C S 487/519 Applied Machine Learning I
Fall 2018
Project 7: Convolutional Neural Networks

1 Objective

In this *individual* project, you are required to understand and design Convolutional Neural Networks (CNNs).

2 Requirements

1. (20 points) Design a CNN architecture with the following configuration and draw the CNN architecture in a similar manner as in the notes.

   - Create the first convolutional layer using kernel size 3×3, strides 1×1, valid padding mode, and output channel size 4.
   - Create the first pooling layer using max pooling with pooling size 2×2 and strides 2×2.
   - Create the second convolutional layer using kernel size 3×3, strides 3×3, valid padding mode, and output channel size 2.
   - Create the second pooling layer using max pooling with pooling size 4×4 and strides 4×4.
   - Create a fully connected layer from the second pooling layer with output channel size 10.

2. (20 points) Given a batch size 100, show the shape of the output tensor of each layer in the CNN architecture that you design to answer Q1.

3. (20 points) Write code (using either lower-level APIs or layers APIs) using TensorFlow to implement this CNN. You can directly copy code in the text book and make changes.

4. (20 points) Test your CNN using the MNIST dataset, which are uploaded to the Canvas `data` folder already. You need to write code to read the dataset. (The textbook has the code on page 391.)

5. (15 points) Properly analyze the performance of the CNN if you change some parameters (e.g., the kernel size, pooling functions, etc.). Put your analysis to a report file. The answers to Q1 and Q2 should also be at the report.

6. (5 points) Write a readme file `readme.txt` with the commands to run your code.

7. Your Python code should be written for Python version 3.5.2 or higher.

8. Please properly organize your Python code.

3 Submission instructions

- Compress your python code to a zip file named `proj7.zip` and upload it to Canvas.

4 Grading criteria

(1) The score allocation has already been put beside the questions.

(2) Please make sure that you test your code **thoroughly** by considering all possible test cases. For this project, your code will not be tested using more datasets. Thus, it does not need to be flexible to accept different datasets as input.

(3) At least 5 points will be deducted if submitted files (including files types, file names, etc.) do not follow the instructions.