

EDGE INTELLIGENCE LABORATORY 5

MACSE604

**DANISH RYWEN T
25MML0048**

EDGE IMPULSE

1.Click Data Acquisition:

Navigate to the Data Acquisition section, where all sensor and image data collection is managed.

2.Select Connect to device:

Choose the option to connect a device for data collection, which allows real-time image capture.

3. Use mobile phone and scan the QR code:

Select the mobile phone option and scan the displayed QR code using your phone's browser to establish a connection.

4.Connect the mobile phone as a camera:

Once connected, the mobile phone camera acts as an input device for capturing images directly into Edge Impulse.

5.Capture sample images:

Use the phone camera to capture images under different lighting and angles to improve model robustness.

6.Collect images for training and testing:

Capture a sufficient number of images and split them into training and testing datasets for proper model evaluation.

7.Rename images with meaningful names:

Assign clear and descriptive filenames to images to help identify classes and improve dataset organization.

8.Label all images correctly:

Apply accurate labels to each image so the model can correctly learn and distinguish between different classes.

Training Data with size if Nine (9):

The screenshot shows the Edge Impulse Studio interface. On the left, there's a sidebar with various project management and development tools. The main workspace displays a dataset summary and a detailed list of training samples. The dataset summary indicates 13 items, a 69% / 31% train / test split, and a 'Collect data' section prompting to connect a device. Below this, a table lists nine samples with their labels (Fan, Mouse, Pen) and addition dates. A dark overlay at the bottom right encourages clicking on a sample to load it. A red button in the bottom right corner allows resuming a tutorial.

SAMPLE NAME	LABEL	ADDED
unknown.6egek1lg	Fan	Today, 16:47:03
unknown.6egehqe6	Mouse	Today, 16:45:50
unknown.6egefsc1	Mouse	Today, 16:44:47
unknown.6egedaad	Pen	Today, 16:43:23
unknown.6egecfur	Pen	Today, 16:42:56
unknown.6ebau1m	Fan	Jan 08 2026, 21:....
unknown.6ebat656	Mouse	Jan 08 2026, 17:....
unknown.6ebason8	Watch	Jan 08 2026, 17:....
unknown.6ebario7	Pen	Jan 08 2026, 17:....

Testing Data with size of Four:

The screenshot shows the Edge Impulse Studio interface. On the left, there's a sidebar with options like Dashboard, Devices, Data acquisition, Experiments, EON Tuner, Impulse design (with Create impulse, Image, Classifier), and an Upgrade Plan section. The main area displays a dataset summary: "DATA COLLECTED 13 items" and "TRAIN / TEST SPLIT 69% / 31%". Below this is a table titled "Dataset" with columns for SAMPLE NAME, LABEL, and ADDED. The table lists 13 entries, each with a small thumbnail image. One row is highlighted with a red box, showing "unknown.6egek1lg" labeled "Fan" added "Today, 16:47:03". At the bottom right of the main area, there's a button that says "Click on a sample to load...".

1. Open Impulse Design and click Create Impulse.

Go to the Impulse Design section and click “Create Impulse” to define the data flow for model training.

2. Add a Processing Block as Image.

Select the Image processing block to convert raw image data into features suitable for learning.

3. Add a Learning Block as Image Classification.

Choose the Image Classification learning block to enable the system to classify images into predefined categories.

4. Click Save Impulse.

Save the impulse configuration so the processing and learning blocks

are applied to the dataset.

5.In Impulse Design, click on Image.

Open the Image processing page to configure parameters such as image size and color depth.

6.Click Generate Features to extract image features.

Generate features from the uploaded images, transforming visual information into numerical representations.

7.After feature generation is complete, go to Image Classification (Classifier).

Navigate to the classifier section to prepare the model for training using the extracted features.

8.Click Start Training.

Start the training process, where the model learns patterns from the labeled image data.

9.Once training is finished, the model accuracy will be displayed for the images you uploaded.

The platform shows performance metrics such as accuracy, indicating how well the trained model classifies the images.

10.Test with live classification:

Try using sample test data

The screenshot shows the Edge Impulse studio profile page. At the top, there are three tabs: "edge impulse - Yahoo India Search", "Profile - Projects - Edge Impulse", and "docs - Yahoo India Search Results". The main header features the "EDGE IMPULSE" logo and a user icon with the letter "S". Below the header, there are two tabs: "Projects" (selected) and "Custom ML blocks".

The "Projects" section displays a list of projects. A message indicates "2 of 3 private projects remaining. Want access to more? Request Enterprise Trial." Below this, a project titled "SHIBU_P / SHIBU_P-project-1" is listed. To the right of the project list are "Sort" and "+ Create new project" buttons.

On the left side, there's a sidebar for "SHIBU_P" (DEVELOPER). It includes a "Enable MFA" section with a note: "Multi-factor authentication is now available for all users. Set up now." and a "Request Enterprise Trial" button. There's also an "Organizations" section with a note: "Allow anyone on your team to collaborate on multiple datasets, automation, and models in a shared workspace." and another "Request Enterprise Trial" button.

