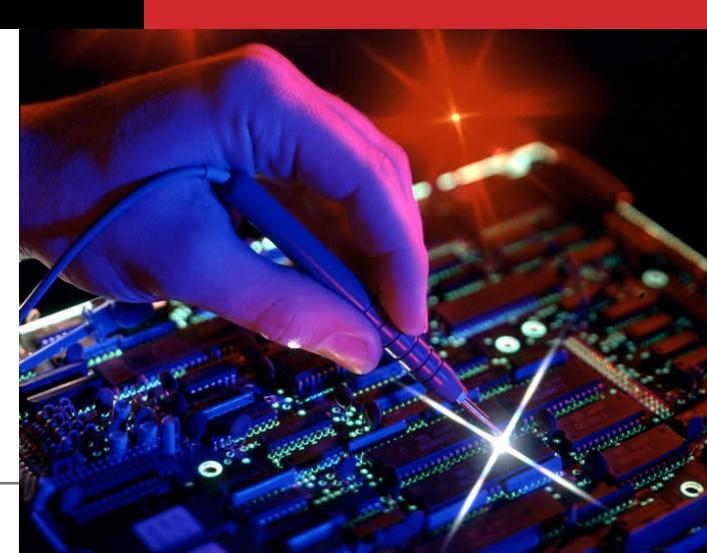
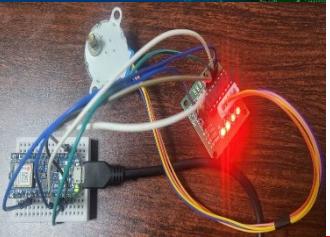


