CMPE 258, Spring 2018

Assignment #5

Due 11:59pm on Sunday, March 8th, 2018
Deadline for re-submitting is 11:59pm on Sunday, March 15th, 2018

Notes

This programming assignment should be submitted in Canvas as a format of ipython notebook (assignment_5_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.

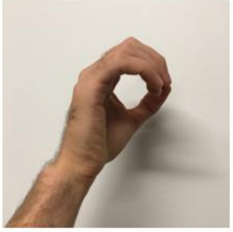
Please do not use any library except pandas, numpy, and matplotlib.pyplot.

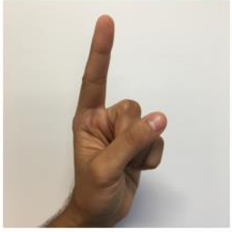
Grading policy

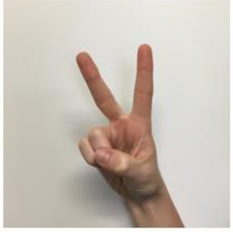
The code is supposed to be executable without any extra effort and produce reasonable result within 50 minutes.
If the code cannot be executable with any error or taking more than 50 minutes, 50 points will be assigned.
Re-submitting is available until March 15th, but 10 point will be deducted every re-submitting after March 8th.
If extra effort is needed to get reasonable result (whatever it is), 5 to 10 points will be deducted.

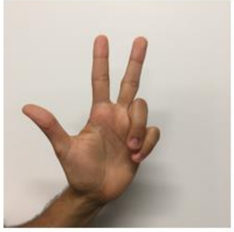
Dataset

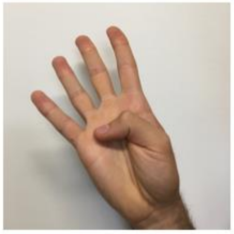
Download data files (ex5_train_x.npy and ex5_train_y.npy) from canvas/files/assignment_5.
This data is subset of SIGNS Dataset from Coursera (Deep Learning specialization).

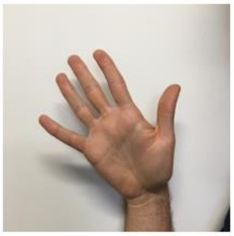

y = 0


y = 1


y = 2


y = 3


y = 4


y = 5

Each picture is a RGB image with 64 by 64 pixels.

Convolution Neural Network

Please build convolution neural network model as below.

Layer	Type	Size	Channels	Kernel size	Stride	Padding	Function
0	Input	64 x 64	3				
1	Convolution	32 x 32	8	4 x 4	2	1	ReLU
1	Pooling	28 x 28	8	5 x 5	1	0	max
2	Convolution	13 x 13	16	4 x 4	2	0	ReLU
2	Pooling	9 x 9	16	5 x 5	1	0	Avg
3	flatten	1296					
4	Fully connected	108					ReLU
5	Fully connected	6					Sigmoid

1. **(70pts) Define functions**

Please define the functions which are needed for CNN architectures. The following list is a suggestion.

One-hot encoding
Activation forward (Relu, sigmoid)
Compute cost
Zero pad
Convolution with single step
Convolution forward (for all data)
Pooling forward (max, average)
Pooling backward (max, average)
Activation backward (Relu, sigmoid)
Convolution backward (for all data)
Forward propagation (including all steps)
Backward propagation (including all steps)
Parameter updating (Gradient descent or other optimization method)

2. Load data

Using Jupyter notebook, load the data.

3. (10pts) Initialize parameters (Weights, bias for each layer)

Please initialize weight coefficients and bias terms for each layer.
Please make sure the size(dimension) of each Weights and bias.
Please consider optimum initialization method depending on Activation function

4. (20pts) Optimization of Convolution Neural Network model

Please build your model with forward propagation procedure and backward propagation procedure.
Please optimize your model using a learning rate and number of iteration.
Please print out cost with number of iteration. It may take long time to calculate. You may limit the number of iteration less than 10.