IE 417

Embedded AI

Lab: 03: Indoor Classification with Object Detection

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Introduction

This project uses the OV7670 camera module and Arduino Nano 33 BLE Sense to classify indoor scenes, like kitchens and bathrooms, on a microcontroller. By capturing images and applying transfer learning with TensorFlow Lite for Microcontrollers, we'll deploy a compact model for recognizing indoor environments on limited hardware. This lab demonstrates how to bring basic computer vision to small devices.

Data Collection

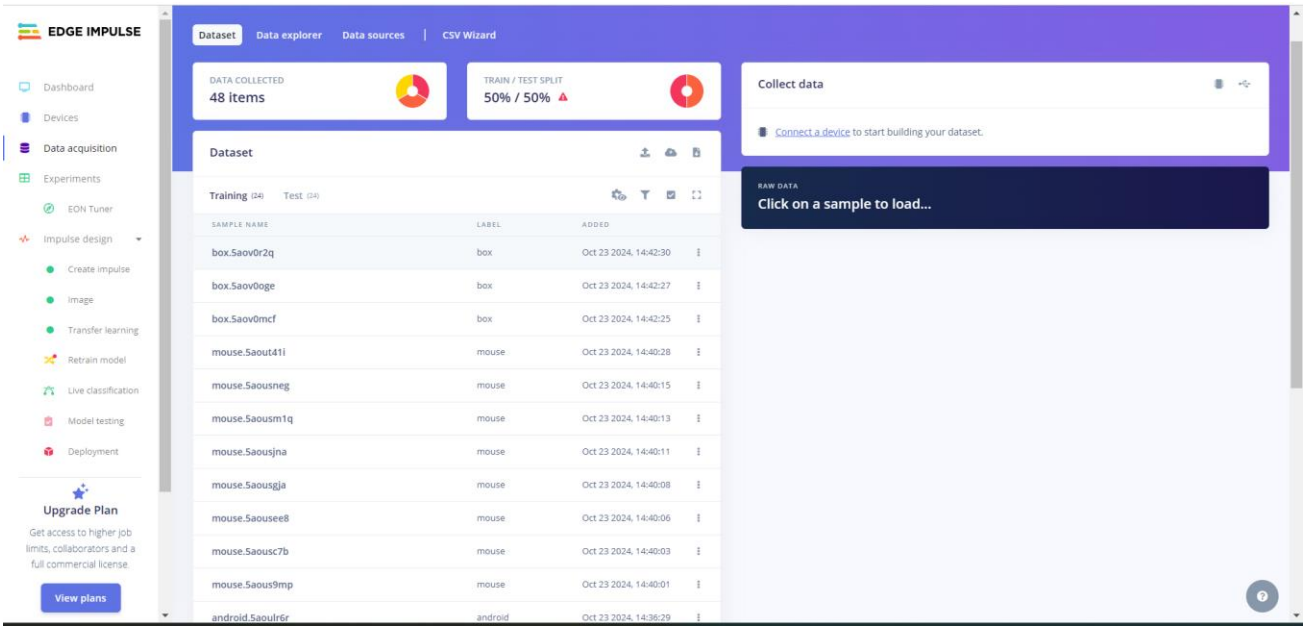
Indoor Classification with Object Detection

In this project, we use the Arduino Nano 33 BLE Sense and OV7670 camera module for indoor scene classification, focusing on detecting specific objects like a box, an Android device, and a mouse. Using TensorFlow Lite for Microcontrollers (TFLu), we apply transfer learning to classify these objects in indoor environments, enabling microcontrollers to perform basic object detection in real-world settings.

Steps for Data Collection:

- **Sensor Data**: Images were captured with the OV7670 camera module.
- **Objects Detected**: Three objects were identified for classification—box, Android device, and mouse.
    - **Box**: Identified to signal the presence of storage items.
    - **Android Device**: Detected to differentiate personal devices in a scene.
    - **Mouse**: Used to recognize workspace items, aiding in workspace classification.

This project highlights how to capture and classify indoor scenes using limited resources on microcontrollers.