# Robotics

## OVERVIEW OF EDGE IMPULSE PLATFORM FOR TINY ROBOT LEARNING

Dennis A. N. Gookyi

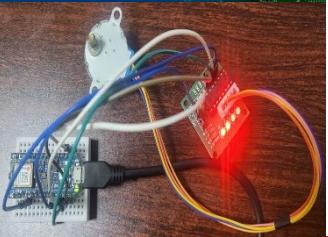




# CONTENTS

- ❖ **Introduction to Edge Impulse**

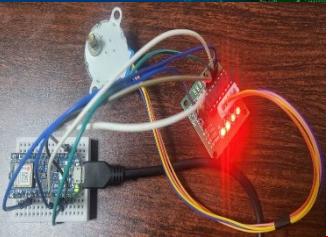




# INTRODUCTION TO EDGE IMPULSE

- ❖ Machine Learning workflow

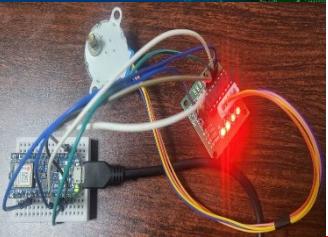




# INTRODUCTION TO EDGE IMPULSE

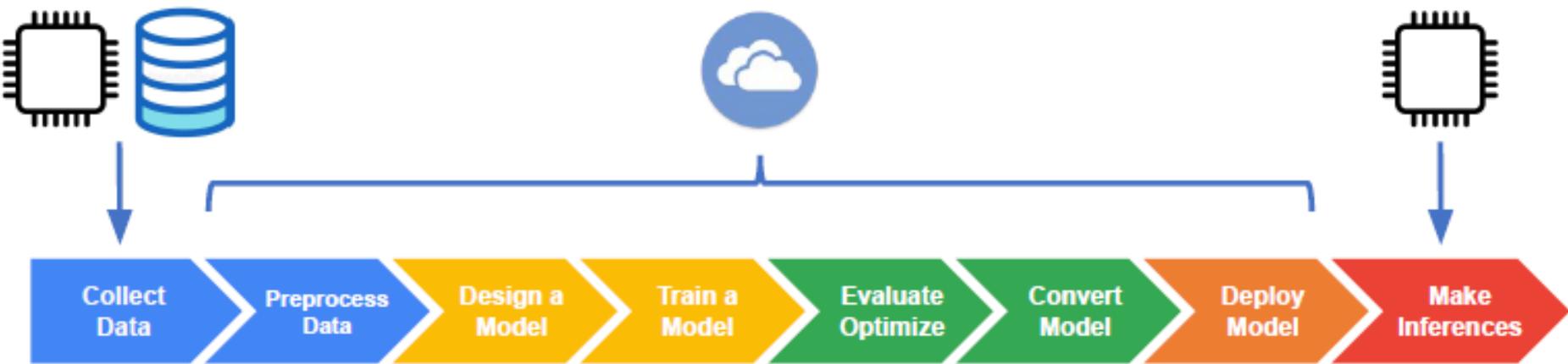
- ❖ Tiny Machine Learning workflow

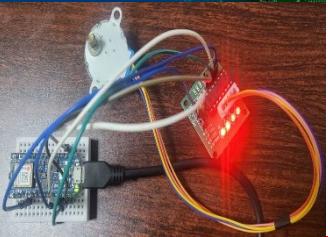




# INTRODUCTION TO EDGE IMPULSE

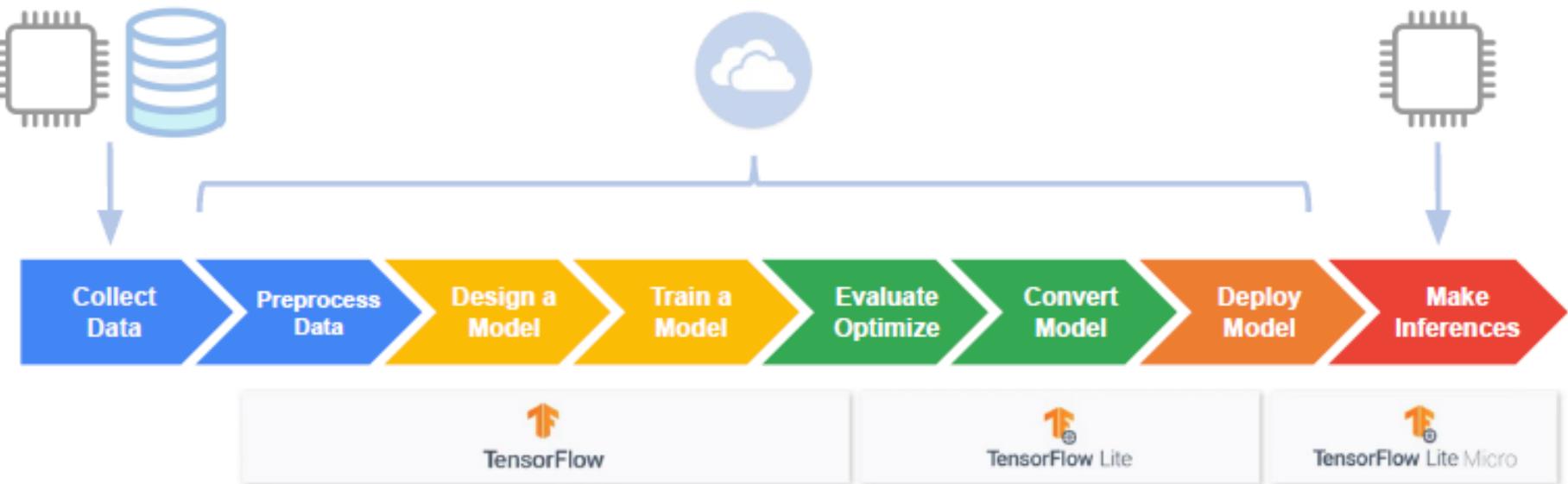
- ❖ Tiny Machine Learning workflow

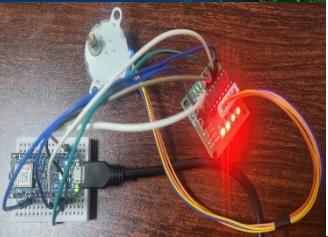




# INTRODUCTION TO EDGE IMPULSE

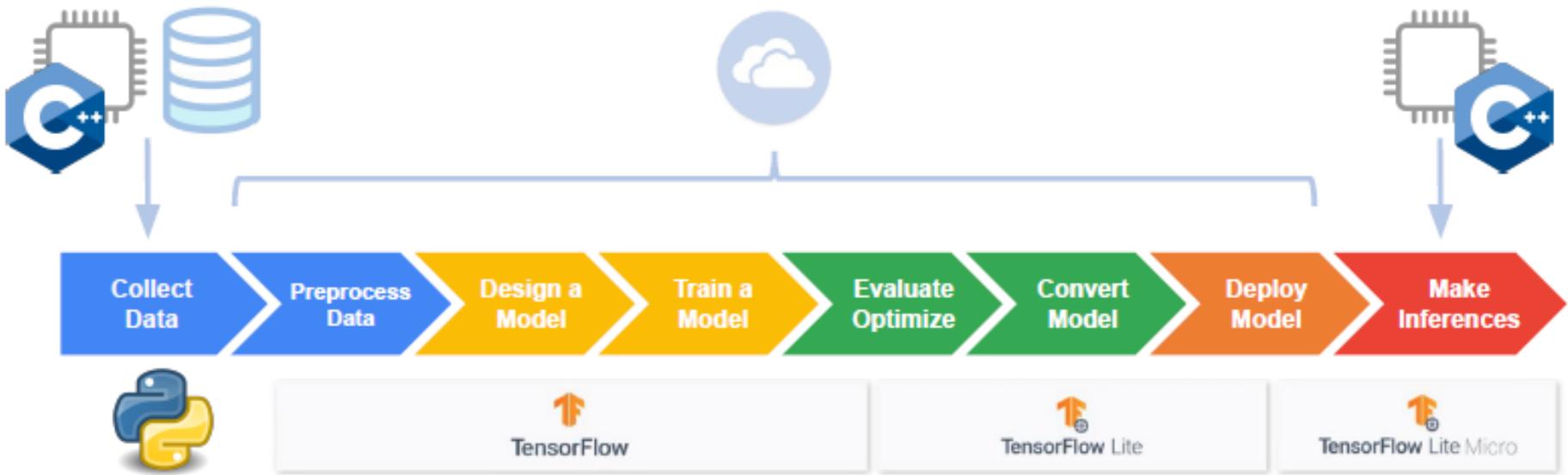
- ❖ Tiny Machine Learning workflow

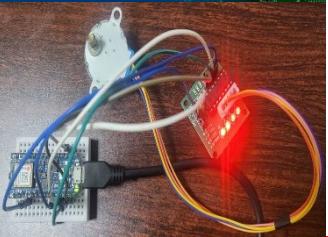




# INTRODUCTION TO EDGE IMPULSE

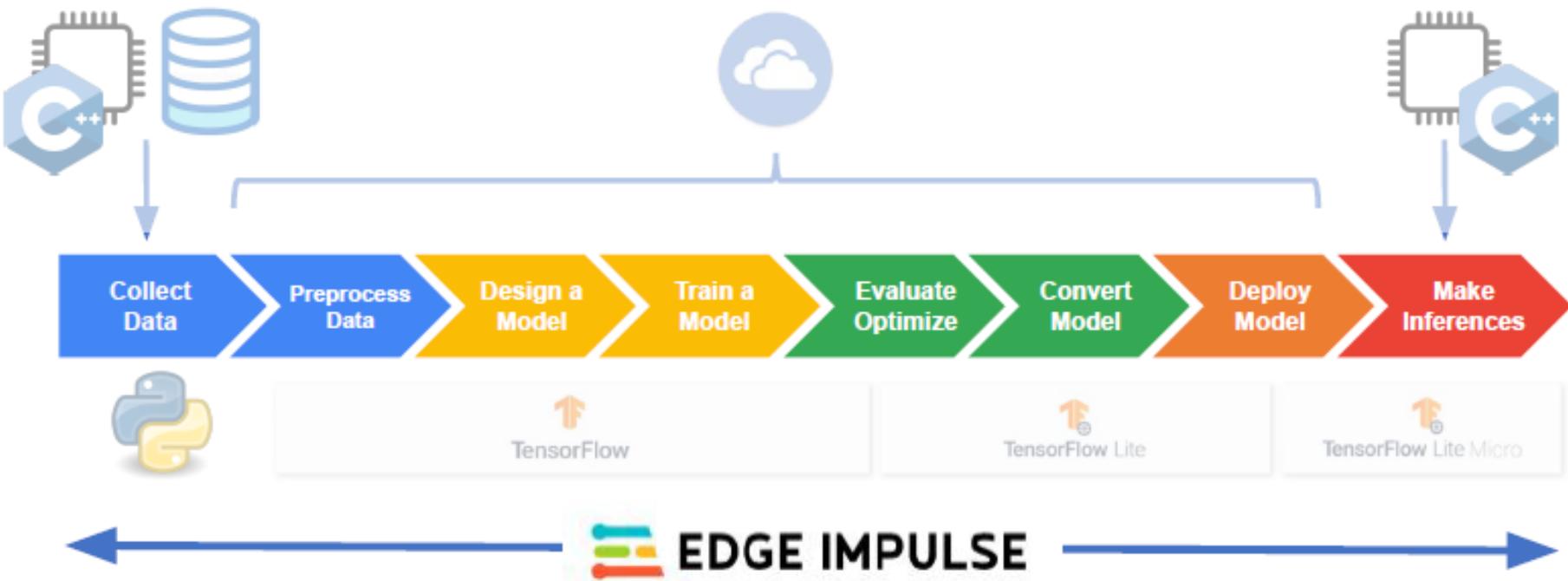
- ❖ Tiny Machine Learning workflow

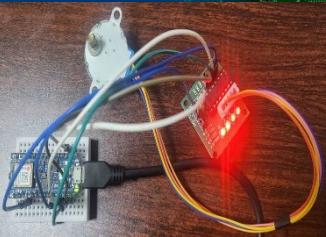




# INTRODUCTION TO EDGE IMPULSE

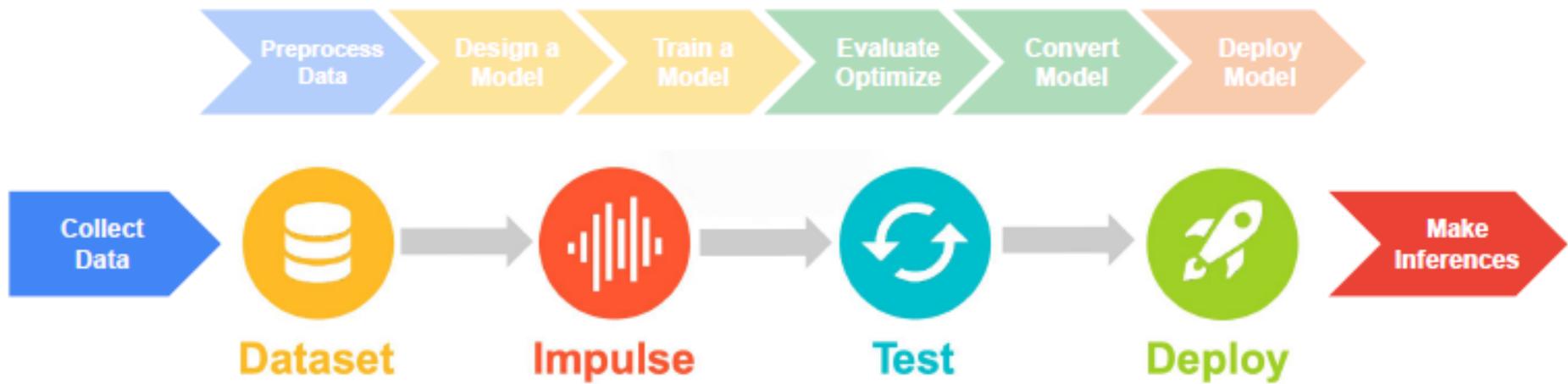
- ❖ Tiny Machine Learning workflow

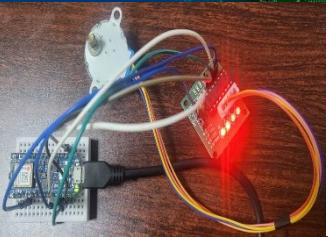




# INTRODUCTION TO EDGE IMPULSE

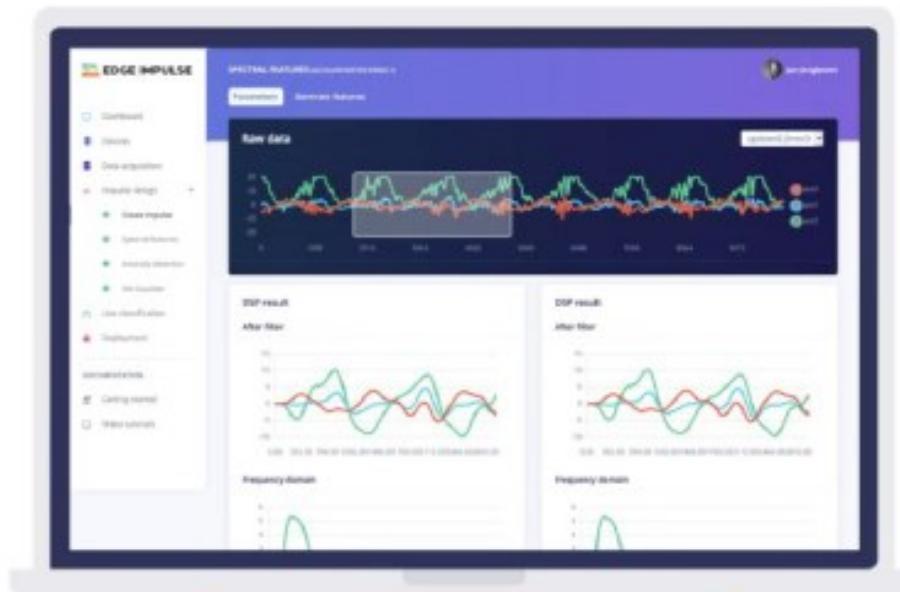
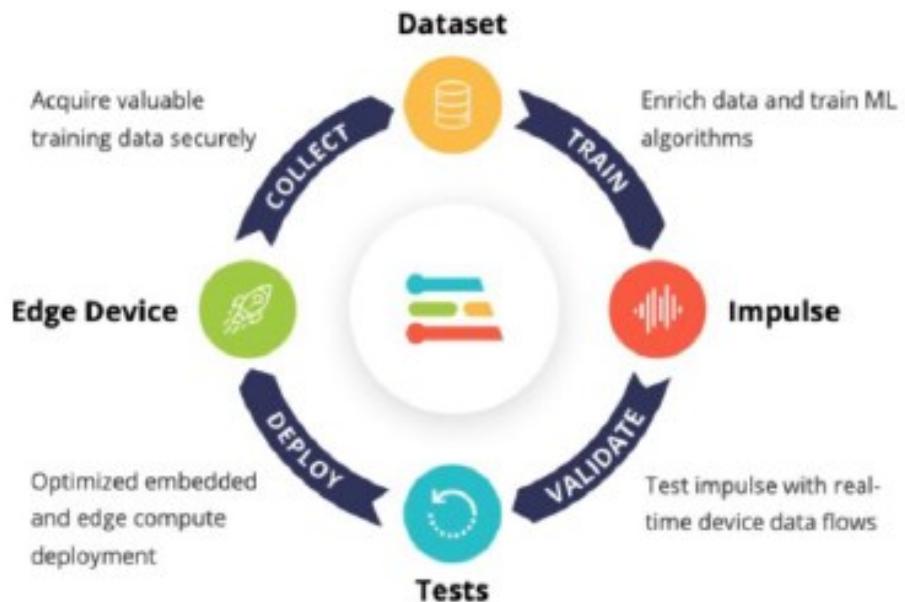
- ❖ Tiny Machine Learning workflow





