CMPE 258, Spring 2018

Assignment #4

Due 11:59pm on Sunday, March 18th, 2018

Notes

This programming assignment should be submitted in Canvas as a format of ipython notebook (assignment_4_yourFirstName_LastnName.ipynb).
You can discuss how to solve the problem with other students or search internet or other resources, but the work should be your own. If any portion of the code is similar to others, it will be treated as cheating.
*The submitted ipynb should be executable without any extra work.*
Please do not use any library except tensorflow,tersorflow.nn. pandas, numpy, and matplotlib.pyplot.

Download data files (ex4_train.csv and ex4_test.csv) from canvas/files/assignment_4.
Using Jupyter notebook, load the data.
This data is a subset of the MNIST handwritten digit dataset (http://yann.lecun.com/exdb/minst/).
Each row is a 20 pixel by 20 pixel grayscale image of the digit. Each pixel is represented by a floating point number indicating the grayscale intensity at that location.
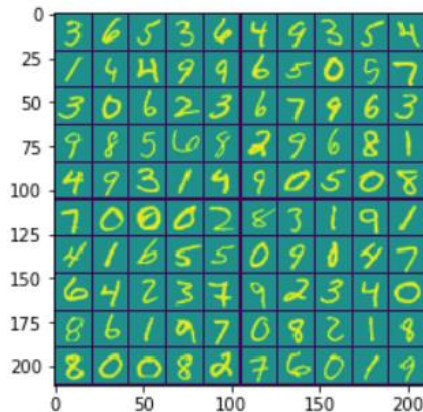
< MNIST handwritten digit>

The 20 by 20 pixels is unrolled into a 400-dimensional vector.
The last column 'y' is the label for the row.

	0	1	2	3	4	5	6	7	8	9	...	391	392	393	394	395	396	397	398	399	y
0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	5
1	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	9
2	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	7
3	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	6
4	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	5

Descriptions

In Assignment_3 and mid-term exam, we used pandas and numpy.
For Assignment_4, we will use Tensorflow.
Please build Deep Neural Network with two hidden layers.
For activation function, please use relu or elu for hidden layers, sigmoid for output layer.
For weight initialization, please use xaiver initialization.
For optimization, please use adam optimization.
For regularization, please use dropout.
As the final output, please plot train accuracy and test accuracy with probability (0.1 ~ 0.9) of dropout.

1. (40pts) Define functions
You may need to define the following functions.
> One-hot encoding
> Create placeholders
> initialize parameters using xavier initializer
> forward propagation with dropout regularization
> compute cost

2. Split data
Please split each data (Train & Test) set as input (x) and output (y) set.
Input set is the columns starting 0 to 399.
Output set is the column of 'y'.

3. Define number of neurons in each layer

4. (30pts) Neural Network model with 2 hidden layers
Please build neural network model using input layer (400 neurons), 2 hidden layers, and output layer (10 neurons) using training data set.
In tensorflow, you do not need to define backpropagation.

> Create placeholders
> Initialize parameters using xavier initializer
> Forward propagation with dropout regularization
> Compute cost
> Optimizer using Adam optimizer
> Update parameters

5. (10pts) Predictions
Please predict digit using softmax function based the optimized parameters.
Please calculate accuracy for the prediction using training data set and testing data set.

6. (20pts) Optimization
Please optimize your model using various probability in drop out.