Creating Impulse:

The screenshot shows the Edge Impulse studio interface. On the left, a sidebar menu includes options like Dashboard, Devices, Data acquisition, Experiments, EON Tuner, Impulse design (with Create impulse selected), Image, Classifier, and an Upgrade Plan. The main area is titled "Impulse #1" and contains four panels: "Image data" (red background) showing input axes for "image" with width 96 and height 96, and a "Resize mode" dropdown; "Image" (white background) showing a lightning bolt icon and a dropdown for "Input axes (1)" set to "image"; "Classification" (blue background) showing a flask icon and a dropdown for "Input features" set to "Image", with "Output features" listed as "4 (Fan, Mouse, Pen, Watch)"; and "Output features" (green background) showing a checkmark icon and the same output feature list. A "Save Impulse" button is at the bottom right. A "Resume tutorial" button is also visible.

Changing into grayscale image:

The screenshot shows the Edge Impulse studio interface. The left sidebar is identical to the previous screenshot. The main area is titled "Raw data" and displays a grayscale image of a ceiling fan. Below it, the "Raw features" section shows raw binary data. The "Parameters" section has a "Color depth" dropdown set to "Grayscale". To the right, the "DSP result" section shows an "Image" of the fan and a "Processed features" section with numerical data. At the bottom, there's an "On-device performance" section with two progress bars: "DECODE TIME" (blue) and "DECODED IMAGE" (red). A "Save parameters" button is located at the bottom center. A "Resume tutorial" button is at the bottom right.

Generate features:

The screenshot shows the Edge Impulse studio interface. On the left, a sidebar lists various project management and development tools: Dashboard, Devices, Data acquisition, Experiments, EON Tuner, Impulse design (with sub-options Create impulse, Image, Classifier), and an Upgrade Plan section with a 'View plans' button. The main workspace is titled 'Parameters' and contains a 'Generate features' button. Below it is a 'Training set' panel showing 9 items and 4 classes: Fan, Mouse, Pen, and Watch. To the right is a 'Feature explorer' panel displaying a scatter plot of feature data points for these four classes. At the bottom right is an 'On-device performance' section with a 'Resume tutorial' button.

Classifier with two Convolution and pooling layer with dropout and flatten layer and achieved an accuracy of 50 %:

The screenshot shows the Edge Impulse studio interface for a project titled "SHIBU_P-project-1 - Classifier".

Neural Network settings:

- Training settings:**
 - Number of training cycles: 10
 - Use learned optimizer:
 - Learning rate: 0.0005
 - Training processor: CPU
- Advanced training settings:**
- Neural network architecture:**
 - Neural network:** Input layer (9,216 features), 2D conv / pool layer (16 filters, 3 kernel size, 1 layer), 2D conv / pool layer (32 filters, 3 kernel size, 1 layer).
 - Transfer learning:**

Training output:

- Model:** Model version: Quantized (int8)
- Last training performance (validation set):**
 - ACCURACY: 50.0%
 - LOSS: 1.40
- Confusion matrix (validation set):**

	FAN	MOUSE	PEN	WATCH
FAN	-	-	-	-
MOUSE	0%	50%	50%	0%
PEN	-	-	-	-
WATCH	-	-	-	-
F1 SCORE		0.67	0.00	

- Metrics (validation set):**
 - Weighted average Precision: 1.00
 - Weighted average Recall: 0.50

Actions: Resume tutorial

The screenshot shows the Edge Impulse studio interface for the same project.

Neural network structure:

- Input layer (9,216 features):** 2D conv / pool layer (16 filters, 3 kernel size, 1 layer), 2D conv / pool layer (32 filters, 3 kernel size, 1 layer).
- Hidden layers:** Flatten layer, Dropout (rate 0.25), Add an extra layer.
- Output layer (4 classes):** Output layer (4 classes).

Actions: Save & train

Metrics (validation set):

Metric	Value
Weighted average Precision	1.00
Weighted average Recall	0.50
Weighted average F1 score	0.67

Data explorer (full training set):

Scatter plot showing data points for four classes: Fan - correct (yellow), Mouse - correct (red), Pen - correct (green), Watch - correct (blue). A legend indicates: Fan - correct, Mouse - correct, Pen - correct, Watch - correct, Mouse - incorrect.

On-device performance:

- Engine: EON™ Compiler
- Inference Time: 587 ms.
- Peak RAM Usage: 182.7K
- Flash Usage: 106.1K

Actions: Resume tutorial

Testing with (Fan) image:

The screenshot shows the Edge Impulse Studio interface. On the left is a sidebar with navigation links: Dashboard, Devices, Data acquisition, Experiments, EON Tuner, Impulse design (selected), Create impulse, Image, Classifier, and Upgrade Plan. The main area has tabs for 'Classify new data' and 'Classify existing test sample'. Under 'Classify new data', there are dropdowns for Device (No devices connected), Sensor, Sample length (ms.) (5000), Frequency, and a green 'Start sampling' button. Under 'Classify existing test sample', there is a dropdown with 'unknown.6ebatkk0 (Fan)' and a blue 'Load sample' button. Below these sections is a 'Classification result' section.

The model predicted an highest probability as Fan:

This screenshot shows the Edge Impulse Studio interface with a different project. The sidebar and tabs are identical to the previous screenshot. The main area displays a 'Summary' section with a table of raw data, a 'Raw features' section showing hex values, an 'Image' section with a scatter plot of processed features, and a 'Processed features' section with numerical values. The 'Summary' table shows:

CATEGORY	COUNT
Fan	0
Mouse	0
Pen	0
Watch	0
uncertain	1

The 'Detailed result' table shows:

	FAN	MOUSE	PEN	WATCH
classification 0	0.42	0.20	0.25	0.14