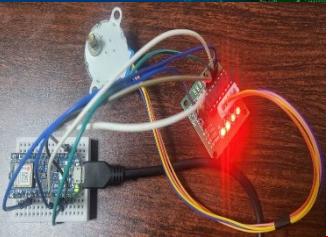
# INTRODUCTION TO EDGE IMPULSE

## ❖ Edge Impulse



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



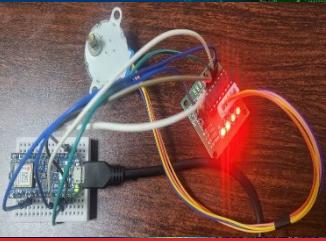


# INTRODUCTION TO EDGE IMPULSE

## ❖ 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](https://studio.edgeimpulse.com/studio/240311) Guest

**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)** [+ Add collaborator](#)

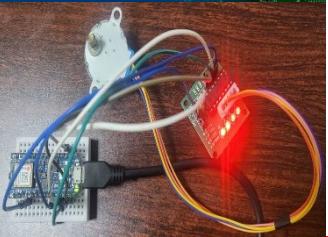
**Ewura OWNER**

**Summary**

DEVICES CONNECTED 0

[Continue with the wizard](#)

12



# 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 ...

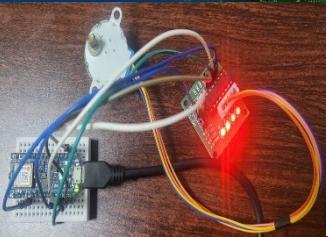
[More results from edgeimpulse.com »](#)

<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

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](#)

Waiting for www.google.com...

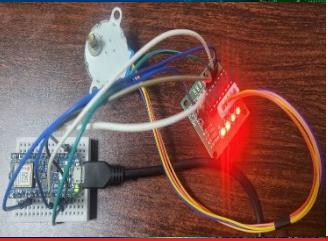
3. Fill the form with your requested details

4. Tick to accept

5. Click to Sign up

Start building embedded machine learning models today.

© 2023 EdgeImpulse Inc. All rights reserved



# INTRODUCTION TO EDGE IMPULSE

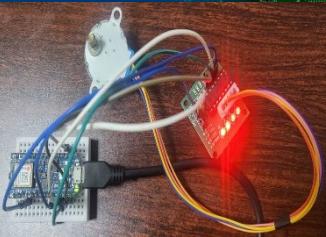
## ❖ Edge Impulse installation guide

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 personalized message: "Thanks **Ewura!**".
- A confirmation 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 large blue callout box containing the text "6. Click to start a new project".
- A prominent white icon consisting of three horizontal bars of increasing length from left to right.
- The text "Start building embedded machine learning models today.".
- The copyright notice "© 2023 EdgeImpulse Inc. All rights reserved".
- A small green icon in the bottom right corner.

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.

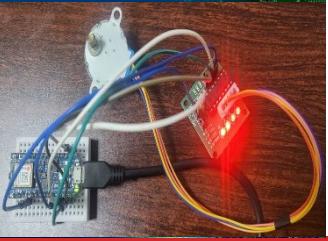




# INTRODUCTION TO EDGE IMPULSE

## ❖ Edge Impulse installation guide

The screenshot shows the Edge Impulse web studio interface. The top navigation bar includes a back arrow, forward arrow, refresh button, a lock icon indicating a secure connection, the URL 'studio.edgeimpulse.com/studio/240311', and a 'Guest' sign-in button. The left sidebar contains a 'EDGE IMPULSE' logo and a list of project management and development tools: Dashboard, Devices, Data acquisition, Impulse design (with 'Create impulse' selected), EON Tuner, Retrain model, Live classification, Model testing, Versioning, and Deployment. A status message at the bottom left says 'Waiting for studio.edgeimpulse.com...'. The main content area has a purple header with tabs for 'Project info' (which is active), 'Keys', 'Export', and 'Jobs'. Below this is a large 'Welcome' modal window. The modal features a colorful pie chart icon, a message saying 'You're only minutes away from making your devices feel, hear and see the real world using machine learning!', a blue button with the text 'Let's build your first model in 5 minutes!', and a smaller link 'Or, continue to your project'. At the bottom of the modal, there's a note 'Start building your dataset or validate your model's on-device performance:'. To the right of the modal, a message says 'Your project is private.' and a button says 'Make this project public'. The bottom right corner of the page shows a small image of a hand working on a circuit board.



# INTRODUCTION TO EDGE IMPULSE

- ❖ Edge Impulse example: Cifar Cats vs Dogs

Select project

Select your Edge Impulse project, or create a new one.

NAME

MjRobot (Marcelo Rovai)

MjRobot (Marcelo Rovai)

MjRobot (Marcelo Rovai)

MjRobot (Marcelo Rovai)

MjRobot (Marcelo Rovai) / sound-classification-blender-faucet

MjRobot (Marcelo Rovai) / ol\_roris\_kwrs

MjRobot (Marcelo Rovai) / Eggs AI

MjRobot (Marcelo Rovai) / Accelerometer-Nano-Ble-IoT

MjRobot (Marcelo Rovai) / video\_tinyml\_raw

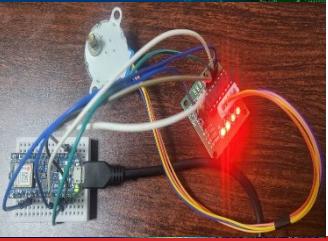
?

Create project

Enter a name for your new project

Cifar10 Classification (Cats vs Dogs)

Cancel Create new project



# INTRODUCTION TO EDGE IMPULSE

- ❖ Edge Impulse example: Cifar Cats vs Dogs

Select project

NAME

MjRoBot (Marcelo Rovai) / Cifar10 Classification (Cats vs Dogs)

MjRoBot (Marcelo Rovai) / SoundClassification-Blender-Faucet

MjRoBot (Marcelo Rovai) / ol\_revis\_lws

MjRoBot (Marcelo Rovai) / Eggs AI

MjRoBot (Marcelo Rovai) / Accelerometer-Nano-Ble-IoT

MjRoBot (Marcelo Rovai) / video\_tinyml\_raw

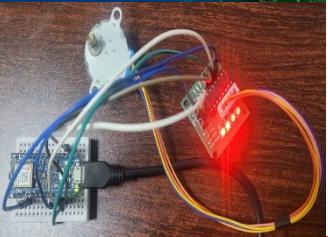
COLLABORATORS

MjRoBot (Marcelo Rovai)

Created project

Successfully created project: "Cifar10 Classification (Cats vs Dogs)"

