

DEEP-LEARNING ASSIGNMENT-2
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SR. NO. 16223

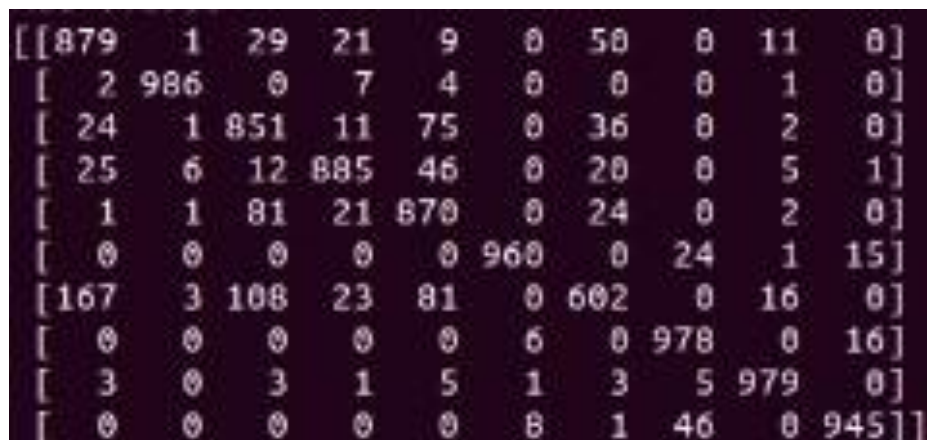
Part1: Train a neural network on Fashion MNIST dataset.

My model specifications are as follows:

#layers 4
#neurons in each layer [512,128,16,10]
activation used in each(r e l u)
batch size 512
#epochs 100
dropout rate 0.

I came to these specifications based on the validation loss and accuracy. And the validation loss was minimum for this configuration so I saved this model. Validation set contains 10% of the train set. 90% of the train set is used for training. At the end I tested my saved model on the test set. I testes various configurations. For #layers I tested for 2,3,4 and for #neurons I tesetd for 16,64,256. Training accuracy of the saved model is 96% and test accuracy is 89.35%. I choose current architecture as validation loss was minimum on this architechture. Also, more complex model requires more data therefore, I didn't choose more than 4 layers. Also, Learning rate is set to 0.001 as higher learning rate will lead to oscillations during training.

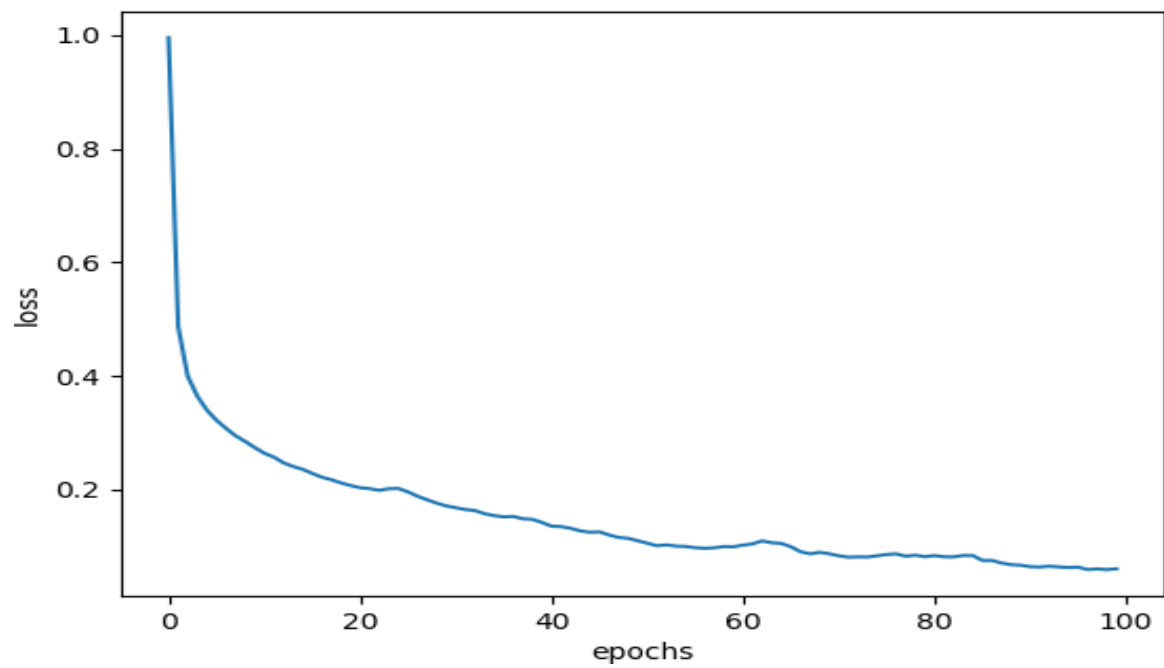
Confusion Matrix for NN model is (on test set):



