

1 Introduction

The aim of this project is to implement different conventional classifiers to achieve hand-written digits recognition. The whole pipeline is described in the following section.

2 Classifiers

SVM Implement linear SVM on MNIST dataset. You can use any online toolbox for this, e.g. LIBSVM (<https://www.csie.ntu.edu.tw/~cjlin/libsvm/>) or the MATLAB built-in functions. You can apply PCA and LDA here to reduce the feature dimensions.

Deep Learning Build a Convolutional Neural Network. Train it on MNIST training set and test it on testing set. You can design your architecture or use the architecture introduced in LeCun's paper [1]. You can use any of the following toolboxes:

Caffe If you are Linux or OSX user, you can follow the instruction from <http://caffe.berkeleyvision.org> to install it.

LightNet[2] It is a pure MATLAB toolbox. If you are a Windows user, this is an alternative choice. You can download it from <https://github.com/yechengxi/LightNet> and the tutorials are also included.

Deep Learning Toolbox It is a pure MATLAB toolbox. If you are a Windows user, you can also try this. You can download it from <http://www.mathworks.com/matlabcentral/fileexchange/38310-deep-learning-toolbox>. However, the original version may not be enough to build your CNN, so we added some features for you and uploaded it on Canvas (DeepLearningToolboxSupplementary.zip).

3 Datasets

You can download **MNIST** from <http://yann.lecun.com/exdb/mnist/>. The description of Dataset is also on the website. Basically it has a training set with 60000 28 x 28 grayscale images of handwritten digits (10 classes) and a testing set with 10000 images.

4 Submission Guidelines

In this project, you can use any programming language you want, such as Matlab (recommended), C++, Python, ...etc. You need to submit your project in the following structure: A zip file with the name **YourDirectoryID.Proj2.zip** on to ELMS/Canvas. A main folder with the name **YourDirectoryID_P2** and the following sub-folders/files:

Code A folder contains all your code

Report Your report should be in pdf format and no more than 5-6 pages (excluding figures). You should concentrate on the employed methods, the experiments and discuss the results you have obtained.

Readme A .txt file describing how to run your code.

References

- [1] Y. Lecun, L. Bottou, Y. Bengio, and P. Haffner. Gradient-based learning applied to document recognition. *Proceedings of the IEEE*, Nov 1998.
- [2] Chengxi Ye, Chen Zhao, Yezhou Yang, Cornelia Fermüller, and Yiannis Aloimonos. Lightnet: A versatile, standalone matlab-based environment for deep learning. In *Proceedings of the 2016 ACM on Multimedia Conference*, MM '16, New York, NY, USA, 2016. ACM.