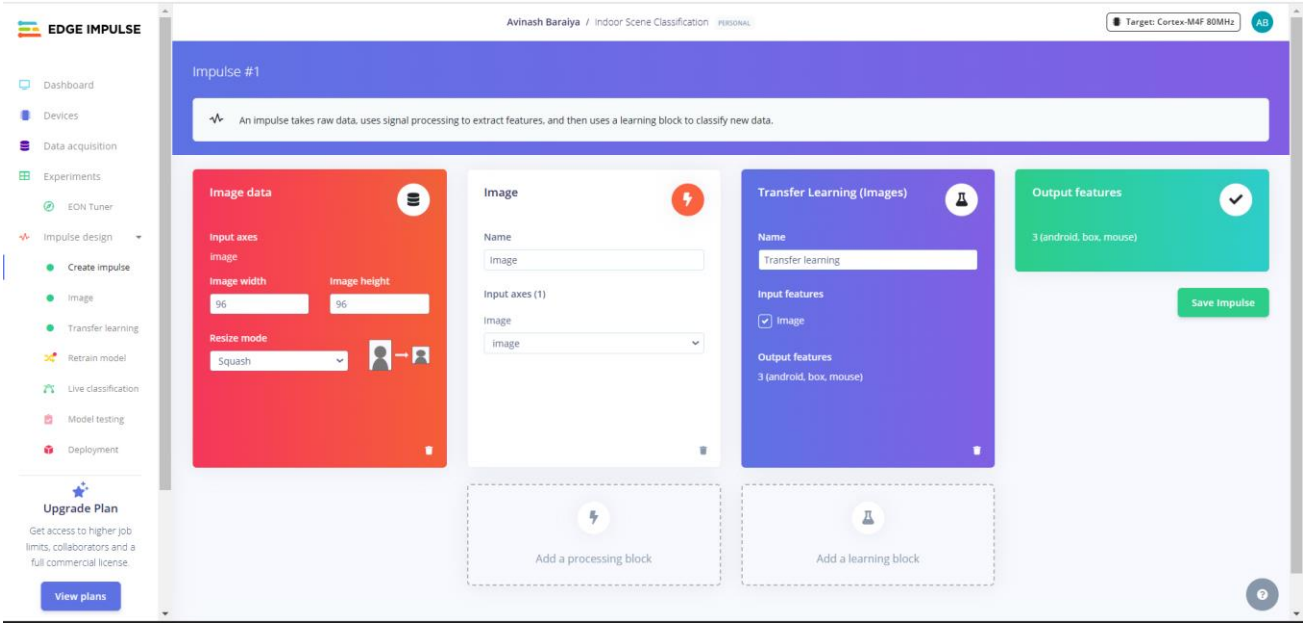


- **Impulse Creation**

Learning Block: Transfer Learning(images)

