

# Summer Training Program for Deep Learning

## Programming Assignment 1

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### 1 Problem Description

In this programming assignment, you are expected to implement a deep neural network (DNN) to recognize hand-written digits. You need to complete the simple classifier which we already handled a lot of works such as data pre-processing, visualization, etc. The provided source code can be executed and produce a preliminary results. The data we use is MNIST. The MNIST database [1] of handwritten digits, has a training set of 60,000 examples, and a test set of 10,000 examples. The digits have been size-normalized and centered in a fixed-size image. Things you need to do is modify the source code we provide so that it can generate a higher accuracy. You can try different width and depth of DNN and observe the output of each layer.

### 2 How to install Keras

In this work, we recommend you to use Keras since it is really convenient to build a DNN. Here is the guide for Keras installation [2]. You can install Keras from PyPI:

```
$ sudo pip install keras
```

### 3 How to run the sample code

In this sample code, we use Keras based on Theano [3]. You can run the program by this command:

```
$ python mlp.py
```

It will train the DNN model first and get a accuracy on testing data. Moreover, this program will use t-SNE [4] to do dimension reduction of the output of each hidden layer and output layer and visualize them. If using GPU acceleration, the program will be finished in five minutes. If you don't have GPU resources, please remove the line 4 in this program and you can also finish this task by CPU in a reasonable time.

## 4 Reminder

- If you need a account on workstation, please contact with teaching assistant, Yang-De Chen, [sacredzaro@gmail.com](mailto:sacredzaro@gmail.com).
- If you have any question, please feel free to contact us or post it on Facebook group.

## References

- [1] MNIST database  
<http://yann.lecun.com/exdb/mnist/>
- [2] Keras installation  
<https://keras.io/#installation>
- [3] Theano  
<http://deeplearning.net/software/theano/>
- [4] sklearn t-SNE  
<http://scikit-learn.org/stable/modules/generated/sklearn.manifold.TSNE.html>
- [5] Keras mnist mlp example  
[https://github.com/fchollet/keras/blob/master/examples/mnist\\_mlp.py](https://github.com/fchollet/keras/blob/master/examples/mnist_mlp.py)