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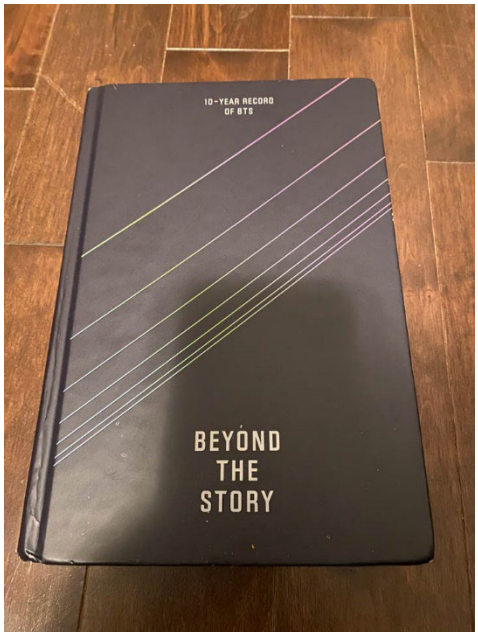
CART451: Networked Media Studio

Assignment 02

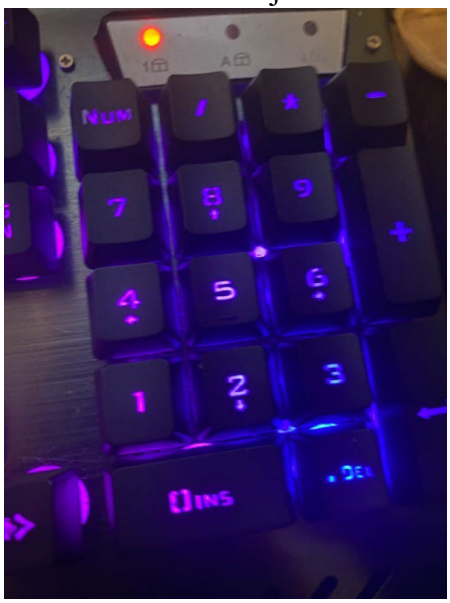
Part A

1. The image datasets created for the assignment were three image folders of a corgi plushie, a book, and random objects. I took 50 images for each object. I decided to use these objects because I could take a variety of interesting pictures with them (e.g., showing different pages of the book.)

   Here is an image of the corgi plushie: Here is an image of the book:

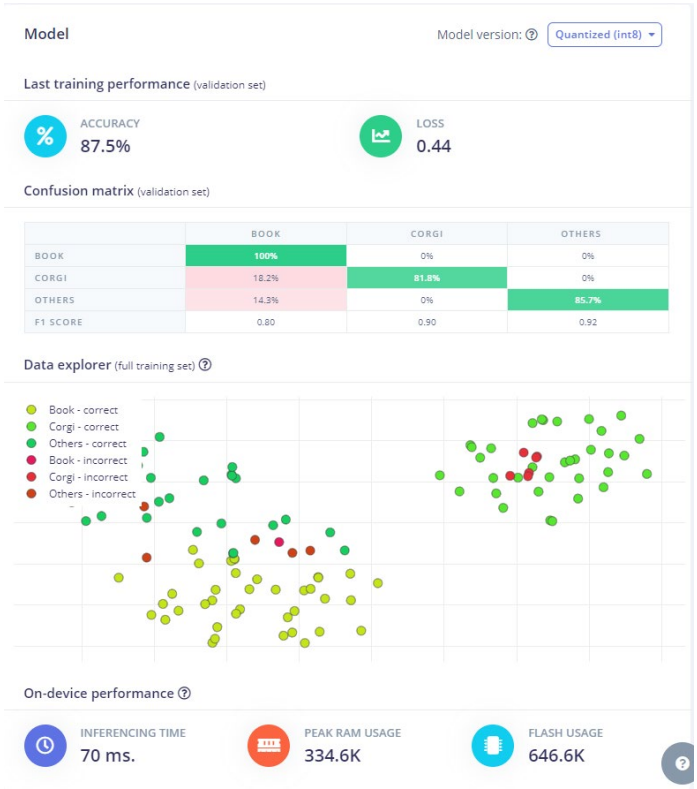


   Here is one of the objects in the others folder:

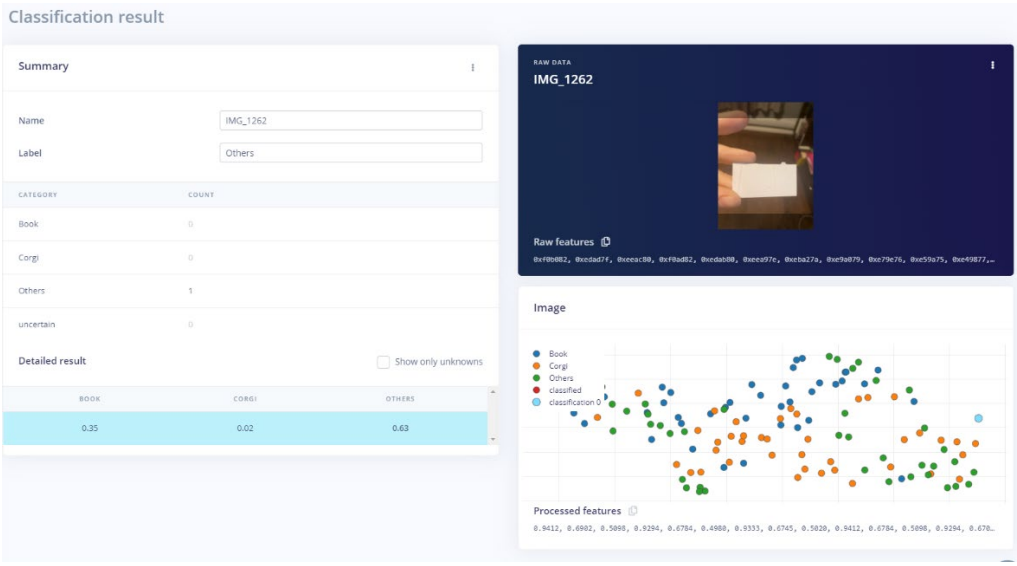


2. For this assignment, we are asked to create an image detection AI model to put objects into their specified category.
3. These are the steps used to train the model:
    a. First, I created an account on Edge Impulse
    b. I added a device that can access the training models.
    c. I uploaded the image folders of each object, plus a third folder named Others with 50 pictures of random objects, all folders had the option of dividing their content for training and testing (i.e., 80% of images of each folder were used for training and 20% were used for testing), I also added labelling on each object.
    d. After uploading the images, I created an impulse for the model.
    e. After creating the impulse, I ensured the raw images were on RGB and then generated their features.
    f. Once their features were generated, I selected neural network settings and a model and then started training the object detection model. For this model, I used the *MobileNetV2 96x96 0.35* (final layer: 64 neurons, 0.5 dropout) neural network architecture.
    g. After transferring images into the model, I enabled EON Tuner and selected the most accurate architecture that does not exceed the performance limits of the model. I selected the *rgb-mobilenetv2-8de* with 88% of accuracy.
    h. After selecting the architecture, I retrained the model.
    i. Once retrained, I did a live classification by loading several samples from each image category.
    j. Once I tested the image samples, I did the model testing to verify the model's accuracy.
4. The model had very good results in terms of accuracy after the model testing (i.e., 90% accuracy). However, the model is not precise due to its lack of clustering. The model can distinguish the images and put them in the right category regarding its recall. During the model testing, the model was uncertain about the category of the images for 10% of them in the dataset.
5. Generated feature clustering:

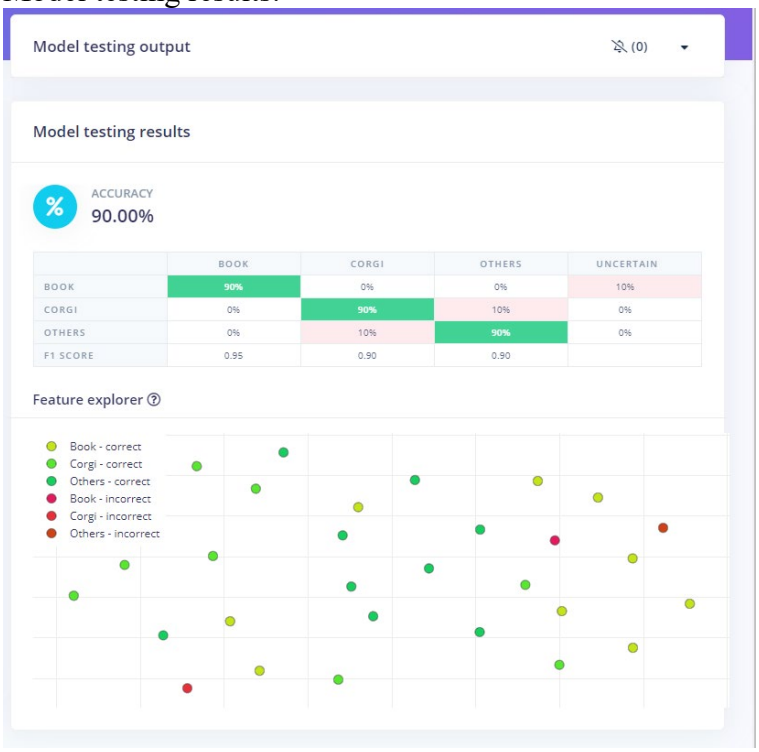
Initial trained model:



Live classification:



Model testing results:



The accuracy of the model increased during the model testing. The clustering was very bad, regardless of the model training stage. Most of the data is spread out. The only step in the process where the clustering is a bit more defined in the initial model training.

6. Better is about accuracy, precision, and relatively tight clusters. It is when the model can distinguish the images and associate them with its specified label. This model could improve its clustering because the data was always spread out in the

graphs. Choosing another neural network architecture and a more accurate EON Tuner architecture could help improve the model's precision.

Part B

1. I used Pat's image dataset for the second part of the assignment. This dataset contained three object folders: fork pictures, pin pictures and miscellaneous items. Each folder contained 50 images. Pat had the generosity of sharing their images with our group, so I used their dataset for the assignment. Because I do not know any Pat images, I decided to use the fork and miscellaneous items folders from Pat's dataset, so I am sure I am not biasing any results. I combined them with my corgi image folder because the colour tones between the fork and the plushie are similar (or at least in the same range of colour), so it could add a layer of difficulty of recognition for the trained model.

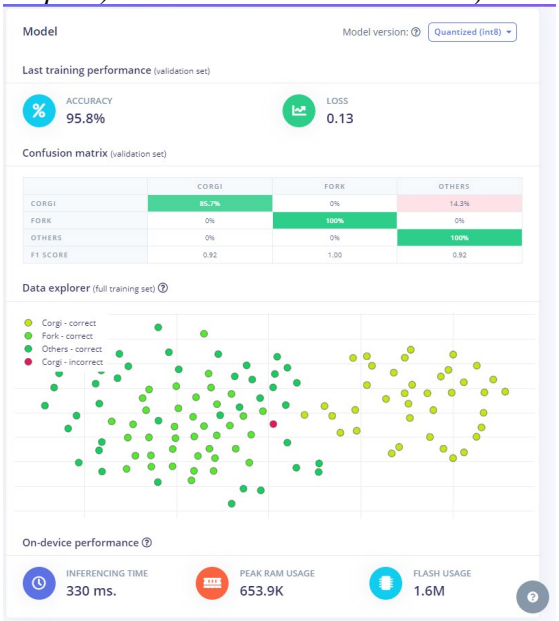
Here's an image of the fork:

Here's an image of the corgi plushie:

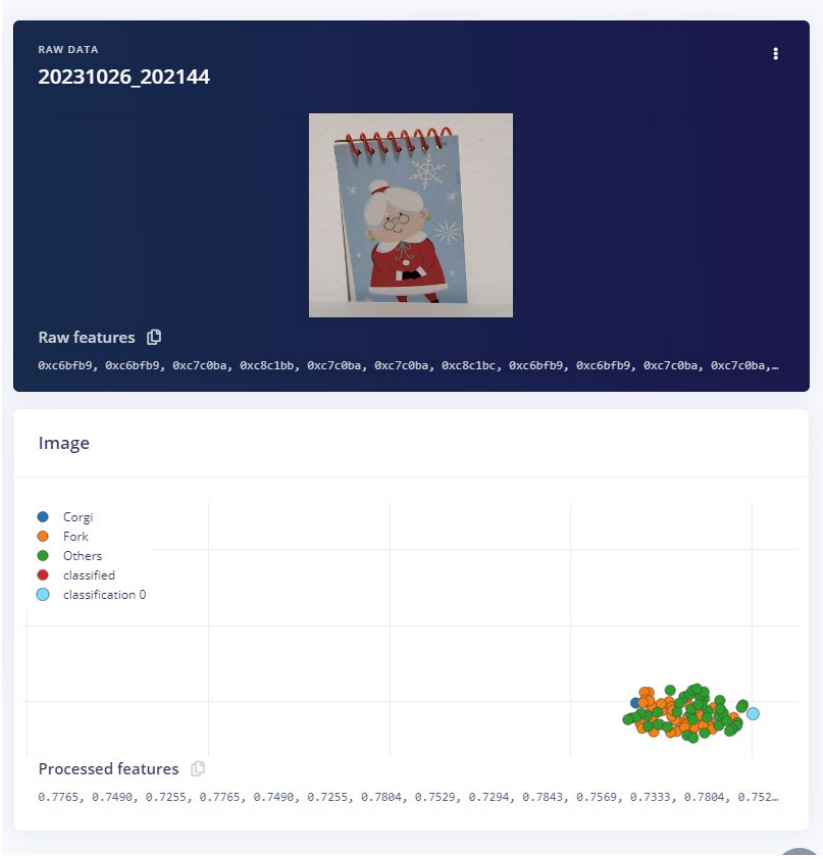
Here is one image from the miscellaneous items folder:

2. For this part of the assignment, the goal was to train a model by using someone else image dataset and verify if there are any issues within both datasets while generating with unknown images. It allows us to verify any biases in the previously trained model and ensure that the images from both datasets provide accurate or reliable results.
3. Overall, the model is highly accurate (95% for the initial trained model and 90% for the model testing results). The precision of the model shifts at all stages of the training; some results show very tight clusters, and others spread out data. It is sure that the model is still imprecise. The model can distinguish the images and put them in the right category regarding its recall, but it was still uncertain about 18% of the images in the dataset during the model testing phase.
4. Generated feature clustering:

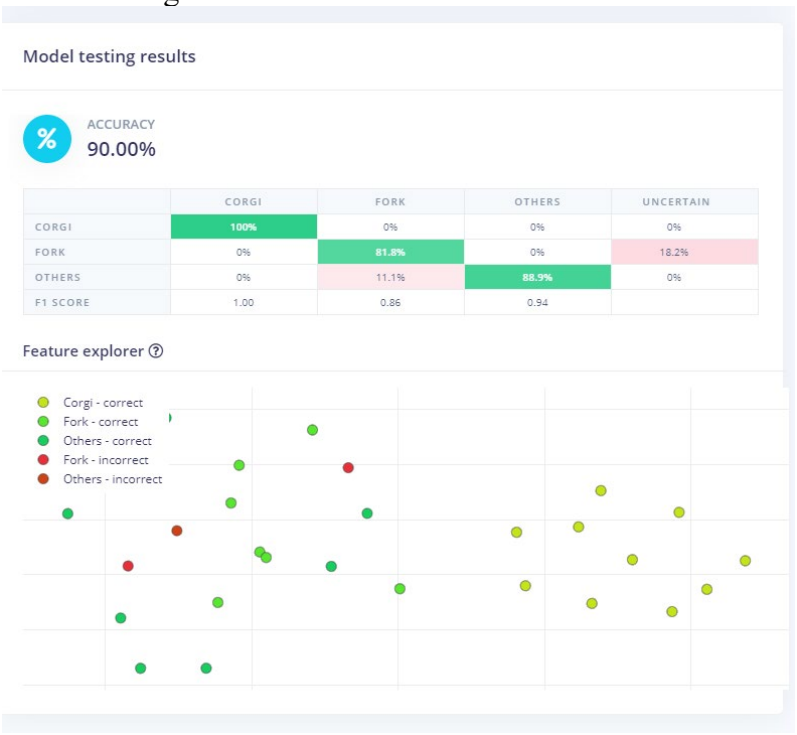
Initial trained model (used *MobileNetV1 96x96 0.25 (final layer: 64 neurons, 0.5 dropout)* neural network architecture):



Live classification (used *rgb-mobilenetv1-cc8* EON Tuner architecture):



Model testing results:



From the results of the graphs, the model's accuracy decreased when the model was used on the testing images. The clustering is very tight in the live classification. There are a lot of overlaps between the data. However, the data is spread out on the initial trained model; no clustering occurs. The generated features are the only well-balanced clustering in this trained model.

5. This model performed better in precision and accuracy. The results in the model training and model testing were highly accurate, which was not the case in the model in Part A. Some tight clustering happened at certain stages of the training, which was not the case in the Part A model. However, the recall of the trained model in part A was better than this model. The model in part B was 18,2% uncertain about the images in the dataset during the model testing while the one in part A had only 10% of uncertainty.

Part C

I think this type of object recognition model can be used to collect data about the fauna of a forest and see if there's a risk of endangered animals within the environment. For example, if we do not detect many beings of a certain species, it can be an indicator of threat for this specific specie.