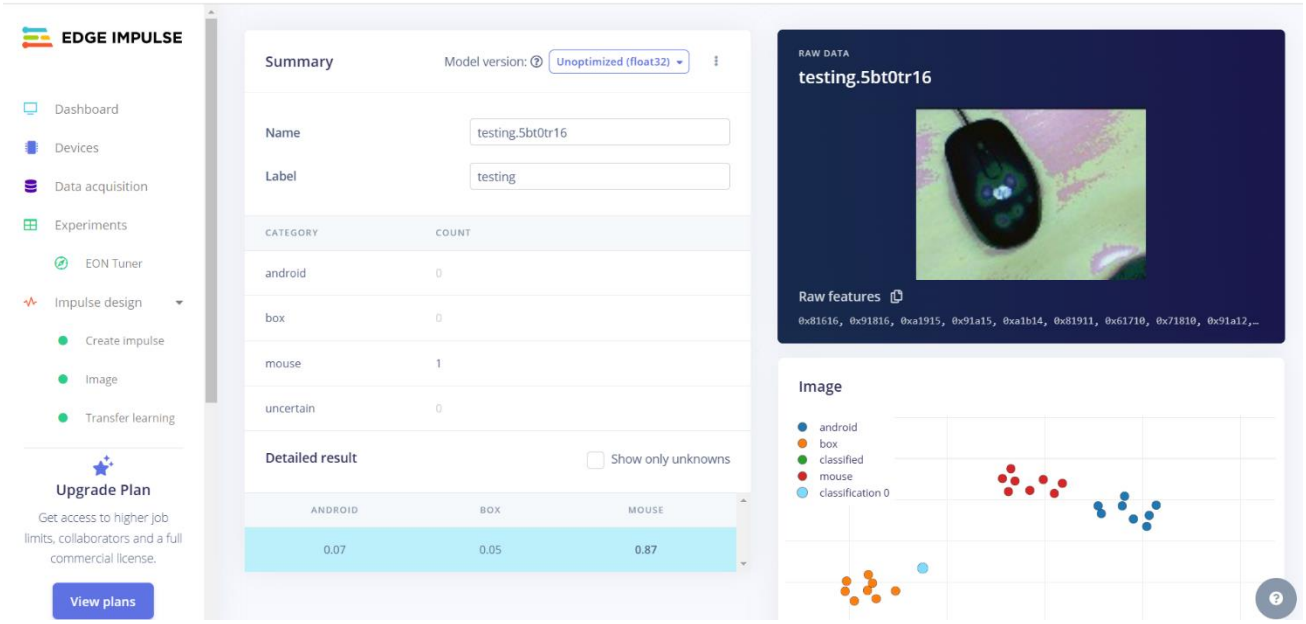
Input Features: Image

Output Features: Android | Box | Mouse

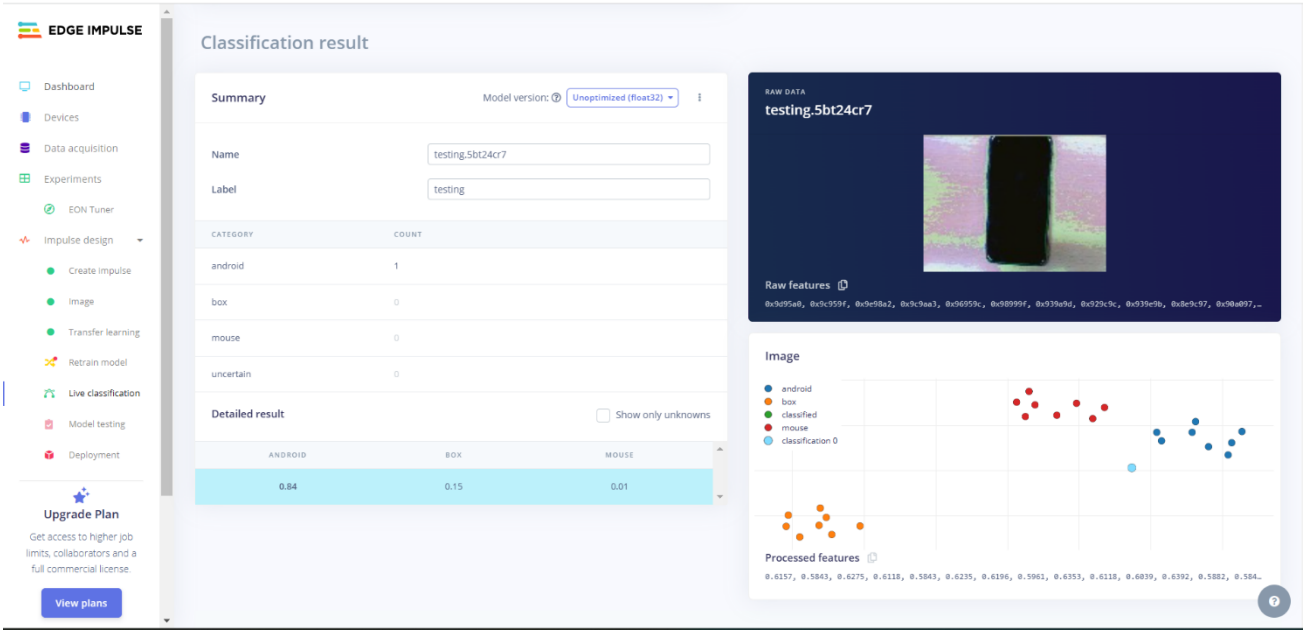