OK



# 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

### 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!



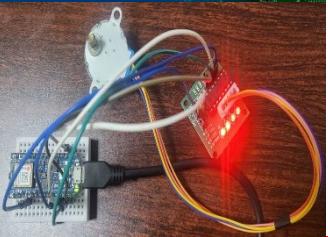
Motion: Gesture recognition



Images: Object detection

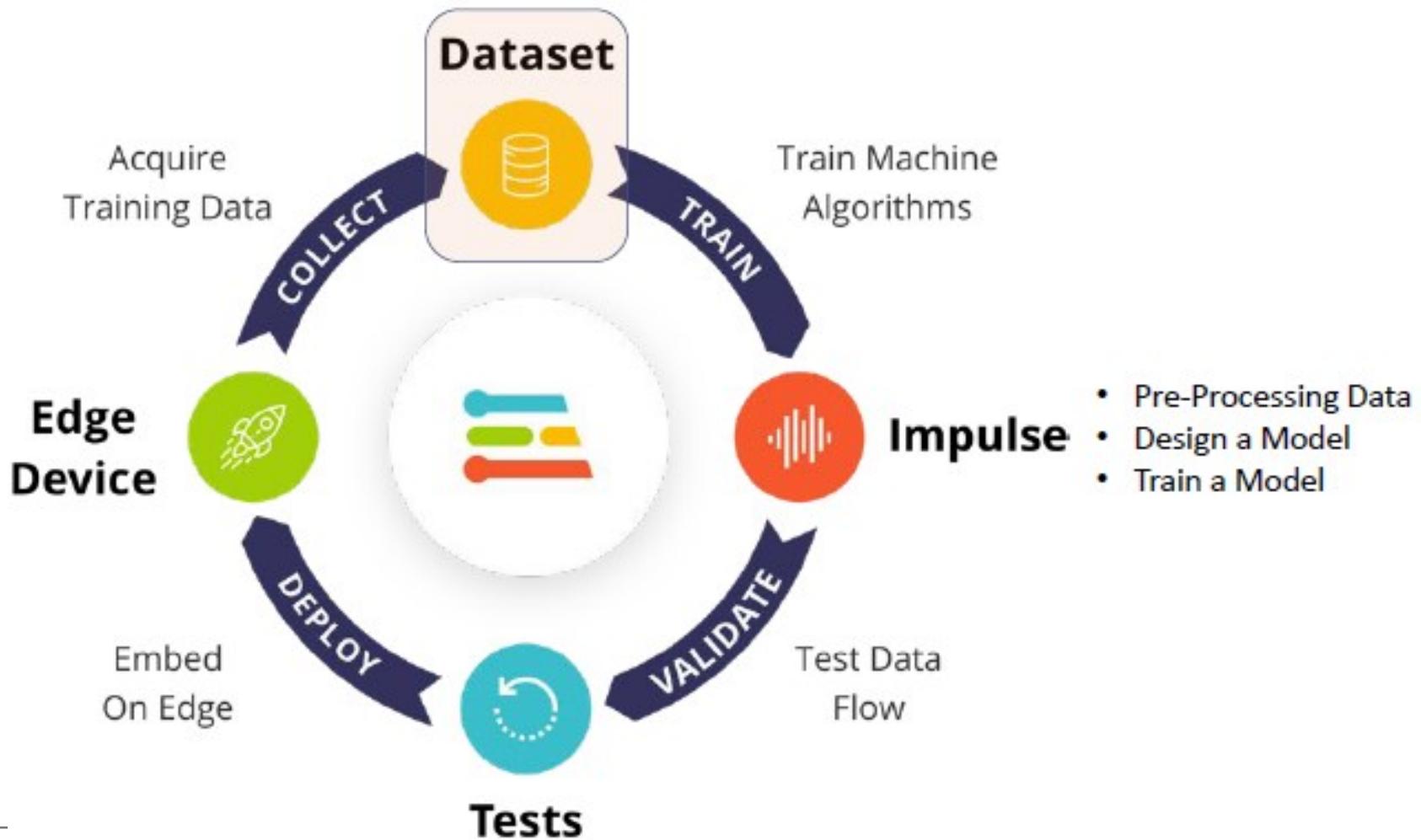


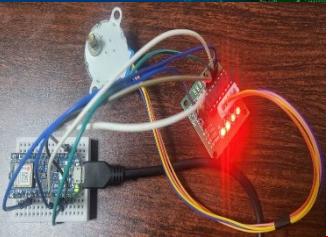
Audio: Audio classification



# INTRODUCTION TO EDGE IMPULSE

- ❖ Edge Impulse example: Cifar Cats vs Dogs





# INTRODUCTION TO EDGE IMPULSE

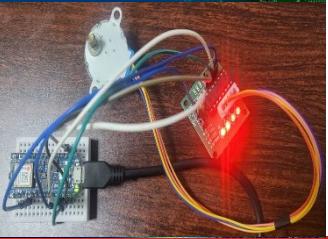
- ❖ Edge Impulse example: Cifar Cats vs Dogs
  - Download: <https://github.com/YoongiKim/CIFAR-10-images>



The screenshot shows a GitHub repository page for 'CIFAR-10-images'. At the top, there are buttons for 'Go to file', 'Add file', and a green 'Code' button, which is circled in red. Below these are links for 'HTTP(S) SSH GPG & CLI' and 'Open with GitHub Desktop'. A large yellow arrow points from the bottom towards the 'Code' button. On the right side of the page, 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 window shows a tree view with 'CIFAR-10-images-master' at the root, containing 'test' and 'train' folders. Inside 'train', there are subfolders for 'automobile', 'bird', 'cat', 'deer', 'dog', 'frog', 'horse', 'ship', and 'truck', each containing numerous image files (e.g., 0001.jpg, 0002.jpg, etc.). A specific image file, '0005.jpg', is selected and shown in a preview pane on the right. Below the preview, the file's information is displayed, including its size (109 Bytes).





# 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!



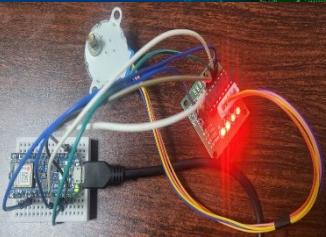
Motion: Gesture recognition



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, a sidebar contains 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 header with tabs: Dataset (which is selected and highlighted in white), Data explorer, Data sources, and CSV Wizard. Below the tabs, the word "Dataset" is displayed. To the right of the word "Dataset" are two small icons: an upward arrow and a cloud. In the center, there is a circular icon containing three vertical bars of increasing height, with the text "Add data" next to it. Below this, a message says "Start building your dataset by adding some data." At the bottom, there is a large blue button with a white plus sign and the text "+ Add data". The entire "Add data" button is surrounded by a red rectangular border.

Dennis / Cifar\_Dogs\_vs\_

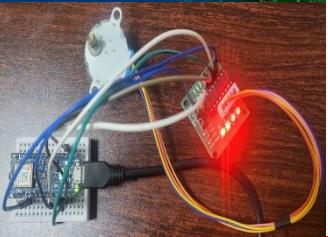
Dataset    Data explorer    Data sources | CSV Wizard

Dataset

Add data

Start building your dataset by adding some data.

+ Add data

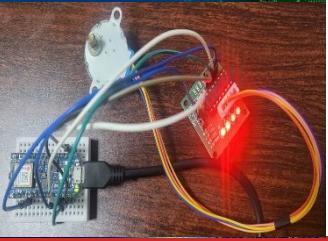


# INTRODUCTION TO EDGE IMPULSE

- ❖ Edge Impulse example: Cifar Cats vs Dogs

The screenshot shows the Edge Impulse web interface. On the left, 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 is another section titled "Add data" with the sub-instruction "Start building your dataset by adding some data." and a blue "Add data" button with a plus sign.





# 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**

[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

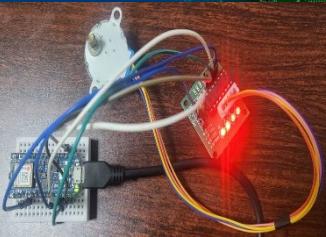
**EDGE IMPULSE**

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

Try Enterprise Free

Get access to high job 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**

[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:

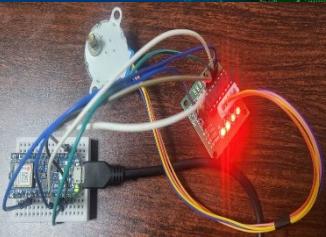
Dog

**Try Enterprise Free**

Get access to high job limits and training on GPUs

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

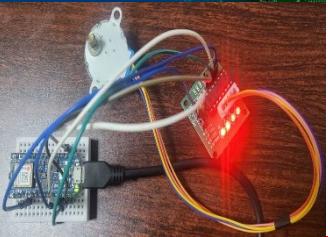
Infer from filename [?](#)

Leave data unlabeled [?](#)

Enter label:

Dog

◀ Back



# 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

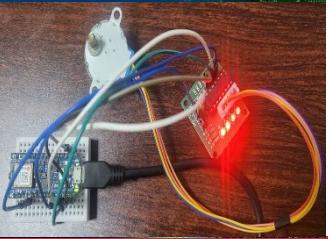
Enter label:

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

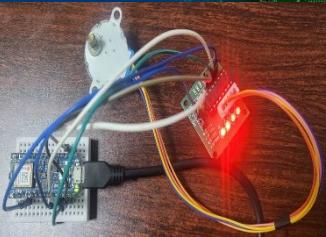
- Infer from filename [?](#)
- Leave data unlabeled [?](#)

#### 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

EDGE IMPULSE

Dennis / Cifar\_Dogs\_vs\_Cats PERSONAL D

Dataset Data explorer Data sources | CSV Wizard

DATA COLLECTED  
12,000 items

TRAIN / TEST SPLIT  
83% / 17%

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	-	⋮

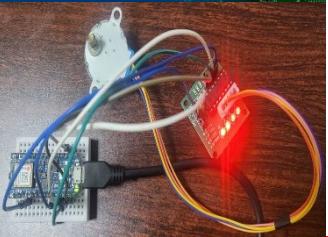
Collect data

Connect a device to start building your dataset.

