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Medical Image Analysis
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subject: Third Assignment

This document represents the report for the third assignment of COMP 548 - medical image analysis course.

Introduction This report aims to explain the steps involved in designing a convolutional neural network (CNN) classifier for colon tissue image classification using a pre-trained Alexnet network.

1 Implementation Details

For this assignment, we have used Google Colab as our platform. We uploaded the dataset to Google Drive and have used it by mounting the drive in our code. We have divided the training dataset into train and validation sets. The validation set consists of 30% of the training data. In the following, we will answer the questions in the assignment PDF and provide a table of our results at the end.

1.1 Input Size

We have used the transforms.Resize((224, 224)) transformation to resize the input images to the size expected by AlexNet, which is 224x224 pixels. This ensures compatibility between the input size and the network architecture.

1.2 Normalization

We have used the transforms.Normalize transformation to normalize the input images. The normalization was performed using the mean and standard deviation values specified in the transformation. The mean and standard deviation values used in the code are standard values used for pre-trained Alexnet networks.

1.3 Network Modification

Alexnet is designed to classify 1000 images; its output is a 1000-sized vector. In the assignment, we have only three labels. For this purpose, we have modified the last layer of the AlexNet architecture. Specifically, we replaced the last fully connected layer with a new linear layer with three output features.

	Training				Validation				Test set			
	class 1	class 2	class 3	overall	class 1	class 2	class 3	overall	class 1	class 2	class 3	overall
1	93	95	93	97	83	75	65	85	90	79	74	90
2	100	97	93	98	92	88	74	92	93	89	75	93
3	85	89	93	94	90	67	50	82	81	81	69	88

1.4 Loss Function

We have used the cross-entropy loss function in backpropagation, a popular loss function in classification tasks.

1.5 Backpropagation Optimization

We have used stochastic gradient descent (SGD) as the optimizer for backpropagation. The parameters used for the optimizer are learning rate (lr=0.001) and momentum (momentum=0.9). These parameter values were selected based on empirical observation and experimentation.

1.6 Class-Imbalance Problem

To address the class imbalance problem, we used class weighting. i.e., Assigning appropriate class weights during the model training process. For this purpose, we used the compute_class_weight() function from scikit-learn.

2 Results

You can find our results in the given table. numbers 1, 2, and 3 correspond to the following:

1. With input normalization and with addressing the class imbalance problem.

2. With input normalization and without addressing the class imbalance problem

3. Without input normalization and with addressing the class imbalance problem