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CART 451

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Exercise 1

1. Please provide a description of the initial data set you brought to class. What were the objects, how many … and why you chose those specific objects. Provide an image of each distinct object.

My two distinct objects were a painted calavera (*skull* in Spanish, and specifically refers to Mexican skull representations during The Day of the Dead celebrations) pottery and a commercial sewing pattern of a simple long sleeve t-shirt on paper. Apart from the two sets of 50+ pictures of those specific objects, another 50+ pictures set of random objects, ranging from water bottle to sunglasses and lipsticks shot in multiple angles. I first chose the calavera because I thought it would be a challenging object to distinguish for a machine. The hummingbird on its forehead, its very bright colours contrasting with its representation of a human skull, which is usually white, made me think the computer would be more indecisive about recognizing it. However, no real skull or hummingbirds were put in the 'noise' picture sets, which in retrospect I realize should have been needed to really test that hypothesis. Its in a similar context that I chose sewing patterns as well, as I thought it would be challenging for a computer to distinguish a sewing pattern. However, because the 'noise' picture set were *too* random and irrelevant to my two chosen objects, I was not able to test that hypothesis. Real sewn clothes and other wearable products should have been added to the 'noise' picture set in order to test more robustly how well the machine could have distinguished between a real sewing pattern and something that looks like one.

Figure 2 Sewing pattern

Figure 1 Calavera

Figure 3 'noise'

2. What was the purpose of the task you were asked to do in class?
Through this exercise, we were meant to understand better the methods used to have a machine learn how to classify certain structured data such as images, into their respective categories or tags. This simple supervised machine learning exercise also made the nuances and challenges of such processes more visible and accessible for us to understand. Though transfer learning helped us through some limitations of having a small data set, we were still able to understand the implications of faulty or very limited datasets that infer on biased and overfitted models.

3. Describe in a series of steps what you did to complete the initial task in class
After taking a few pictures of all objects forming the different datasets, I uploaded the data unto the edge impulse platform, making sure to tag them with calavera/sewing-pattern/noise tag. By creating an impulse, we made sure all images had the same quantity of information by making them the same width and height (the same number of pixels), stated we were processing images and added a transfer learning layer to make our small datasets more usable and less faulty. We then trained the machine on 80% of our datasets so it could learn to predict classification of images. After training it, we were able to observe not only its accuracy through tables and statistics, but also test it via our own camera, showing different objects for the machine to predict what object it was seeing.

4. How well did your dataset do in terms of Accuracy, Precision and Recall?

The accuracy of my data sets was very high and culminated to 87% when testing. However, both object specific datasets scored 100%, whereas the 'noise' dataset scored 81%, meaning the machine was always able to predict accurately both calavera and sewing pattern, but some 'noise' pictures were not as easily predicted.
Precision and recall were also very high, because both object data sets were too dissimilar to all other 'noise' objects. Hence, all pictures that were tagged as 'sewing pattern' got the correct prediction, and all pictures predicting a calavera were indeed that object.

5. Take screen grabs of the graphs available through the Feature Explorer for both the training and test/ live classification sets. Discuss the graphs in detail.

