Mehul Suresh Kumar

U52982215  Neural Networks and Deep Learning

Project 4 – CNN - REPORT

Question 1:

(50 pts) Implement a convolutional neural network that has one convolutional layer, one max pooling layer and two fully-connected layers. The convolutional layer has 10 filters (or kernels with size of 5x5) and their strides are 2. The pooling is 4x4 pooling. The two full-connected layers have 100 and 10 neurons, respectively.

a. (10 pts) Report the number of parameters you need to train.   
Number of weights: 50250

Number of biases: 120

b. (30 pts) Train the network with the MNIST dataset

c. (10 pts) Visualize the 10 filters.

Please run 1layer.py

After testing over 20,000 iterations accuracy is 98.2%

How to Run:

1. Install Tensor Flow by following instructions from <https://www.tensorflow.org/versions/r0.7/get_started/os_setup.html>
2. Enter the following   
   python 1layer.py  
   tensorboard --logdir=/tmp/1layer\_logs
3. Go to <http://localhost:6006/#images> to view the filters

Notes:

* Used Tensor flow libraries
* Used Tensor Board to visualize the filters
* Mnist database loaded with a built in script from TensorFlow
* Includes ReLu, Dropout layer, Softmax layer, Cross-entropy and uses Adam optimizer instead of gradient descent

Sample output:

USF-Wifi-224-7-198:project-4 mehul$ python 1layer.py

Extracting MNIST\_data/train-images-idx3-ubyte.gz

Extracting MNIST\_data/train-labels-idx1-ubyte.gz

Extracting MNIST\_data/t10k-images-idx3-ubyte.gz

Extracting MNIST\_data/t10k-labels-idx1-ubyte.gz

step 0, training accuracy 0.12

step 100, training accuracy 0.42

step 200, training accuracy 0.6

step 300, training accuracy 0.64

step 400, training accuracy 0.86

step 500, training accuracy 0.78

step 600, training accuracy 0.84

step 700, training accuracy 0.84

step 800, training accuracy 0.78

step 900, training accuracy 0.7

step 1000, training accuracy 0.9

step 1100, training accuracy 0.88

step 1200, training accuracy 0.9

step 1300, training accuracy 0.84

step 1400, training accuracy 0.86

step 1500, training accuracy 0.92

step 1600, training accuracy 0.78

step 1700, training accuracy 0.96

step 1800, training accuracy 0.94

step 1900, training accuracy 0.94

step 2000, training accuracy 0.9

step 2100, training accuracy 0.88

step 2200, training accuracy 0.96

step 2300, training accuracy 0.96

step 2400, training accuracy 0.92

step 2500, training accuracy 0.94

step 2600, training accuracy 0.94

step 2700, training accuracy 0.94

step 2800, training accuracy 0.96

step 2900, training accuracy 0.96

step 3000, training accuracy 0.96

step 3100, training accuracy 0.94

step 3200, training accuracy 0.94

step 3300, training accuracy 0.94

step 3400, training accuracy 0.98

step 3500, training accuracy 0.98

step 3600, training accuracy 0.94

step 3700, training accuracy 0.92

step 3800, training accuracy 0.96

step 3900, training accuracy 0.96

step 4000, training accuracy 0.98

step 4100, training accuracy 0.94

step 4200, training accuracy 0.92

step 4300, training accuracy 0.94

step 4400, training accuracy 0.96

step 4500, training accuracy 0.92

step 4600, training accuracy 0.96

step 4700, training accuracy 0.96

step 4800, training accuracy 0.94

step 4900, training accuracy 0.94

test accuracy 0.9548

Question 2:

(50 pts) Implement another convolutional neural network that has two convolutional layers, two max pooling layers, and two fully-connected layers.

a. (20 pts) Report the design of your CNN (number of filters, size of the filters, stride, padding, pooling, and number of neurons in each layer)   
  
FIRST CONVOLUTION LAYER  
number of filters 32  
size of the filters 5 x 5  
stride 1  
padding: 2(to match size of input)  
pooling : 2 x 2

SECOND CONVOLUTION LAYER

number of filters 64  
size of the filters 5 x 5  
stride 1  
padding : 2(to match size of input)   
pooling : 2 x 2  
  
FIRST FULLY CONNECTED LAYER  
number of neurons : 1024   
SECOND FULLY CONNECTED LAYER  
number of neurons : 10

b. (10 pts) Report the number of parameters you need to train.

Number of weights: 3,273,504

Number of biases: 1130

c. (10 pts) Train the network with the MNIST dataset

d. (10 pts) Visualize the filters for the first convolutional layer.

Please run 2layer.py

After testing over 20,000 iterations accuracy is 99.2%

How to Run:

1. Install Tensor Flow by following instructions from <https://www.tensorflow.org/versions/r0.7/get_started/os_setup.html>
2. Enter the following   
   python 2layer.py  
   tensorboard --logdir=/tmp/2layer\_logs
3. Go to <http://localhost:6006/#images> to view the filters

Notes:

* Used Tensor flow libraries
* Used Tensor Board to visualize the filters
* Mnist database loaded with a built in script from TensorFlow
* Includes ReLu, Dropout layer, Softmax layer, Cross-entropy and uses adam optimizer instead of gradient descent

Sample output:

USF-Wifi-224-7-198:project-4 mehul$ python 2layer.py

Extracting MNIST\_data/train-images-idx3-ubyte.gz

Extracting MNIST\_data/train-labels-idx1-ubyte.gz

Extracting MNIST\_data/t10k-images-idx3-ubyte.gz

Extracting MNIST\_data/t10k-labels-idx1-ubyte.gz

step 0, training accuracy 0.1

step 100, training accuracy 0.86

step 200, training accuracy 0.96

step 300, training accuracy 0.9

step 400, training accuracy 1

step 500, training accuracy 0.94

step 600, training accuracy 1

step 700, training accuracy 0.94

step 800, training accuracy 0.86

step 900, training accuracy 1

step 1000, training accuracy 0.94

step 1100, training accuracy 1

step 1200, training accuracy 0.96

step 1300, training accuracy 0.94

step 1400, training accuracy 0.96

step 1500, training accuracy 0.9

step 1600, training accuracy 0.94

step 1700, training accuracy 0.96

step 1800, training accuracy 0.98

step 1900, training accuracy 1

step 2000, training accuracy 0.98

step 2100, training accuracy 1

step 2200, training accuracy 0.98

step 2300, training accuracy 1

step 2400, training accuracy 1

step 2500, training accuracy 0.96

step 2600, training accuracy 0.96

step 2700, training accuracy 0.98

step 2800, training accuracy 0.98

step 2900, training accuracy 0.98

step 3000, training accuracy 0.98

step 3100, training accuracy 0.98

step 3200, training accuracy 1

step 3300, training accuracy 1

step 3400, training accuracy 1

step 3500, training accuracy 1

step 3600, training accuracy 1

step 3700, training accuracy 1

step 3800, training accuracy 1

step 3900, training accuracy 0.96

step 4000, training accuracy 0.94

step 4100, training accuracy 0.96

step 4200, training accuracy 0.98

step 4300, training accuracy 1

step 4400, training accuracy 0.98

step 4500, training accuracy 1

step 4600, training accuracy 0.98

step 4700, training accuracy 0.98

step 4800, training accuracy 1

step 4900, training accuracy 0.98

test accuracy 0.9875