- ## Classification and Testing Results

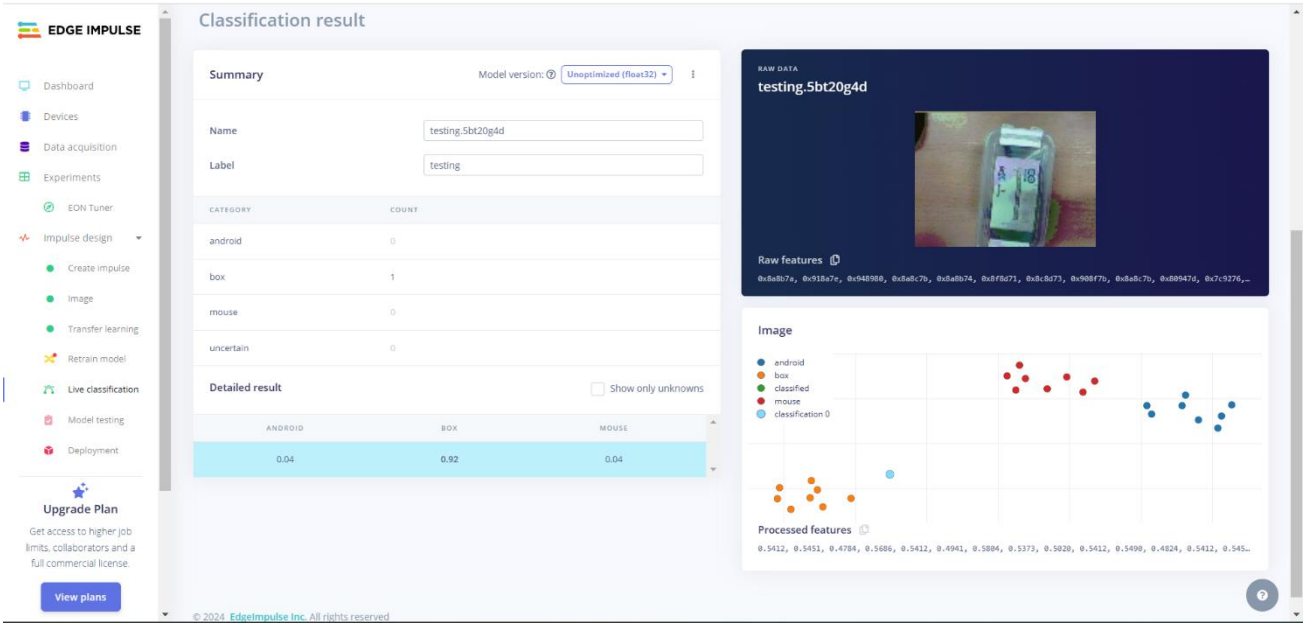
1. Mouse Sample Taken by Arduino and it correctly Predicted with value **0.87** that it is **Mouse**



