Eren Berke Demirbaş – 0064627
Batuhan Yalçın – 0064274

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COMP 448/548 – Medical Image Analysis

Homework #3

Specify the platform that you used for your implementation.

In this implementation, we have utilized from Google Colab platform. As explained in the homework description, we chose GPU as hardware accelerator for training part. We have used Pyton as programming language and utilized from the library given in homework description (Pytorch library). While separating the files for valid data set, we took 10% of training data for each class.

1. **How did you make the input size compatible with the AlextNet network?**

From the paper of AlexNet network proposed by Krizhevsky, we found that AlexNet is trained with 224 × 224 × 3 input images. Since our images in the dataset are in the size of 256 × 256 × 3, we resized our transforms by 224. The command we have used for this purpose is the following:

transforms.Resize(224)

2. **How did you normalize the input?**

The inputs are normalized by using the normalization parameters used in pretrained AlexNet network. According to the Alexnet Pytorch documentation, we chose the following means and standard deviations **"mean=[0.485, 0.456, 0.406], std=[0.229, 0.224, 0.225]".** These parameters are used in **transforms.Normalize()** command.

3. **What parts of the AlextNet architecture did you modify?**

In AlexNet classification part, we did not change the initial layers which are pretrained. We only changed the last layer by replacing it with a linear transformation. The input size is chosen as 4096. The out feature of the final classifier(6) is chosen as 3 since there are 3 classes in our dataset.

4. **What loss function did you use in backpropagation?**

The cross-entropy loss function is used for backpropagation purposes. This function computes the entropy loss between input and target.

5. **How did you select the parameters related to backpropagation? For example, did you use any optimizer? If so, what were the parameters of this optimizer and how did you select their values?**

We have utilized from SGD optimizer given in the homework description. Learning rate is chosen as 0.001 and momentum is chosen as 0.9 as given in the paper of Krizhevsky. Also, these parameters are tested with different values, and these are considered as optimums.

6. How did you address the class-imbalance problem?

To solve class-imbalance problem, weighted sampling method is preferred. We have implemented an algorithm called **determine_weights_of_balanced_classes**. This algorithm basically computes weights for each class for each data type (training, test, and validation sets).

7. Additional Comments on Results

We observed the effect of normalization and addressing class-imbalance problem on our dataset. It was seen that the best test result is taken in both normalization and balancing applied run. In class-wise comparison, similar to homework 2, we got lower results for class 3. Furthermore, we got better results in test data set by applying just normalization in comparison to applying just normalization. This issue is also related to class 3 results.

	Training portion of the training set				Validation portion of the training set				Test set			
	Class 1	Class 2	Class 3	Overall	Class 1	Class 2	Class 3	Overall	Class 1	Class 2	Class 3	Overall
With input normalization and with addressing the classimbalance problem	0.882	0.835	0.667	0.890	0.800	0.807	0.655	0.866	0.773	0.757	0.644	0.842
With input normalization and without addressing the classimbalance problem	0.893	0.867	0.529	0.896	0.831	0.789	0.474	0.855	0.767	0.767	0.425	0.812
Without input normalization and with addressing the classimbalance problem	0.731	0.843	0.623	0.865	0.738	0.828	0.616	0.860	0.732	0.814	0.598	0.849