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ECEN 631

16 February 2025

Image Classification

For this assignment, I wrote some code in PyTorch to classify Fish species and Oyster shells. For both tasks, I used the **ResNet50**: a state-of-the-art Convolutional Neural Network in image classification. It has approximately 25.6million parameters, making it capable of classifying images in a wide variety of tasks. Furthermore, I was able to start my model with pretrained weights from ImageNet, greatly reducing the training time for my specific tasks.

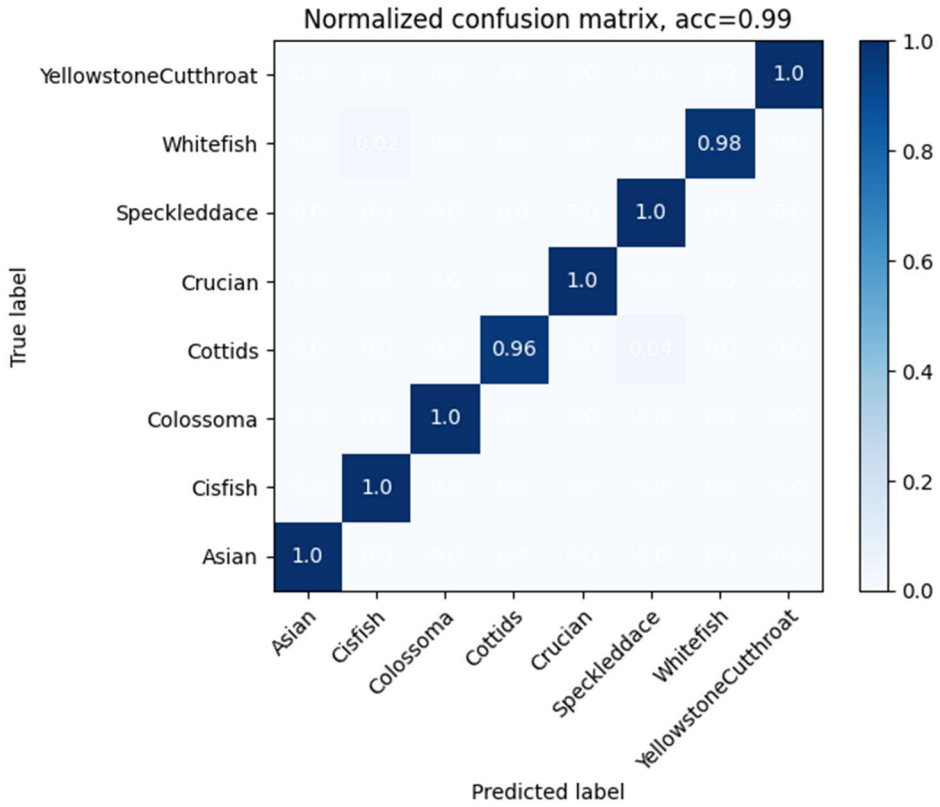
Additionally, for each task, I used torchvision.transforms to augment the training set. Specially, I randomly flipped the images with a 50% chance, randomly cropped and resized them, randomly rotated them, added small random color changes, and added small random translations. These augmentations expanded the training set and made the model more robust. Furthermore, I normalized the data for both the training and test sets to ensure consistency across training.

Here are some of the various hyperparameters I used for each task. To avoid having to perform a massive grid, most of the other

Loss Function	Cross Entropy
Learning Rate	0.0001
Epochs	10
Optimizer	AdamW

Task 1: Fish Species

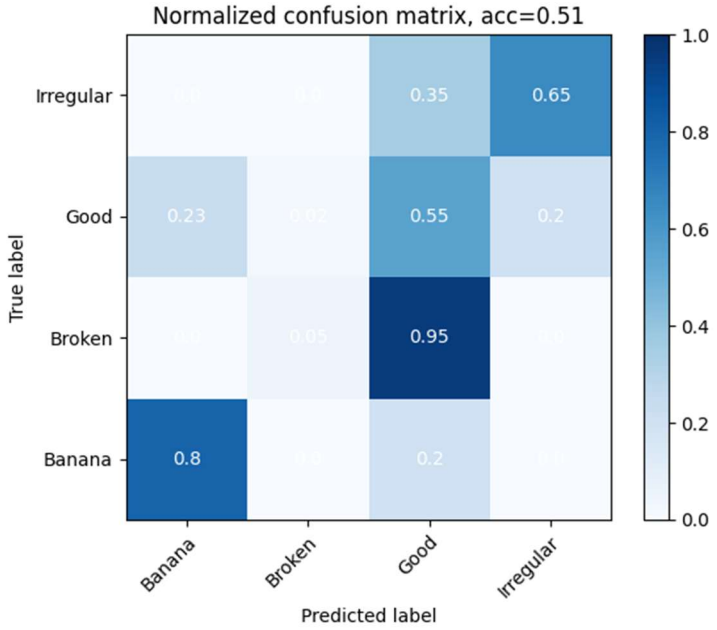
The ResNet50 worked very well for the fish species dataset, as you can see in the confusion matrix for the test set. The only problems we seemed to run into was that only 98% of the Whitefish were predicted correctly (the other 2% were classified as Cisfish) and only 96% of the Cottids were predicted correctly (the other 4% were classified as Speckleddace).



Upon further examination, here are two example images below. The left image is a Cottid and the right is a Speckeddace. It appears that both fish have similar colors, and relatively similar shapes. So, I can see why the model at times struggled to tell the difference between the two of them. Fortunately, the differnences are distinct enough that these inaccuracies only happened 4% of the time, and only as False negatives for the Speckleddaces.

Task 2: Oyster Shells

The ResNet50 did not work as well for this task. It appears that classifying the shape of oyster shells is much more difficult. This makes sense because the images are gray scale (which results in a loss of information). And, as a human, it is just more difficult to determine what shape each shell should classify as. The confusion matrix is shown below. The banana shells seemed to be the easiest to classify. But, hardly any shells were classified as broken, and it was a toss up between good and irregular shells.



Upon further examination, here are two example images. The left image is classified as “good” and the right one as “irregular”. The good shell seems to be slightly more smooth than the other. But, it is honestly quite difficult to tell the difference for me. The algorithm would have to notice subtle details about the texture and shape that an untrained eye just would not notice. This explains why this task was much more difficult than the last. The model did not fail; the task was just an inherently difficult problem.