Akshay Kamath Individual Report

1) Introduction -

The initial idea was to try and build models across different frameworks. Keeping all other hyperparameters constant, we wanted to see if results could be reproduced across different frameworks. I chose to work on Caffe.

2) Description of your individual work, Describe the portion of the work that you did on the project in detail.

For using the Caffe Framework, the data needs to be in a database. Formats acceptable are LMDB, & HDF5. Our dataset was initially in a *.mat* format.

The files were of MATLAB3 format. I tried using MATLAB to convert the *.mat* files to MATLAB7.3 format since I read that this version can be used in Caffe as an HDF5 database. Caffe needs data in **[batch_size, channels, height, width]** format. The data in the *.mat* file was in **[height, width, channels, batch_size].** I used the permute function in MATLAB on the image matrices and saved the results in a MATLAB7.3 version file. I found that this transformation was not working. I eventually found out that MATLAB files can be read as Numpy arrays in python. So, using the Scipy.io package in python, I managed to read the files in python. Since we had 3 datasets (Training, Testing & Validation) we decided to group them together into one single dataset. I then helped preprocess it, (i.e - reshuffled the data, split it into train and test, used histogram equalization to improve the contrast of our images) & exported the outputs into test and train *.mat* files.

In order to convert the processed *.mat* files to a LMDB database format, I needed to convert the arrays to images *.jpg* and save it in the following file folder structure.

| root/train/label_0/img0.jpg |
| root/train/label_0/img1.jpg |
| root/train/label_1/img0.jpg |

I used the PIL (Python Imaging Library) for this very process.

Then using Dr. Jafari's 03-CreateLMDB.py code & tweaking it a bit, I created LMDB databases for the Train and Test sets. These databases were then used in a CNN architecture to train the model.

3) Results. Describe the results of your experiments, using figures and tables wherever possible. Include all results (including all figures and tables) in the main body of the report, not in appendices. Provide an explanation of each figure and table that you include. Your discussions in this section will be the most important part of the report.

4) Summary and conclusions. Summarize the results you obtained, explain what you have

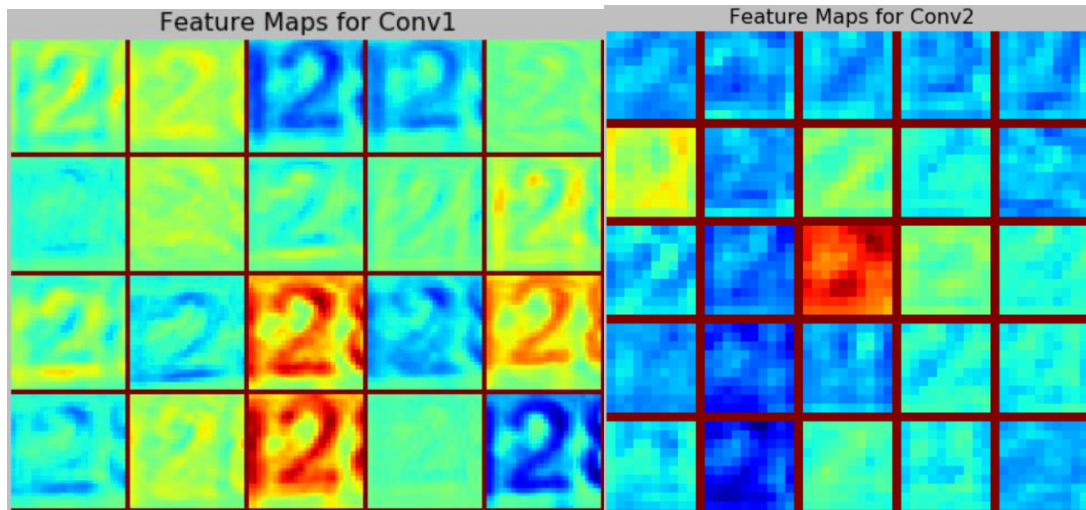learned, and suggest improvements that could be made in the future.

Initially, I had used Dr. Amir's solver files check if my model was executing correctly. On executing that I figured that the losses were all over the place & the accuracy was really poor. I then modified the train_test &