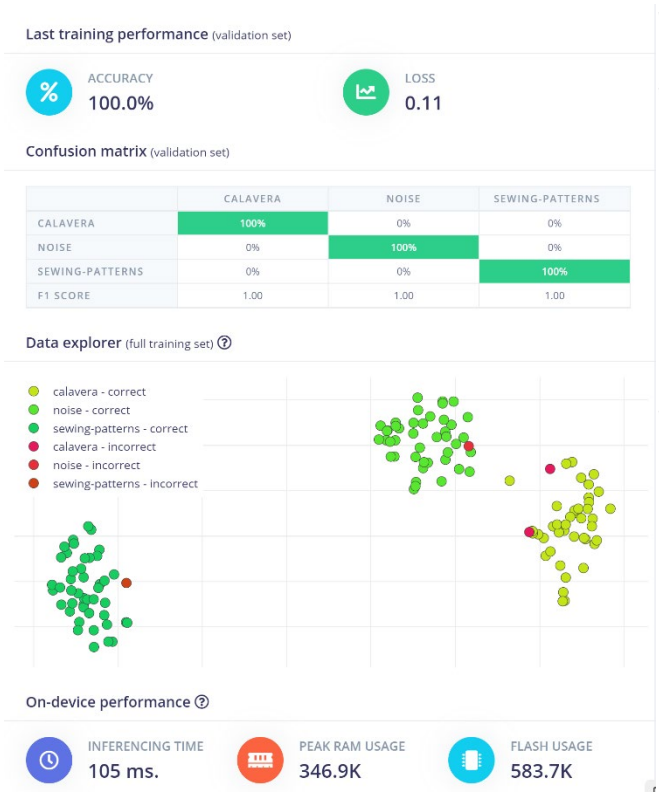

Figure 4 Training set

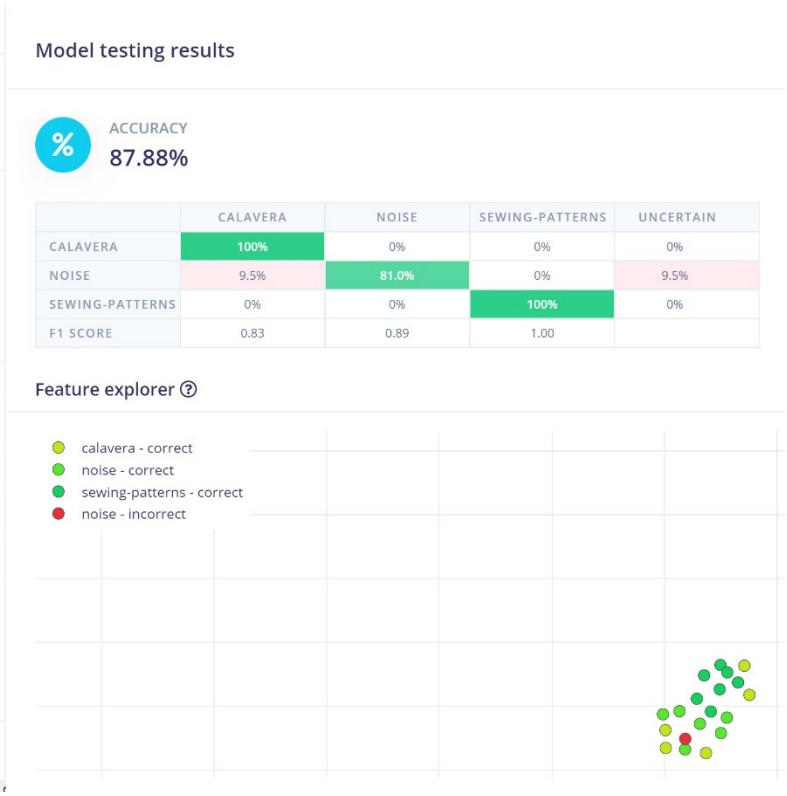

Figure 5 Testing set

In the training set, the accuracy rate was 100% and we can more easily understand why through exploring the graph. Indeed, both object specific sets were very well clustered together, however very far from each other. The 'noise' dataset was also well clustered, and arguably more closely related to the calavera set. Nevertheless, the graph indicates clearly that all three sets were too dissimilar which resulted in a 100% accuracy rate. The clusters, although well grouped within each other, were too far from each other, and so the computer was *too easily* able to distinguish between all objects.

6. Provide brief postulations for how you think you could get your model to perform better. What does better mean?

As mentioned in previous questions, adding more data to the 'noise' datasets that are similar but not the same as the two object specific datasets would have probably resulted in a more mitigated result. By adding other representation of skull, colourful or not, as well as a hummingbird, the calavera dataset would have probably had a lesser, more realistic, accuracy rate. As for the sewing pattern, adding sewn clothes, fabric pieces, and other garment-related objects would have also rendered the accuracy rate

more realistic. Having been *too* random with the 'noise' datasets, it made it so that the objects were *too* dissimilar to the object specific datasets and rendered the exercise rather obsolete.

Figure 8 Testing deployment, 'noise'

Figure 7 Testing deployment, sewing pattern

Figure 6 Testing deployment, calavera