

Assignment 1 (Microscopy Image Classification)

Worth 10% of total weight

The goal of this assignment is to familiarize participants with microscopy image classification. With this exercise the students will learn:

- (1) How to deal with large images
- (2) How to use pre-trained CNN models to your own dataset
- (3) How to use multiple image channels as inputs to pretrained CNN model
- (4) Learning about the pros and cons of traditional vs. deep learning methods for image classification.

You need to download these [images](#) for this assignment.

Question 1 (30%).

Data preparation. This is binary image classification problem. Randomly split 113 images into training (70%), validation (20%) and test (10%) sets. Note that each image name suggests its tag - positive or negative. Then tile large images (only in training and validation sets) into smaller, possibly overlapping patches. Tag these patches as negative/positive according to its origin. Possibly make use of PyTorch's `torch.utils.data.DataLoader`.

Training. Choose a pre-trained model of your choice. Finetune the model on training set. In your report you will include training loss, validation loss, training accuracy and validation accuracy versus training epochs. Make use of tensorboard for this purpose. Save trained model.

Testing. Load test model and apply it on test images. Note that you need to tile test images and apply trained model on these patches. Classify a test image as positive (negative) if majority of the patches are classified as positive (negative). Include test accuracy in your report.

Question 2 (40%).

Modify your training and testing modules and models in question 1 to include multi-resolution input. For multi-resolution input to CNN, make use of Skimage's Gaussian pyramid construction. Feed patches of three different resolutions to the CNN to classify them. Note that instead of 3 channels, now you are feeding 9 channels to CNN. Describe your strategy handle this multi-channel input using a pre-trained model capable of handling only 3 channels. Once again include training loss, validation loss, training accuracy and validation accuracy versus training epochs in your report. Also report test set accuracy.

Question 3 (30%).

Read this [paper](#) to learn about the origin of this image classification problem. Now discuss within 300 words advantages and disadvantages of applying deep learning to this problem over the traditional method that the paper uses.