RAW DATA  
**4998**

The screenshot shows the Edge Impulse web interface. On the left is a sidebar with various icons for dashboard, devices, data acquisition, impulse design, creating an impulse, EON Tuner, retraining models, live classification, and model testing. A prominent 'Try Enterprise Free' button is also present. The main area has a purple header with navigation tabs: Dataset (which is selected), Data explorer, Data sources, and CSV Wizard. Below this is a summary box with 'DATA COLLECTED 12,000 items' and 'TRAIN / TEST SPLIT 83% / 17%' with a pie chart icon. A red box highlights this summary section. The main dataset table shows four entries, all labeled 'Cat'. To the right, there's a 'Collect data' section with a placeholder message 'Connect a device to start building your dataset.' and a 'RAW DATA' section showing the number '4998' above a small thumbnail image of a cat's face.





# 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 limits

Dennis / Cifar\_Dogs\_vs\_Cats PERSONAL D

Dataset Data explorer Data sources | CSV Wizard

DATA COLLECTED  
12,000 items

TRAIN / TEST SPLIT  
83% / 17%

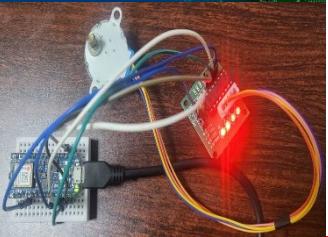
Collect data

Connect a device to start building your dataset.

RAW DATA  
**4998**

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

Image data

Input axes  
image

Image width 32      Image height 32

Resize mode  
Fit shortest

Add a processing block

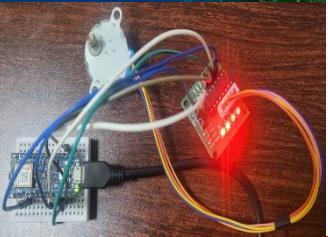
Add a learning block

Output features

Save Impulse

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

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.

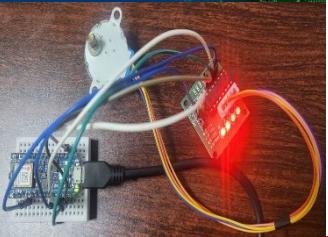
Add a processing block

Add a learning block

Output features

Save Impulse





# INTRODUCTION TO EDGE IMPULSE

## ❖ Edge Impulse example: Cifar Cats vs Dogs

⚡ Add a processing block

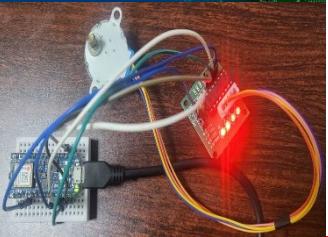
Did you know? You can bring your own DSP code.

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

Some processing blocks have been hidden based on the data in your project. Show all blocks anyway

**Add custom block**

For optimal accuracy with



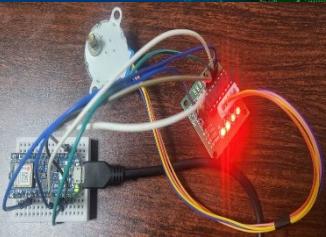
# INTRODUCTION TO EDGE IMPULSE

- ❖ Edge Impulse example: Cifar Cats vs Dogs

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

- Image data** (red 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 containing a flask icon and placeholder text.
- Output features** (green card):
- Save Impulse** (green button)





# INTRODUCTION TO EDGE IMPULSE

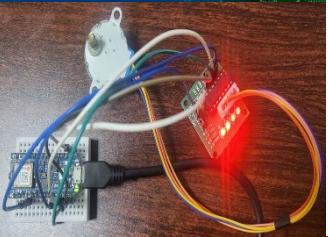
## ❖ Edge Impulse example: Cifar Cats vs Dogs

**⚠ Add a learning block** ×

**Did you know?** You can bring your own model in PyTorch, Keras or scikit-learn.

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





# 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

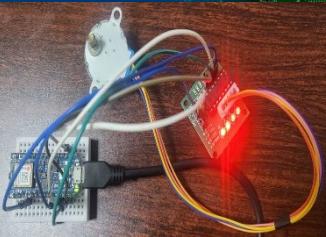
**Output features**  
2 (Cat, Dog)

**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, 0xa2927, 0xb2a28, 0xc2b29, 0xd2c2a, ...

Parameters

Image

Color depth RGB

Save parameters

DSP result

Image

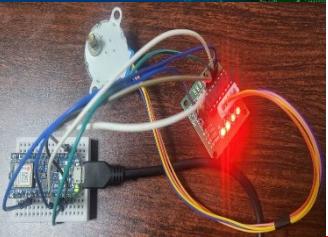
Processed features

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

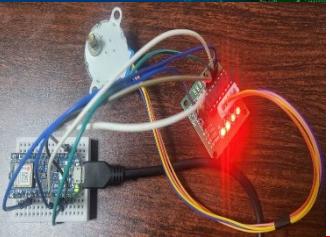
Classes      2 (Cat, Dog)

[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)

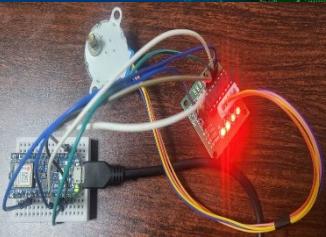
[Generate features](#)

