

SEIS 764 Artificial Intelligence
Assignment 4
Due: midnight Friday 3/19/22 on Canvas

Individual effort

In class, we first used the MNIST dataset to build a Neural Network. This NN did not have convolutions. Later, we built a Convolutional Neural Network for classifying Fashion-MNIST dataset.

For this assignment, you will build CNNs and try to achieve the highest possible accuracy on MNIST.

- You should use the Functional API for this assignment, and not Sequential.
- You should normalize the pixel values to be between 0 and 1.
- In all the models you will be building, you need to try out and decide the filter size and number of feature maps to use.
- To explain the results of each of the models, use accuracy/loss plots and confusion matrix showing images.

Conv-Pool:

- **Model 1:** Build the first CNN with one conv-pool (i.e. convolution followed by max pooling). What results do you get? Explain.
- **Model 2:** In this model, have two conv-pools. What results do you get? Explain.
- **Model 3:** Try different model optimization strategies like Dropout, increasing the number of conv-pooling layers, etc. Which of the models give you the best generalization performance? Explain your results.

Strided Conv:

- **Model 4:** Build a CNN with one strided convolution layer. How do the results compare with Model 1.
- **Model 5:** Build a CNN with two strided convolution layers. How do the results compare with Model 2.
- **Model 6:** Try different model optimization strategies like Dropout, increasing the number of strided conv layers, etc. Compare the results of this model with that of Model 3. Which of the models give you the best generalization performance? Explain your results.

Image Data Augmentation:

- **Model 7:** Of the 6 models, take the best model you have, and perform Batch Normalization. Explain your results.
- **Model 8:** Of the 6 models, take the best model you have, and perform image data augmentation. You would need to decide the hyperparameters like width_shift_range, etc. Explain your results.

Submission:

- Each of the above parts should have a clear heading in your notebook.
- Your code should be well commented and easy to read (either with text cells or comments in code cell).
- Make sure each of the cells have been run with the output shown right below. Now, export the notebook as .html file.
- Submit the **.html** file and **.ipynb** notebook on Canvas.

Note: You will lose points if the notebook is not structured properly or if all the cells are not already run before converting to HTML.