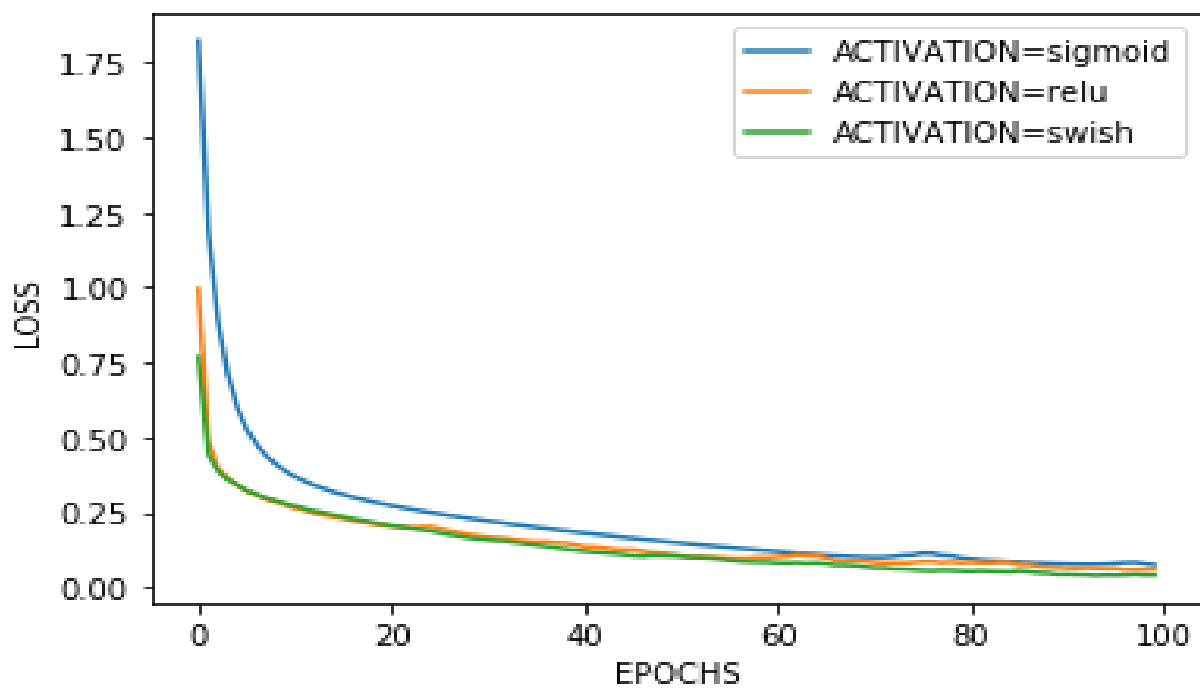
[879	1	29	21	9	0	50	0	11	0]
[2	986	0	7	4	0	0	0	1	0]
[24	1	851	11	75	0	36	0	2	0]
[25	6	12	885	46	0	20	0	5	1]
[1	1	81	21	870	0	24	0	2	0]
[0	0	0	0	0	960	0	24	1	15]
[167	3	108	23	81	0	602	0	16	0]
[0	0	0	0	0	6	0	978	0	16]
[3	0	3	1	5	1	3	5	979	0]
[0	0	0	0	0	8	1	46	0	945]]