2. Mobile Sample Taken by Arduino and it correctly Predicted with value **0.84** that is **Android**

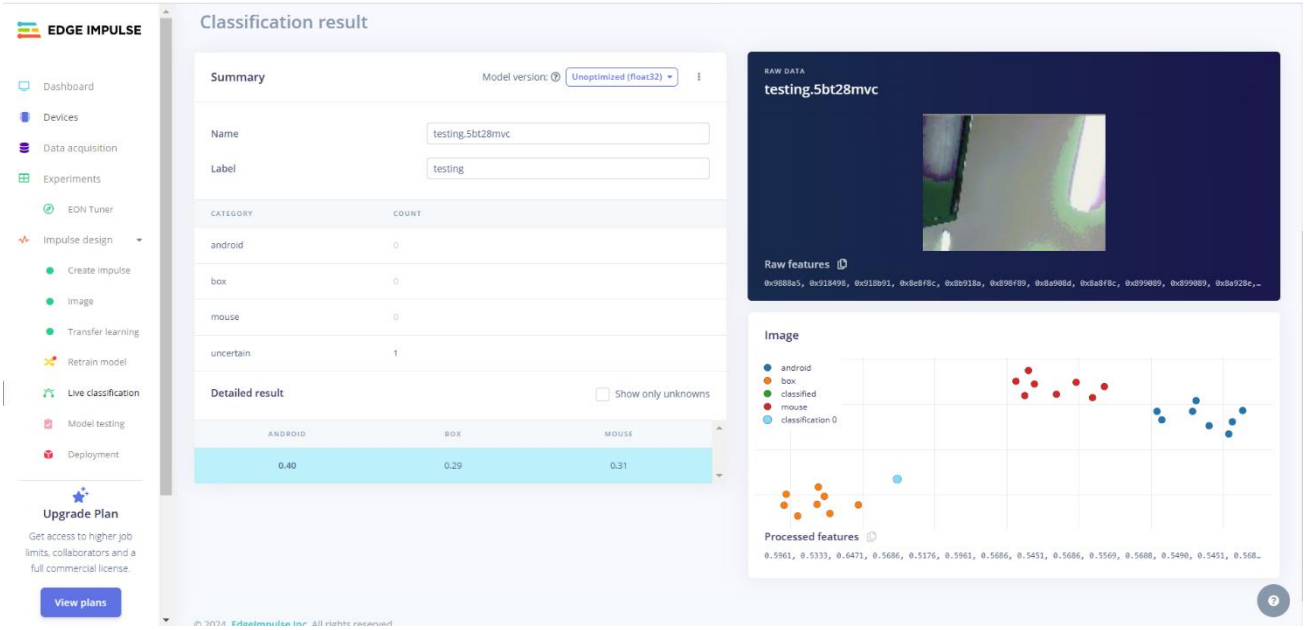


3. Box Sample Taken by Arduino and it correctly Predicted with value **0.92** that is **Box**

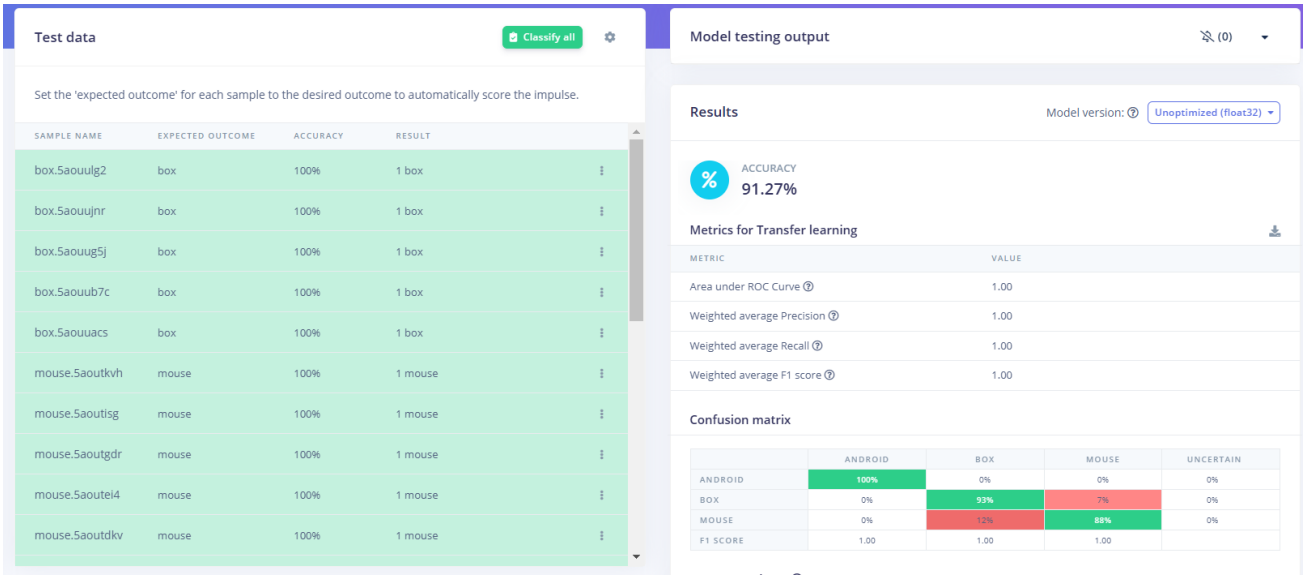


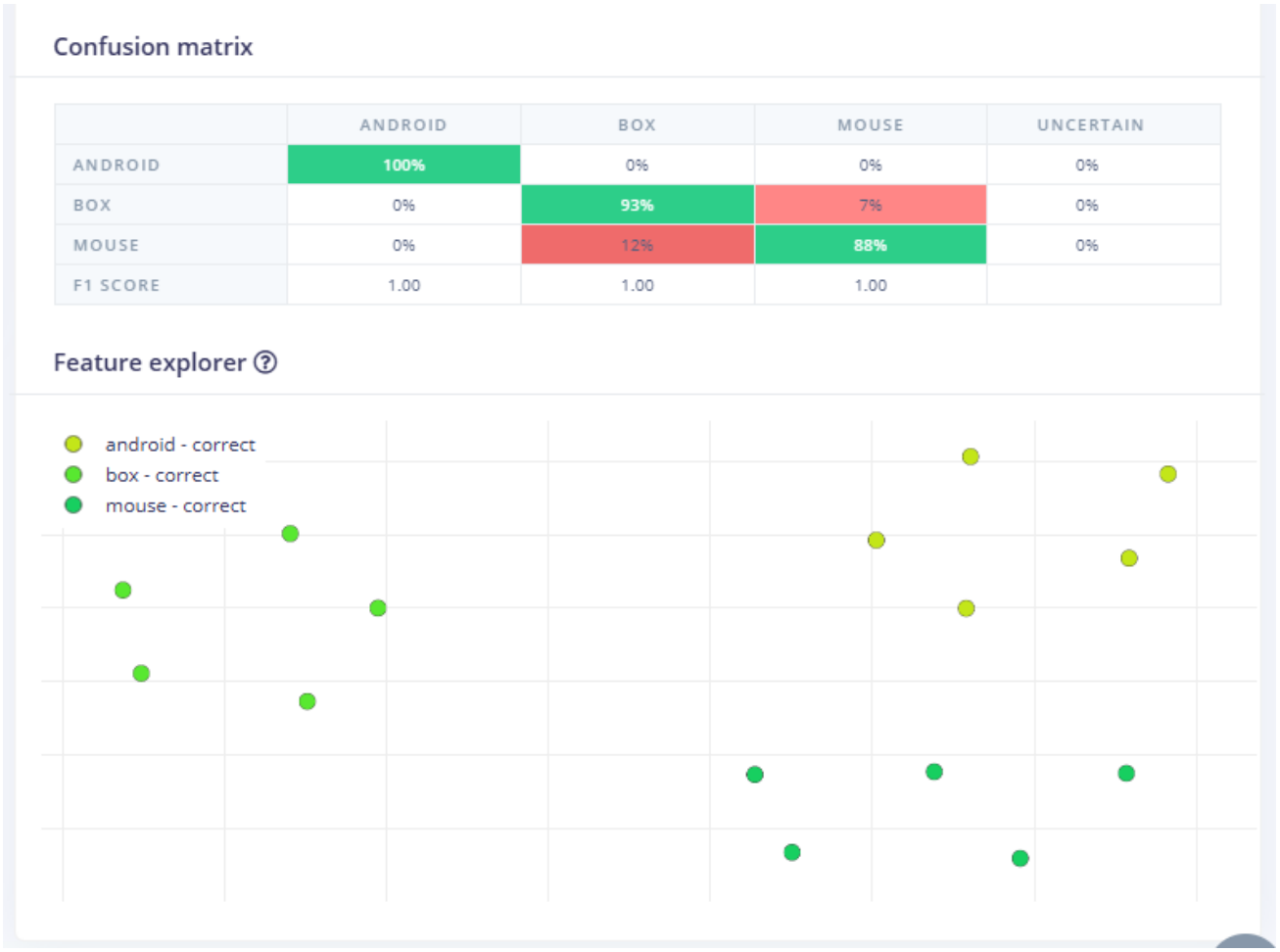
4. Random Sample Taken by Arduino and it correctly Predicted **Uncertain.**

Android – 0.40 | Box – 0.29 | Mouse – 0.31



Testing Data:





- **Code Implementation**
  https://drive.google.com/drive/folders/1WiqxxtDulSYp1AO4rWOd3ulTBMM56kAC?usp=sharing

- **Practical Video Link**

  Part 1: https://youtu.be/fFQpoj-ub_g

  Part 2: https://www.youtube.com/shorts/BTtuHPeYFQE