Homework Assignment

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This homework assignment is based on Lab4_ConvolutionalNeuralNetwork.ipynb notebook.

Before doing this assignment, you should first complete the following tutorial:

- Reading MNIST Dataset
- Understanding CNN Hyper-Parameters
- Building CNN Models
- Training and Evaluating CNN Model

Review the notebook and answer the following questions.

Question 1

1/1 point (graded)

What is the shape of the output of the second layer in your convolutional network?

- (1, 28, 28)
- (8, 7, 7)
- (16, 7, 7) ✔
- (8, 14, 14)
- (16, 14, 14)

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Question 2

1/1 point (graded)
Which code can you use to obtain the shape of the output of the second layer?

- z.first_conv.shape
- z.second_conv.shape ✔
- z.second_conv.value
- z.classify.shape

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Run the notebook and observe the average test error rate. Right now, your average test error hovers around 1.3x% to 1.6x% which is a slight improvement from the multi-layer perceptron model.

Important: For the following questions, when asked to "train the model" or "run the notebook", you should re-run your **whole** notebook from the **beginning** so that you are building the model from scratch each time you change a parameter.

Experiment with the following activation functions: Sigmoid, Tanh, ReLu, LeakyRelu, and observe the average test error.

Question 3

1/1 point (graded)
Which of the following activation function results in the lowest average test error?

- Sigmoid

- Tanh
- Relu ✔
- LeakyRelu

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Question 4

1/1 point (graded)

Which of the following activation function results in the highest average test error?

- Sigmoid ✔
- Tanh
- Relu
- LeakyRelu

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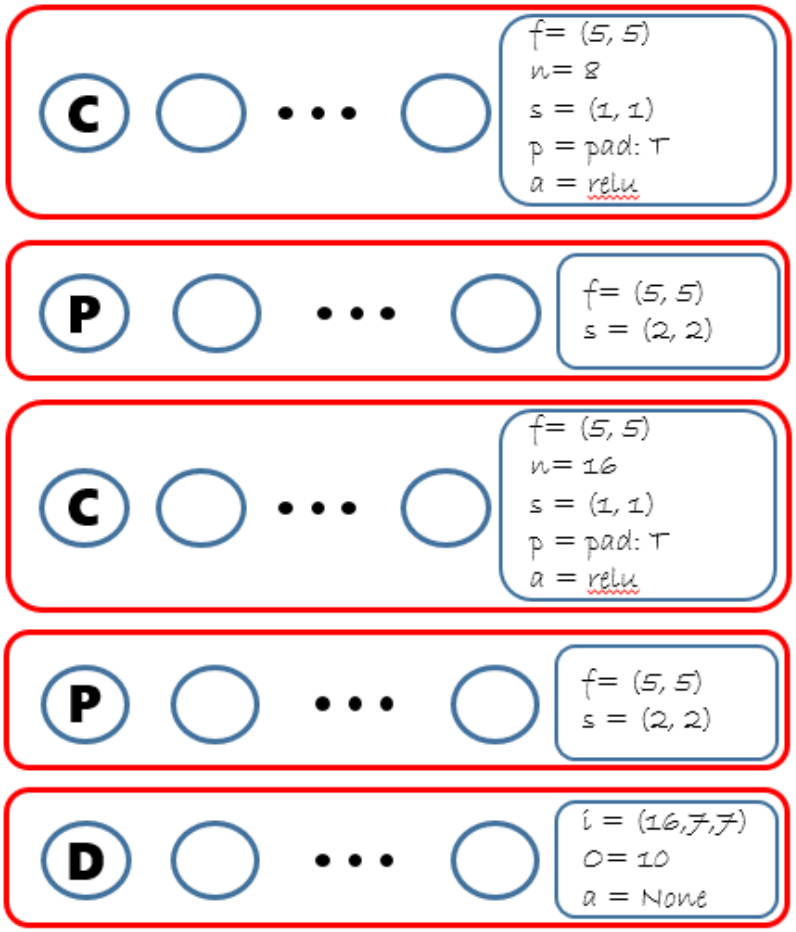
Typical convolutional networks have interlacing convolution and pooling layers. The previous model had only convolution layer. Now, you will create a model with the following architecture.



Specifically:

- Edit the `create_model` function and add the Average Pooling operations.
- Use the CNTK Average Pooling function to achieve this task.
- Note that the strides for the convolution layers are now (1,1)

Question 5

0/1 point (graded)

The previous model, without pooling layers, has 11274 parameters. How many parameters does the second model (with two average pooling layers) have?

- (•) 11274 (since avg pooling does not add any parameters) ✖
- ( ) 11074
- ( ) 5774

- 5994

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Experiment with the following activation functions: Sigmoid, Tanh, ReLu, LeakyRelu, and observe the average test error.

Question 6

1/1 point (graded)
Which of the following activation function results in the lowest average test error?

- Sigmoid
- Tanh
- Relu
- LeakyRelu ✔

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Question 7

1/1 point (graded)
Which of the following activation function results in the highest average test error?

- Sigmoid ✔
- Tanh
- Relu
- LeakyRelu

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Let's use your best model, i.e the one with the least average test error, to predict our mystery number.

Question 8

1/1 point (graded)

Download and extract the following file. It contains a bmp file for a mystery number. Upload the bmp file to your Jupyter notebook server, write some code to read the bmp file and predict its label. You can use the PIL (Python Image Library) Image class to open the file and then load the pixels. Which label is predicted?

- 0
- 2 ✔
- 5
- 6
- 8
- 9

Submit You have used 1 of 2 attempts

We've beaten MNIST to death! But did we? How about challenging yourself?

Can you beat these benchmarks? https://en.wikipedia.org/wiki/MNIST_database

What is your **best** average test error?

Play around and enter your best average test error below and get some "free" points. Remember the Honor code!

Bonus points

2.0/2.0 points (graded)

Enter your **best** average test error below..

0.99 ✔

0.99

Submit You have used 1 of 10 attempts

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