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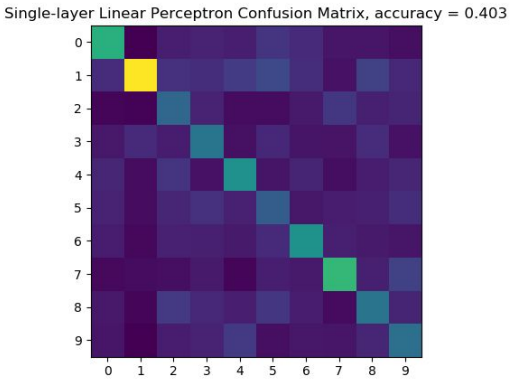
CSCI 5561: Assignment 4 - Convolutional Neural Network

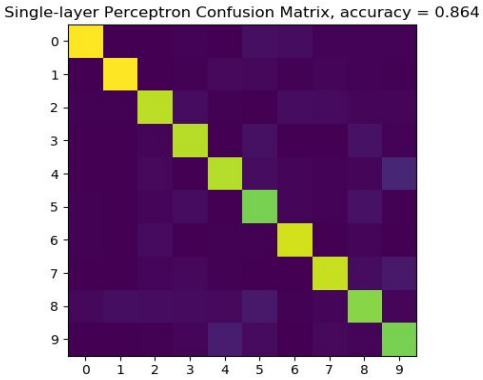
Dataset utilised for the purpose of training the following perceptrons and network is a subset from the MNIST handwritten digit dataset with images of 14x14 and the goal is to predict the digit in the test set which is also sampled from the MNIST dataset.
The backpropagation is implemented throughout is via mini batch stochastic gradient descent.

1.



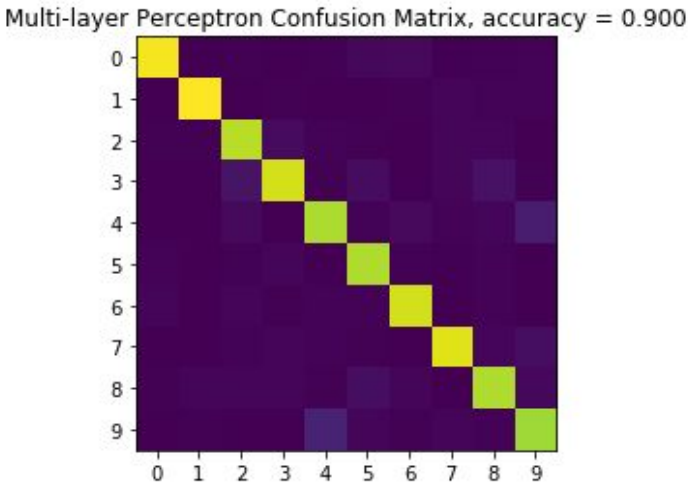
The perceptron is implemented by utilising a single fully connected layer along with euclidean loss (thus linear). The accuracy achieved is unsurprisingly low which is about 40%. The learning rate is 0.01, decay rate is 0.5 and number of iterations is 3000.

2.

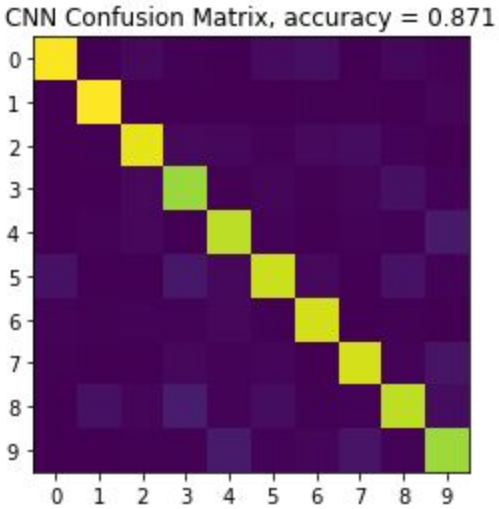


The perceptron is implemented by utilising a single fully connected layer along with softmax loss (thus non linear). The accuracy achieved is 86.4%. This is lower than the multi layer perceptron but significantly better (more than double) than single linear perceptron. The learning rate is 0.2, decay rate is 0.9 and number of iterations is 3000.

3. Multi layer perceptron uses a fully connected layer, RelU, single hidden layer along with softmax loss. The accuracy achieved is 90%. This is higher than the single layer perceptrons mentioned above. The learning rate is 0.283, decay rate is 0.97 and number of iterations is 10000.



4.



The convolution neural network utilises multiple layers with first layer as the convolution layer followed by ReLU and maxpool. Output of the maxpool is provided to flattening layer as input. This is followed by a fully connected layer and then a soft max layer to compute loss. The loss computed on the predictions is then back propagated throughout the network to update the weights and bias. The accuracy achieved is 87.1%. The learning rate is 0.15, decay rate is 0.9 and number of iterations is 25000.