Feature generation output

```
[ 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 [i](#)

2990  
Label: Dog  
[View sample](#)  
[View features](#)



# INTRODUCTION TO EDGE IMPULSE

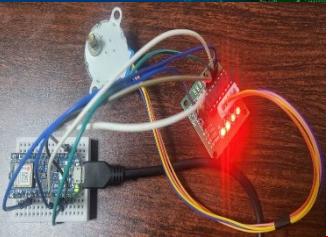
- ❖ Edge Impulse example: Cifar Cats vs Dogs

The screenshot shows the Edge Impulse web application's sidebar menu. The menu items are:

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

The "Classifier" option under "Image" is highlighted with a red rectangular border.





# 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

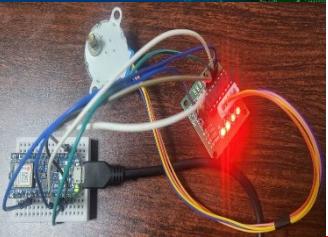
Number of training cycles ⓘ

10

Learning rate ⓘ

0.0005

Advanced training settings

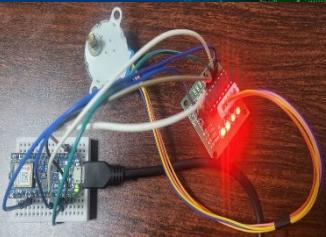


# INTRODUCTION TO EDGE IMPULSE

- ❖ Edge Impulse example: Cifar Cats vs Dogs

Neural network architecture

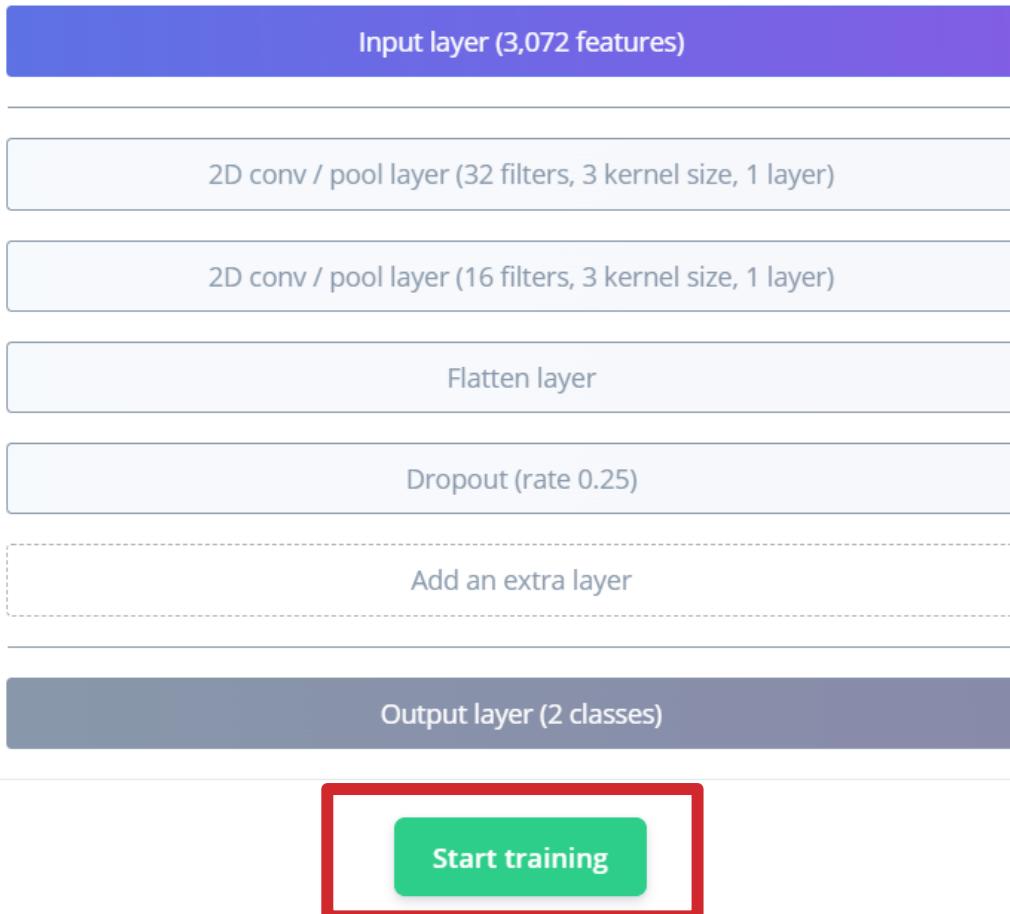


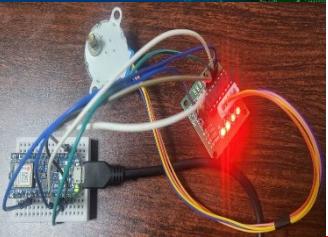


# INTRODUCTION TO EDGE IMPULSE

- ❖ Edge Impulse example: Cifar Cats vs Dogs

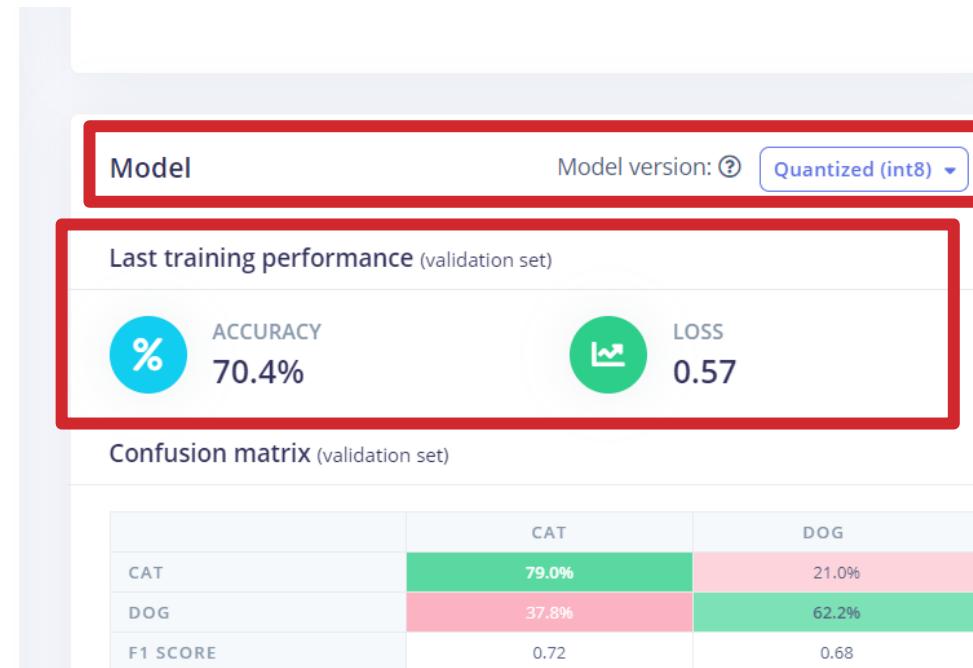
Neural network architecture

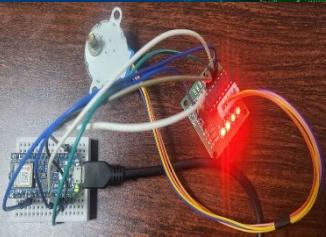




# INTRODUCTION TO EDGE IMPULSE

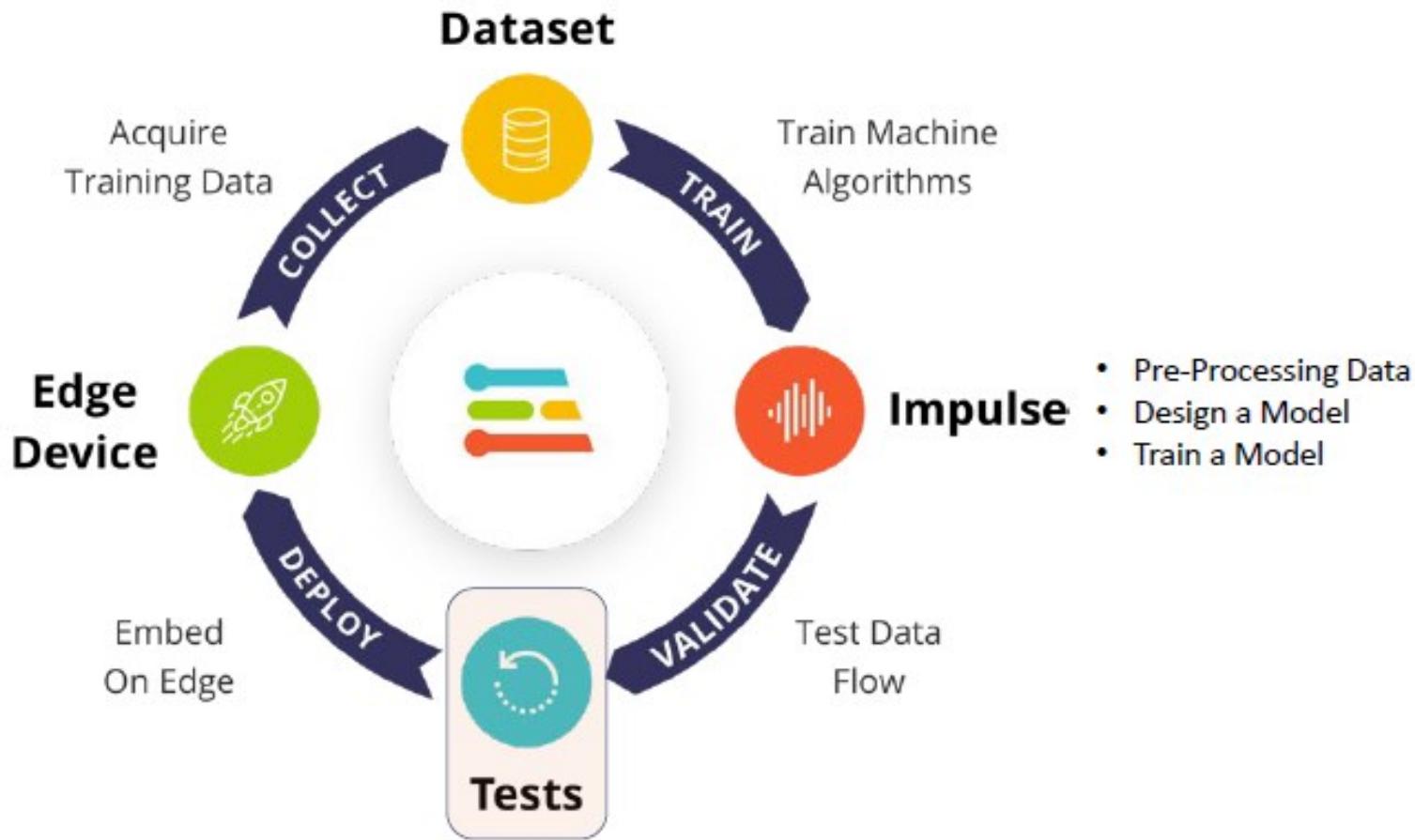
- ❖ Edge Impulse example: Cifar Cats vs Dogs

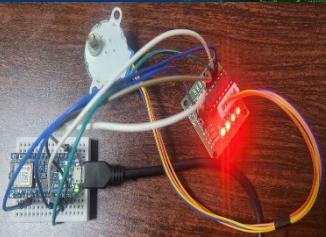




# INTRODUCTION TO EDGE IMPULSE

- ❖ Edge Impulse example: Cifar Cats vs Dogs



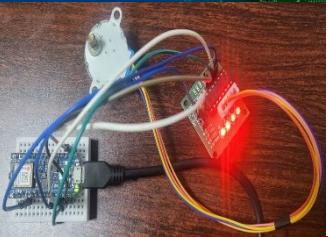


# INTRODUCTION TO EDGE IMPULSE

## ❖ Edge Impulse example: Cifar Cats vs Dogs

- Create impulse
- Image
- Classifier
  
- 🌐 EON Tuner
- ⚡ Retrain model
- ⌚ Live classification
- 🛍 Model testing**
  
- 📅 Versioning
- 📦 Deployment





# INTRODUCTION TO EDGE IMPULSE

- ❖ Edge Impulse example: Cifar Cats vs Dogs

Test data

Classify all

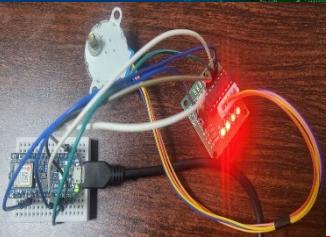
Model testing output

(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

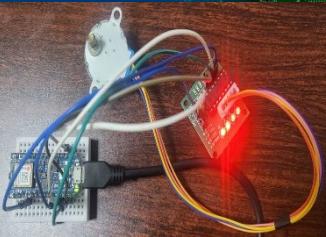
Classifying data for float32 model...
Scheduling job in cluster...
Container image pulled!
Job started
INFO: Created TensorFlow Lite XNNPACK delegate for CPU.
Classifying data for Classifier OK

Job completed
```

