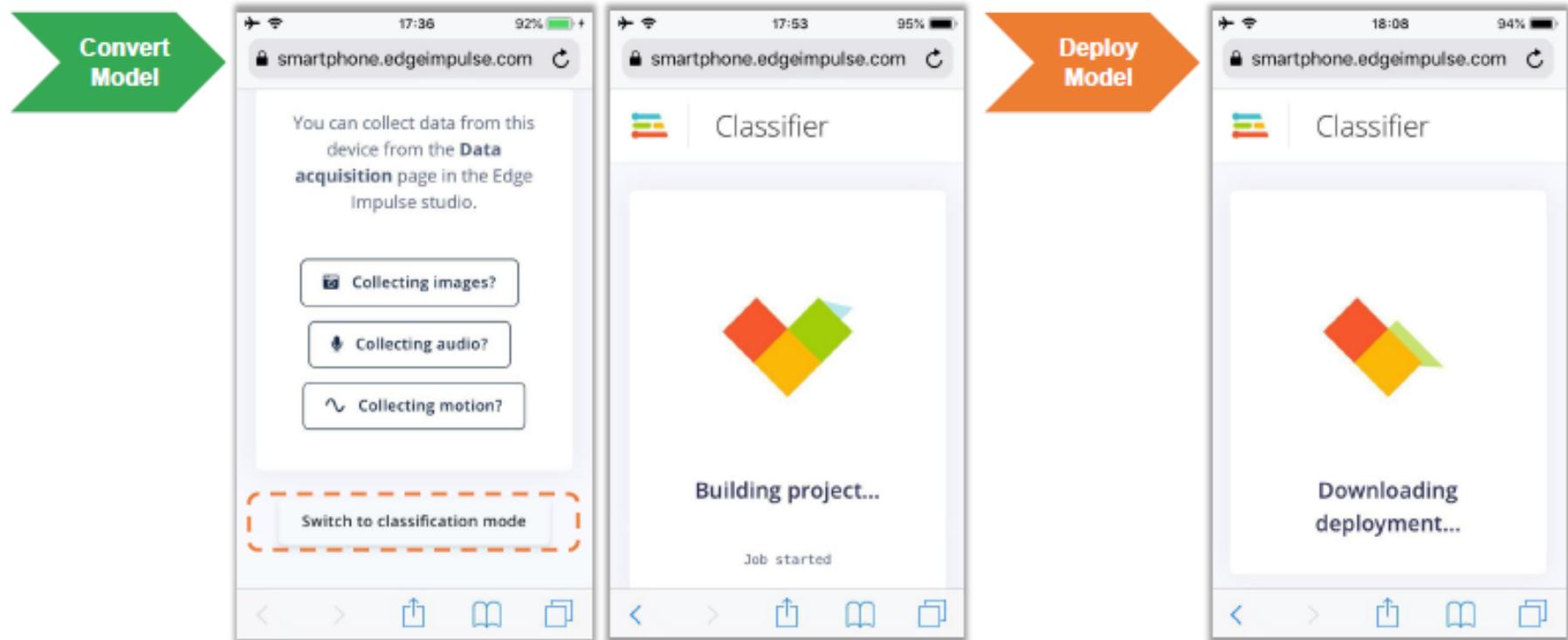
Switch to classification mode

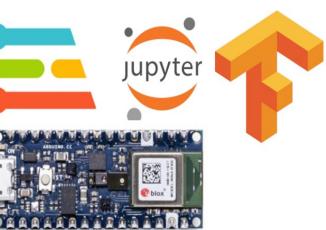




INTRODUCTION TO EDGE IMPULSE

- ❖ Edge Impulse example: Cifar Cats vs Dogs





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- ❖ Edge Impulse example: Cifar Cats vs Dogs

Make
Inferences

The figure consists of four screenshots of a mobile application interface titled "Classifier". Each screenshot shows a different image and its classification results.

- Screenshot 1:** A Beagle dog running. The classification table shows:

	CAT	DOG
16	0.03	0.97
15	0.49	0.51

A red dashed box highlights the "DOG" row with a confidence of 0.97.
- Screenshot 2:** A white and tan dog. The classification table shows:

	CAT	DOG
17	0.00	1.00
16	0.03	0.97

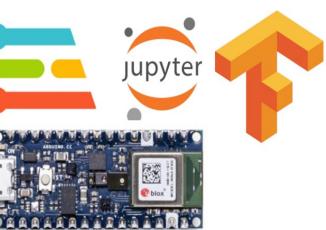
A red dashed box highlights the "DOG" row with a confidence of 1.00.
- Screenshot 3:** A fluffy white cat. The classification table shows:

	CAT	DOG
39	0.94	0.06
38	0.98	0.02

A red dashed box highlights the "CAT" row with a confidence of 0.94.
- Screenshot 4:** A cat with a human face. The classification table shows:

	CAT	DOG
40	0.64	0.36
39	0.94	0.06

A red dashed box highlights the "CAT" row with a confidence of 0.64.



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- ❖ Edge Impulse example: Cifar Cats vs Dogs