Given are some plots for some configurations which I tested: (All plots on y axis denotes the train accuracy/train loss) :

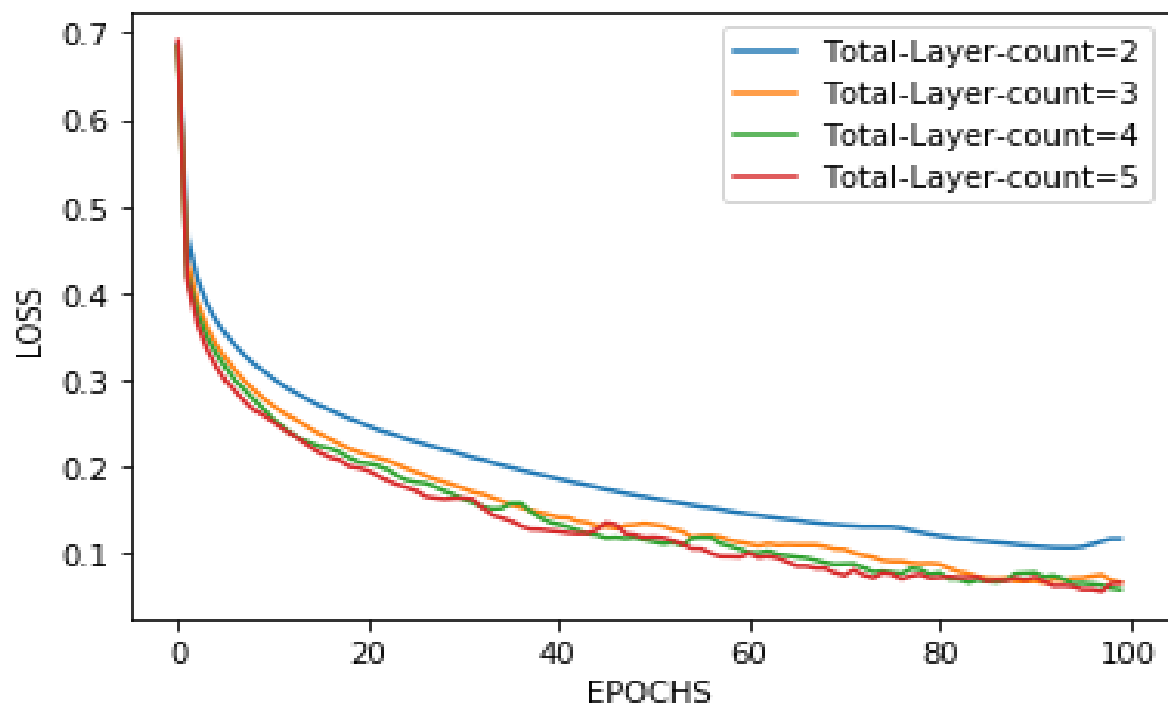
Plot 1: EPOCHS VS LOSS



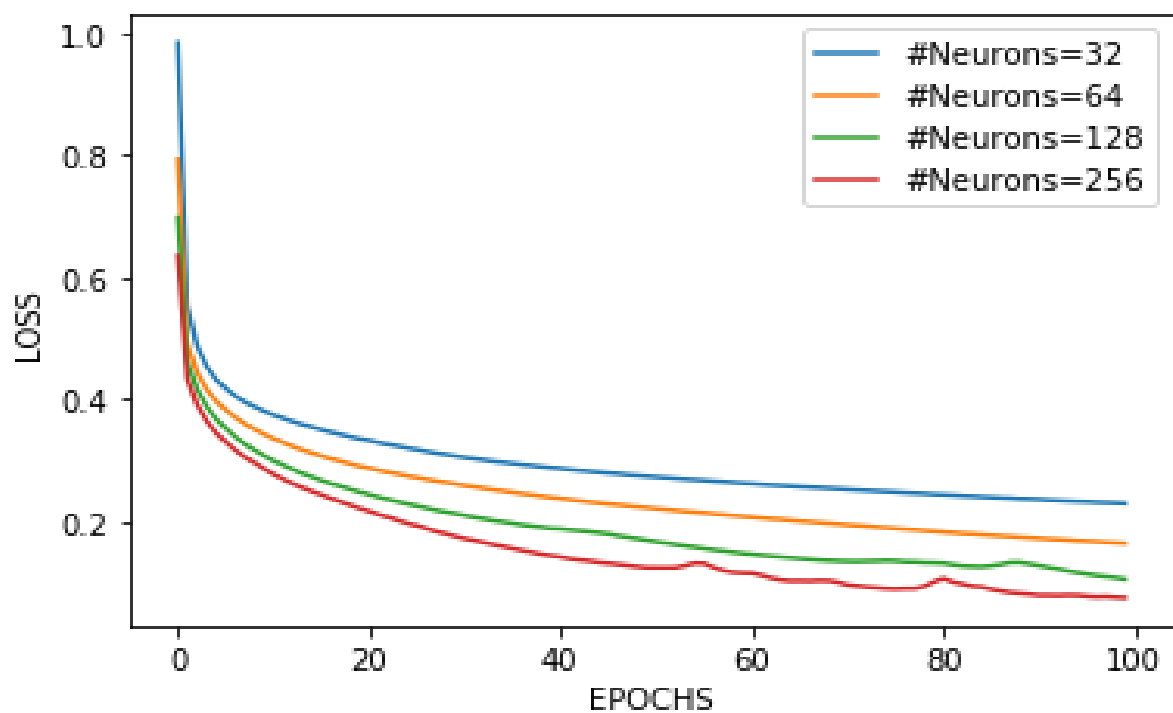
Plot 2: VARYING ACTIVATION FUNCTIONS



Plot 3: DIFFERENT NUMBER OF LAYERS



Plot 4: VARYING NUMBER OF NEURONS



Relative strengths and weakness of the model:

True Positive count is 879 and 50 false positive count with label 7 in row 1. Main reason is the model is confused between T-shirt/top and shirt classes. Also model is unable to differentiate between Pullover and Coat. For rest of the classes the model is strong enough to distinguish between true and false class.

PART 2: Train a CNN on Fashion MNIST dataset.

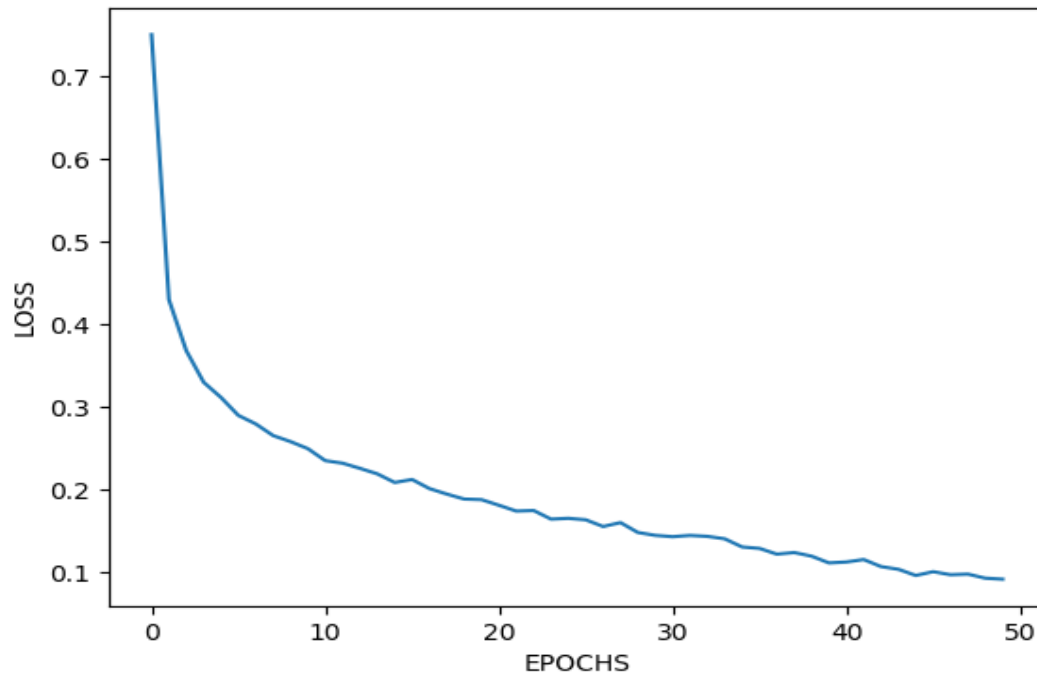
My model specifications are as follows:

- #CNN layers 2
- Filter size 5,2
- activation used in each layer relu
- batch size 128
- #epochs 30
- #filters in each CNN layer 32,64
- #FCC layers 3
- #neurons in each FCC layer 512,10

I came to these specifications based on the validation loss and accuracy. I keep doubling the #channels in each CN layer as input to a CNN layer is decreasing after every CNN layer. And the validation loss was minimum for this configuration so I saved this model. Validation set contains 10% of the train set. 90% of the train set is used for training. At the end I tested my saved model on the test set. I testes various configurations. For #CNN/FC layers I tested for 2,3,4 and for #neurons I tested for 16,32,64,128,256 for each FC layer. Training accuracy of the saved model is 98% and test accuracy is 91.55%. More complex model requires more data therefore, I didn't choose more than 2 CNN layers and 2 FCL. Also, model is converging and hence these configurations are used. The early stopping is used while training CNN and when validation loss starts increasing for some epochs I stop the training. Also, Learning rate is set to 0.001 as higher learning rate will lead to oscillations during training. Confusion matrix is (on test set):

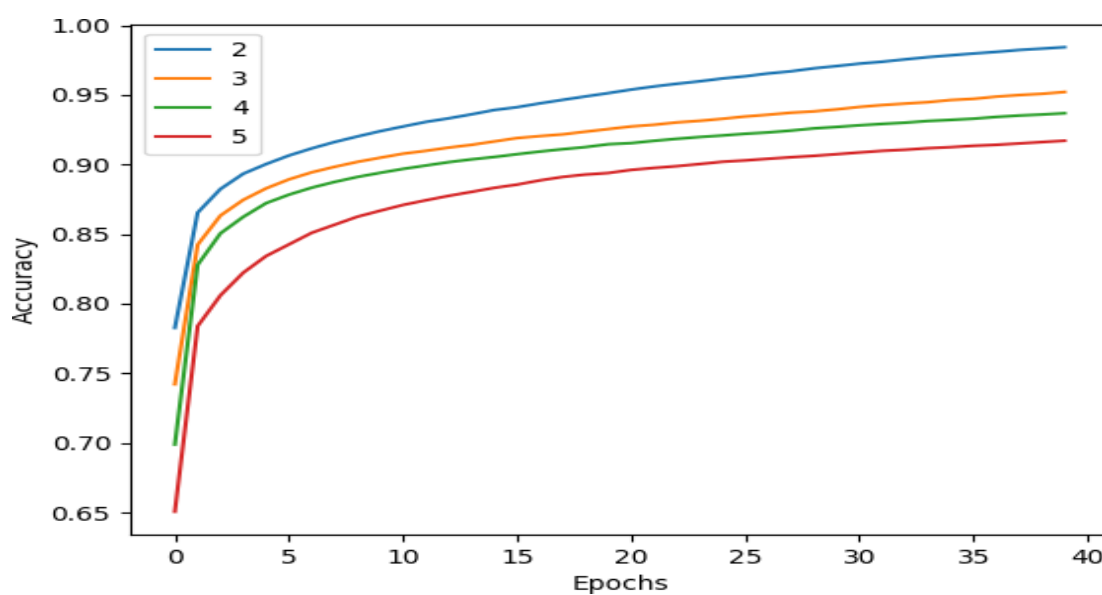
[847	0	18	15	7	1	107	0	4	1]
[3	979	3	9	4	0	2	0	0	0]
[15	1	853	7	71	0	53	0	0	0]
[13	2	9	911	37	0	28	0	0	0]
[3	0	36	15	916	0	30	0	0	0]
[0	0	0	0	0	981	0	13	0	6]
[101	1	59	24	97	1	714	0	3	0]
[0	0	0	0	0	4	0	979	0	17]
[3	0	6	3	3	2	3	4	976	0]
[0	0	0	0	0	5	1	29	1	964]]