**Model testing results**

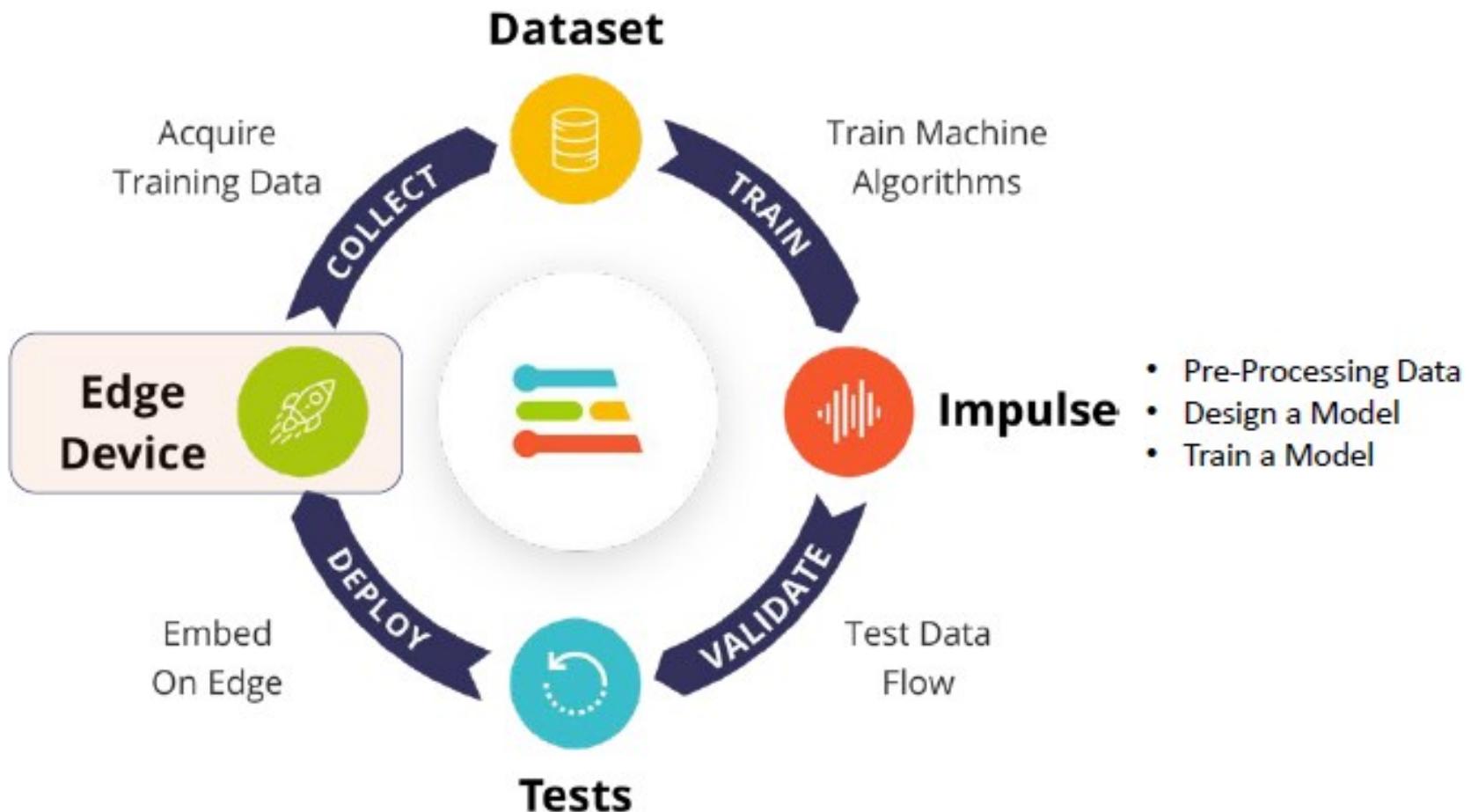
 **ACCURACY**  
**55.10%**

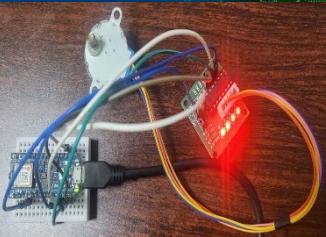
	CAT	DOG	UNCERTAIN
CAT	60.8%	10.5%	28.7%
DOG	21.6%	49.4%	29%
F1 SCORE	0.67	0.62	



# INTRODUCTION TO EDGE IMPULSE

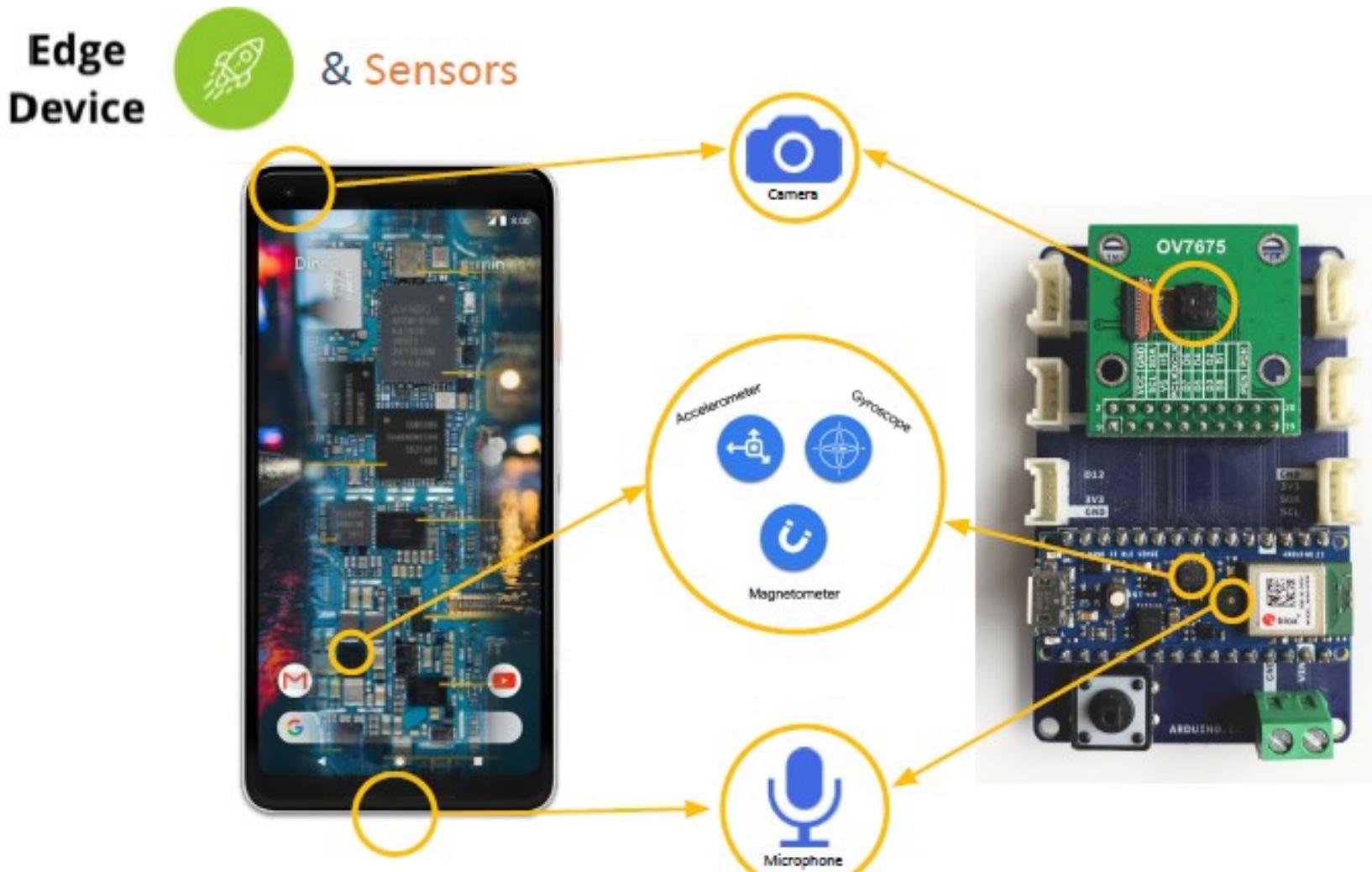
- ❖ Edge Impulse example: Cifar Cats vs Dogs

