UC Irvine, Division of Continuing Education
Deep Learning Using TensorFlow
Spring 2019
Homework#7

Date Given: May 20, 2019   Due Date: May 26, 2019
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Problem#1

Lesson#7.2 includes the Python + TensorFlow code (file name 'Linear Regression MNIST.py') which does the following tasks.
- Reads the MNIST dataset
- Builds a Linear Regression model using the training MNIST dataset
- Predicts the label of the images in the test dataset
- Computes the accuracy of the prediction by creating a confusion matrix

Modify the given "Python + TF" code to do the following.

- Vary the learning rate from 0.5 to 0.1 with a step size of 0.1. Measure the accuracy as a function of learning rate.

- Change the optimizer from GradientDescent to AdagradOptimizer or AdamOptimizer. These optimizers will reduce the number of iterations to converge the Neural Network. Measure the number of iterations for Gradient Descent and compare it with the number of iterations used for AdagradOptimizer and AdamOptimizer.

- Change the batch size from 1 to 1000 with a step size of 100. How do these changes affect the accuracy of predictions?

Problem#2

The following matrix represents an image of size 7x7.

Image

	A	B	C	D	E	F	G
1	97	52	99	62	69	45	70
2	99	14	60	50	74	45	22
3	59	72	74	14	74	100	28
4	28	8	47	85	2	88	77
5	74	6	30	87	49	22	43
6	86	87	4	53	36	10	46
7	54	7	67	23	29	26	15
8							

Apply the 2D Convolution operation between the image and the following Gaussian filter of size 3x3.

Gaussian Filter

|	A	B	C
1	1	2	1
2	2	4	2
3	1	2	1
4			

Use 'SciPy' and TensorFlow' packages to solve this problem. Answer computed by both packages should be the same. Perform 'Full' and 'Valid' convolution operations.

Problem#3

Apply the Laplacian sharpening filter on the image stored in the file "01 Lady.png".
- Display the image before the filter is applied
- Display the image after the Laplacian sharpening filter is applied.

Apply both filters (Filter#1 + Filter#2).
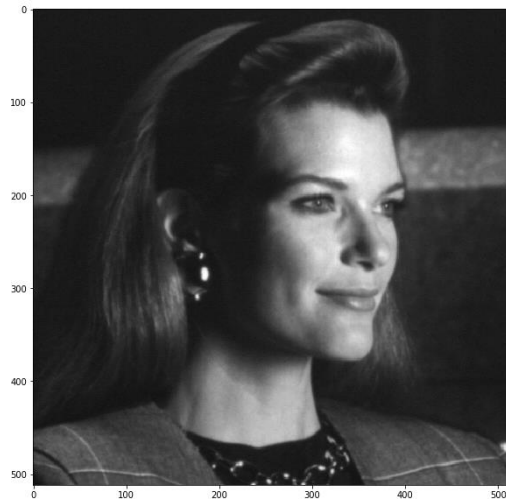
Laplacian Sharpening Filter#1

	A	B	C	
1	0	1	0	
2	1	-4	1	
3	0	1	0	
4				

Laplacian Sharpening Filter#2

	A	B	C	D
7				
8	1	1	1	
9	1	-8	1	
10	1	1	1	
11				

Since the filter size is only 3x3 pixels, the object's edges in the image may not become sharp. To increase the sharpness, the filter size must be increased from 3x3 to 15x15 or higher.