Special Topics: Deep Learning
Sheet 1   —   COMP 499/691
Assignment 3

Due Date: April 21

Submission: Submit a pdf of your written answers and code and output from programming portions. You will also submit a runnable ipynb (single file) including all answers to programming portions of the questions.

Note: The assignments are to be done individually. You may discuss ideas regarding questions with others but should not share answers. List the names of anyone you have extensively discussed a question with at the top of your final submission.

1. (a) We will use the MNIST and SVHN datasets provided by pytorch torchvision modules. A base CNN model architecture to use in this exercise is provided in the starter package:
   `https://colab.research.google.com/drive/13OPzfcPI9K9sskoGBetFokC4WnOIcmX3?usp=sharing`. For training in these excercises the suggested batch size is 128, optimizer Adam with learning rate 1e-3 and 20 epochs. However you may adjust these as appropriate or desired. In questions (b)-(d) show the training curves and final test accuracies for both datasets. For (b)-(d) convert the SVHN dataset to grayscale to allow using the same base network, while in (e) use the full color version of the dataset.

   (b) (10 points) Train each of these datasets individually using 20 epochs and evaluate it on each.

   (c) (20 points) Now train the model in the multi-task setting with a shared network. You should add for each task a "head" which consists of a 1 hidden layer network: meaning one linear layer + non-linearity+ final project to 10 classes. During training to construct the batch of size 128 sample sample half from SVHN and half from MNIST. You can use a separate dataloader with batchsize 64 for each to accomplish this. Evaluate the model on both datasets

   (d) (45 points) We will use a triplet loss to train models that allows learning a meaningful distance metric between two domains. In this question we will use this to map MNIST and SVHN digits to a joint representation. The rest of this question is described in the starter code.

2. (a) (25 points) Show your interpolations and code from `https://colab.research.google.com/drive/1zyGQrlJOfOGPzWiJ_pSs-JXOqruJ5-HN?usp=sharing`. N