Loss VS Epochs Plot:

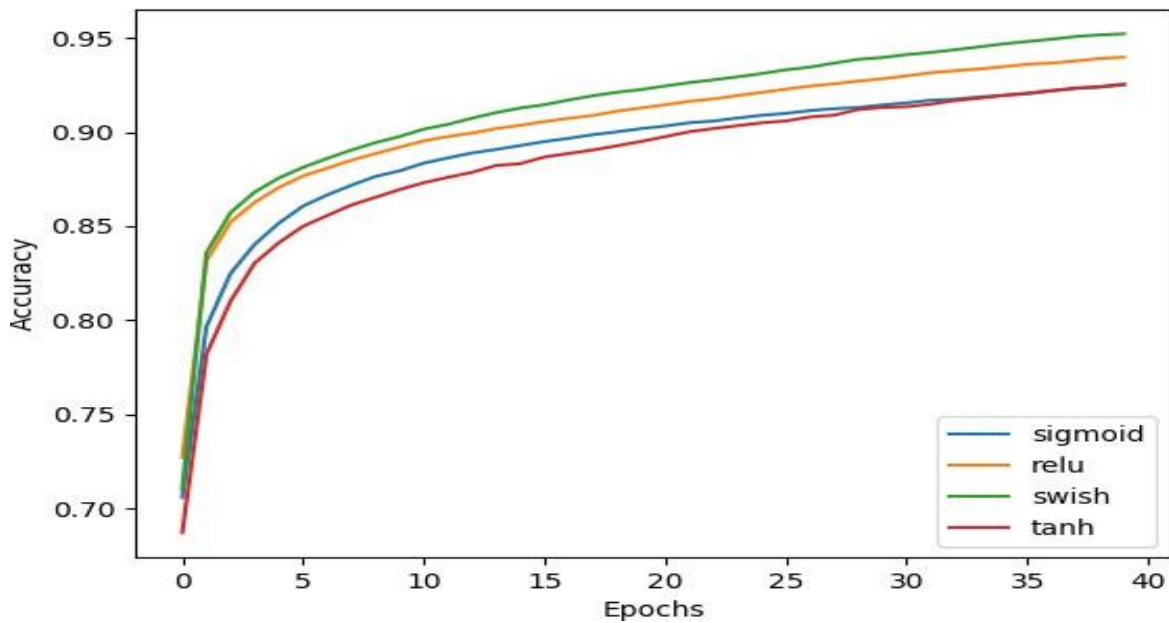


Given are some plots for some configurations which I tested: (All plots on y axis denotes the train accuracy)

Plot 1: DIFFERENT NUMBER OF CNN LAYERS



Plot 2: VARYING ACTIVATION FUNCTIONS



Relative strengths and weakness of the model:

True Positive count is 847 and 7 false positive count with label 107 in row 1. Main reason is the model is confused between T-shirt/Top and Shirt classes. Also model is unable to differentiate between Pullover and Coat. For rest of the classes the model is strong enough to distinguish between true and false class. Also, the CNN has more number of correct classifications in each class as compared to NN model.