

EECE5640 Project Proposal: Benchmark Deep Neural Network Models

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For my final project, I plan to present an in-depth analysis of the majority of the deep neural networks (DNNs) proposed in the state of the art for image recognition. For each DNN, two performance indices are observed, such as recognition accuracy and training time. To measure the indices, I experiment with the use of DNNs on two different computer architectures. Both computer architectures are in the Northeastern Discovery System. One is Nvidia Tesla P100 which has 12 nodes with 4 GPUs each. Another one is Nvidia Tesla K80 which has 8 nodes with 8 GPUs each. But they both share the same CPU which is E5-2680v4@2.40GHz. This lines up with option A. This project will be completed by myself.

I propose to use PyTorch which needs GPU acceleration to evaluate executing speedup. And this project will use two different deep neural network models. The first one is GoogLeNet, it is a new convolutional neural network, and it has 22 layers. Different from other convolutional networks, GoogleNet achieves good classification performance while controlling the amount of computation and parameters. It removes the last fully connected layer, uses a global average pooling layer, and replaces large convolutions with multiple small convolution kernels. Another one is ResNet-18. It is 18 layers deep that can learn rich feature representations for a wide range of images.

And There are three datasets that will be used. MNIST, CIFAR-10, and KMNIST are three different popular datasets in deep learning. CIFAR-10 is a 3-channel color RGB image dataset that consists of 60000 32x32 color images in 10 classes, with 6000 images per class. 50000 training images and 10000 test images in total. MNIST is a large database of handwritten digits in grayscale images that are commonly used for training various image processing models. The dataset contains 60,000 examples for training and 10,000 examples for testing. The numbers are size normalized and centered in the image, which is a 28x28 fixed size. And KMNIST is a dataset, adapted from Kuzushiji Dataset, as a drop-in replacement for MNIST dataset, which is the most famous dataset in the machine learning community. Just change the setting of your software from MNIST to KMNIST. We provide three types of datasets, namely Kuzushiji-MNIST、Kuzushiji-49、Kuzushiji-Kanji, for different purposes.

The following lists the grades that I expect to receive:

- A = 2 deep neural network models implemented in all three datasets. Benchmarked and analyzed for each program. Additional analysis of DNNs-specific implementation process and principle.
- A- = 2 deep neural network models implemented in only two datasets. Benchmarked and analyzed for each program. Additional analysis of DNNs-specific implementation process and principle.
- B+ = 2 deep neural network models implemented in only two datasets. Benchmarked and analyzed for each program.
- B = 1 deep neural network model implemented in only two datasets. Benchmarked and analyzed for each program.
- C = 1 deep neural network model implemented in only one dataset. Benchmarked and analyzed for each program.
- F = Else.