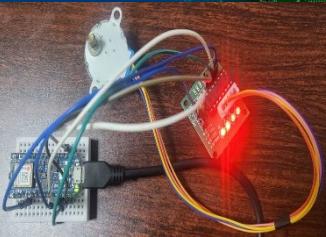




# INTRODUCTION TO EDGE IMPULSE

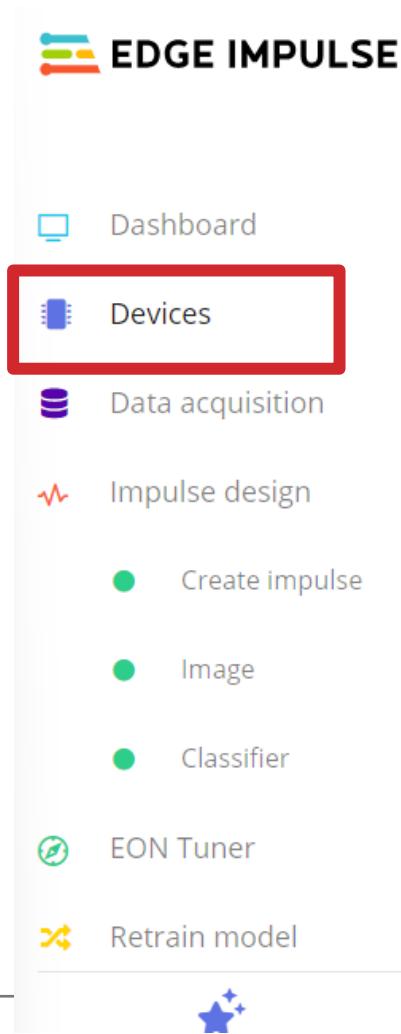
- ❖ Edge Impulse example: Cifar Cats vs Dogs

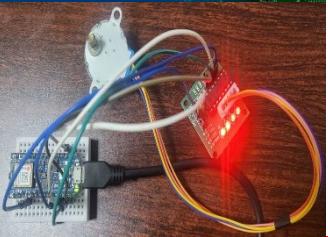




# INTRODUCTION TO EDGE IMPULSE

- ❖ Edge Impulse example: Cifar Cats vs Dogs





# INTRODUCTION TO EDGE IMPULSE

- ❖ Edge Impulse example: Cifar Cats vs Dogs

Your devices

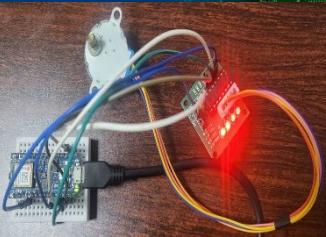
These are devices that are connected to the [Edge Impulse remote management API](#), or have posted data to the [ingestion SDK](#).

No devices connected yet.

[!\[\]\(24c3016d327ccfda05ea189c50b4b062\_img.jpg\) Learn how to connect a new device](#)

+ 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

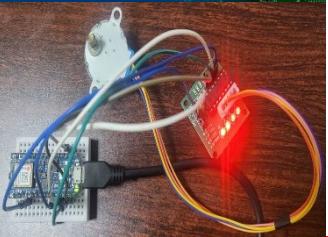


Connect to your computer



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

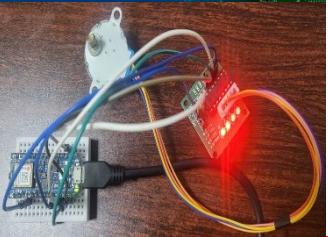
Device "phone\_lrg89hd0" is now connected

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

Get started!

Back





# 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.

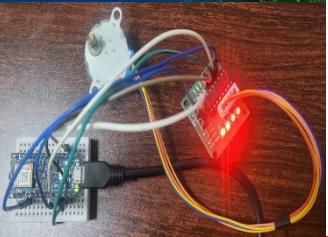
Collecting images?

Collecting audio?

Collecting motion?

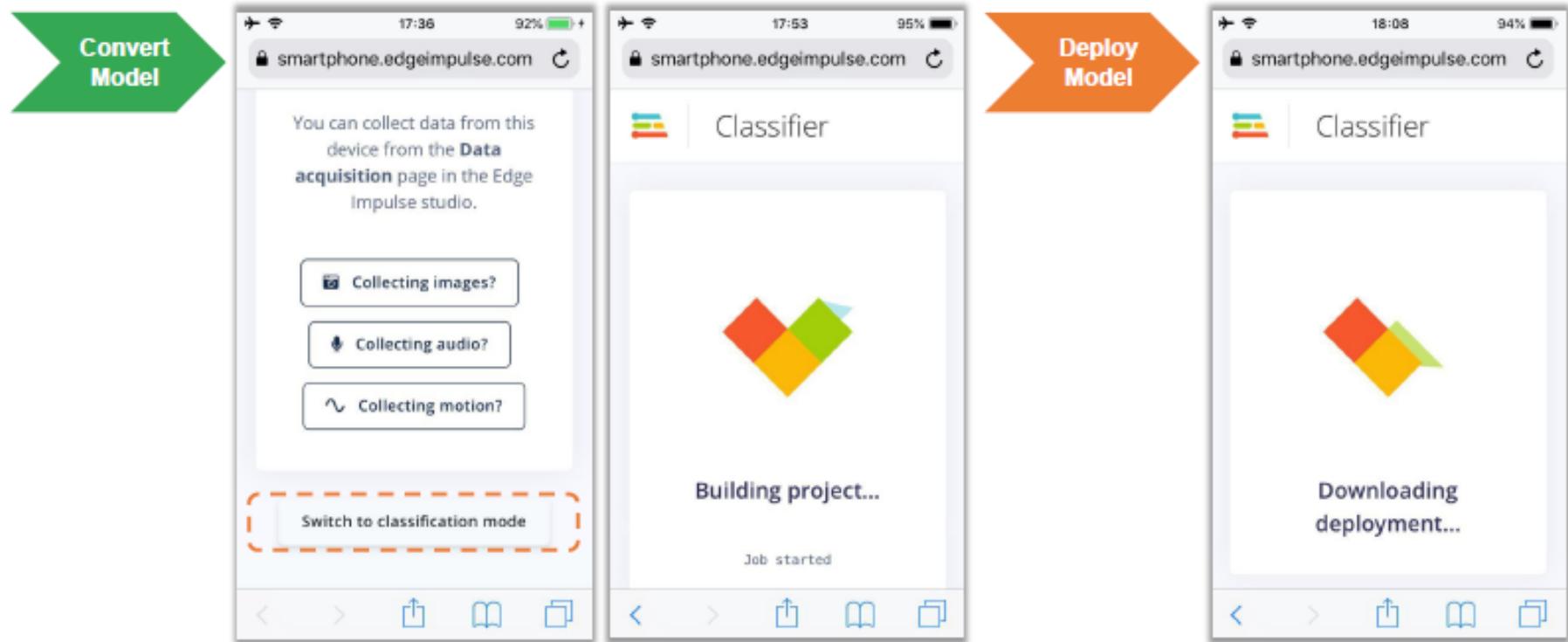
Switch to classification mode

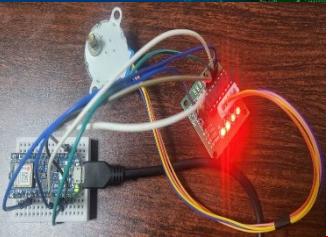




# INTRODUCTION TO EDGE IMPULSE

- ❖ Edge Impulse example: Cifar Cats vs Dogs





# INTRODUCTION TO EDGE IMPULSE

- ❖ Edge Impulse example: Cifar Cats vs Dogs

Make  
Inferences

The screenshots show the Edge Impulse mobile application interface. Each screen displays a camera feed at the top, followed by a "Classifier" section. Below each classifier section is a photo of either a dog or a cat. At the bottom of each section is a "Next photo" button. The classifier results are presented in a table format.

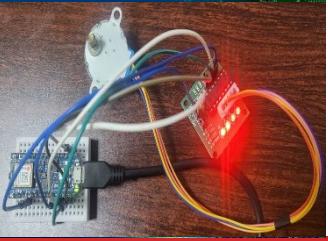
	CAT	DOG
16	0.03	0.97
15	0.49	0.51

	CAT	DOG
17	0.00	1.00
16	0.03	0.97

	CAT	DOG
39	0.94	0.06
38	0.98	0.02

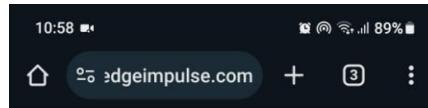
	CAT	DOG
40	0.64	0.36
39	0.94	0.06



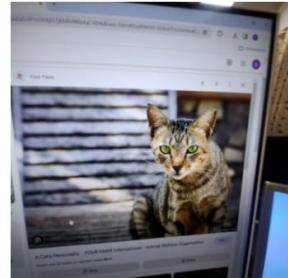


# INTRODUCTION TO EDGE IMPULSE

- ❖ Edge Impulse example: Cifar Cats vs Dogs



Dennis / Cifar\_Dogs...



Inferencing...

Cat

Time per inference: 1 ms.

CAT	DOG
2...	0.87
2...	0.84
2...	0.85