solver files with a different set of layer combinations and hyperparameters. However, the model accuracy was still pretty poor.
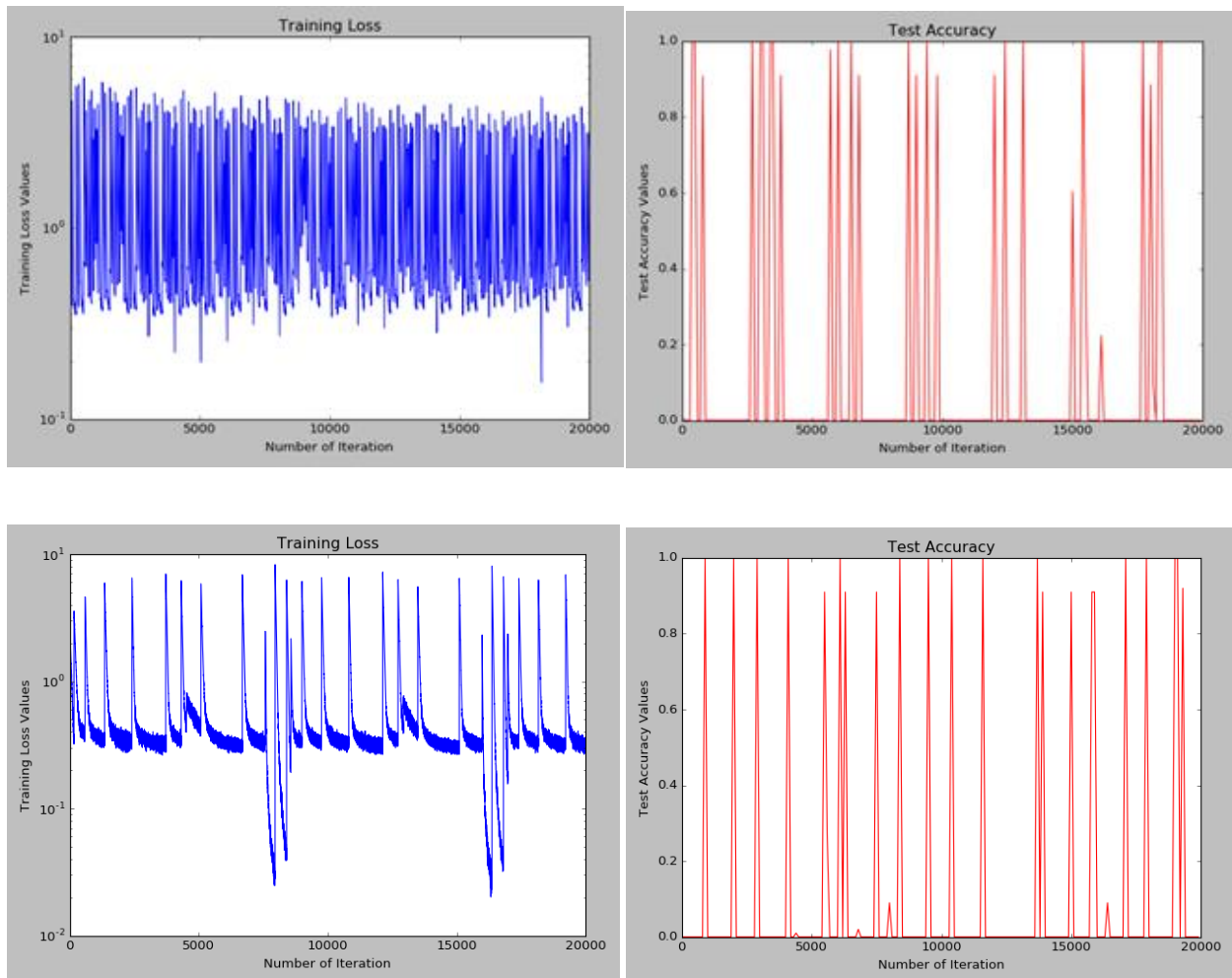
As we can see, the initial graph on the bottom left has losses that tend to drop over time, but when a new batch enters the model, the loss tends to go up high. This was a bit baffling to me as well. After having a chat with Dr. Jafari, we came across 2 scenarios.-

- The data was perhaps not loaded correctly onto the LMDB. However, after debugging the code which created the databases, we concluded that the LMDB was created correctly.

- According to the Caffe documentation, I had rescaled my dataset from the range of 1-255 to 0-1. However, this in not really Normalization. It is just rescaling the values. In order to **correctly** normalize the datasets, I needed to add a LRN layer (to do a batch normalization) to the batch_size.

Feature Maps for Conv1 | Feature Maps for Conv2

5) Summary and conclusions. Summarize the results you obtained, explain what you have learned, and suggest improvements that could be made in the future.

Caffe Community is pretty sparse as compared to some other frameworks. Help is not easily available, and the documentation is not too informative. Being built run on top of C++, it is a bit clunky to use. However, being built on C++, the execution time is extremely low as compared to some other frameworks.

6) Calculate the percentage of the code that you found or copied from the internet.

I've used 3 files to build this model.
01_DataManipulation - I've written all codes by myself apart from the Image Histogram Equalization bit.
02_LMDBCreator – Referred Dr. Jafari's code to create LMDB files.
03_SVHNCaffe – Referred Dr. Jafari's code to test the models.

7) References.

http://caffe.berkeleyvision.org/tutorial/
https://github.com/BVLC/caffe
https://github.com/amir-jafari/Deep-Learning/blob/master/Caffe_/3-Create_LMDB/create_lmdb_tutorial.py#L133
http://caffe.berkeleyvision.org/tutorial/net_layer_blob.html