

IST_597 Deep Learning Assignment 00010 Report

tfv5097-Thejasvi Velaga

Github Link: https://github.com/thejasvi204/IST597_spring22

Inputs:

```
size_input = 784
size_hidden = [128,64]
size_output = 10
number_of_train_examples = 10000 #60000
number_of_test_examples = 5000 #10000

Batch=100 #for Train set
Batch =50 #for Test set
seed=5097
```

Model X: Without Regularization(MLP)

Model Y:With drop out(MLP_Regdp)

Model Z:With L2(MLP_Regl)

Findings:

When changing the hyper parameters from SGD to ADAM, I observed that ADAM has better performance when compared to SGD when we are considering soft max cross entropy as a loss equation.

Instead of mean squares using softmax cross entropy would help to increase the performance of the model as there are 10 categories of MNIST.

Adding the drop out and L2 regularization to model X resulting in boost for regularization for there is drop out of performance when using dropout regularization which can be represented in below figures.

As part of the hyper-parameter optimization, I changed the batch sizes to 100 and used a default learning rate of adam and observed that after 10 epochs model Z out performances the Model X in terms of accuracy for MNIST data set but for fashion MNIST Model X seems to be efficient.

Adding Drop out to the model X seems to hinder the accuracy and MSE for both MNIST and Fashion MNIST.

Considering the results of training and test data, I observed that there is significant performance for all models and as for each epoch, The MSE has been improved for Model X and Z when Compared to Y.

When we run the single inference on test data, Model Y seems to have better performance when compared to other models.

From the results, I conclude the Model Z has low variance and low bias.

Tables:

For GPU without Regularization					
MNIST			Fashion MNIST		
Epoch	Avg MSE	accuracy	Epoch	Avg MSE	accuracy
1	193.81835	49.0	1	218.15515	50.0
2	47.4423	68.0	2	45.16298125	71.0
3	28.629678125	71.0	3	32.410046875	74.0
4	20.9186734375	77.0	4	26.922003125	80.0
5	16.644890625	81.0	5	23.0907109375	81.0
6	13.72404375	84.0	6	20.414459375	83.0
7	11.6000390625	83.0	7	18.498790625	85.0
8	10.10431171875	86.0	8	16.8674609375	81.0
9	8.94155546875	86.0	9	15.39673125	81.0
10	7.92645546875	89.0	10	14.308290625	85.0
Total time taken (in seconds): 34.53			Total time taken (in seconds): 38.91		

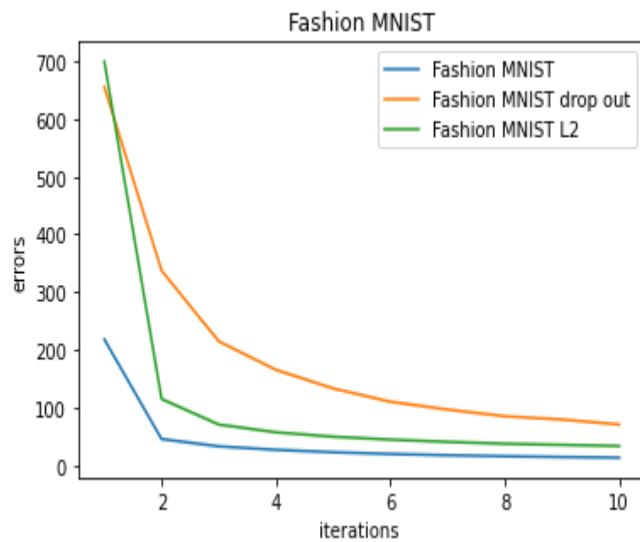
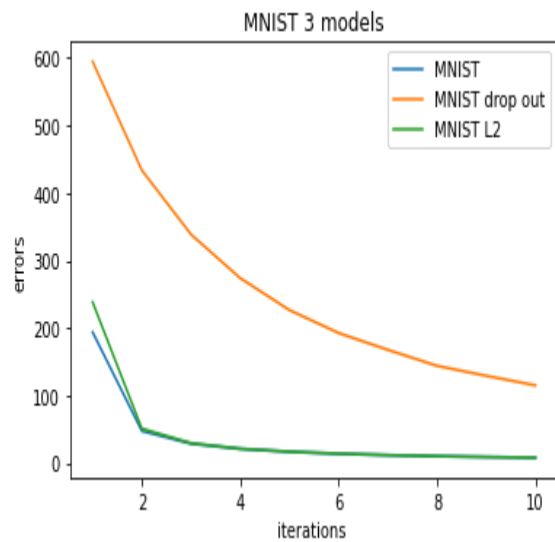
For GPU with Drop Out					
MNIST			Fashion MNIST		
Epoch	Avg MSE	accuracy	Epoch	Avg MSE	accuracy
1	594.74455	10.0	1	655.2248	18.0
2	433.8414	10.0	2	337.301725	22.0
3	338.642525	13.0	3	214.718225	32.0
4	273.909075	23.0	4	165.2754125	33.0
5	226.582575	30.000001907348633	5	133.0815625	37.0
6	192.5428375	30.000001907348633	6	109.9601	31.0
7	167.68	36.0	7	96.48029375	41.0
8	143.9419625	37.0	8	84.9134625	42.0
9	129.1663625	43.0	9	79.15125625	48.0
10	115.063	52.0	10	70.56514375	46.0
Total time taken (in seconds): 50.65			Total time taken (in seconds): 42.73		

For GPU with L2					
MNIST			Fashion MNIST		
Epoch	Avg categorical_crossentropy	accuracy	Epoch	Avg categorical_crossentropy	accuracy
1	238.3273	45.0	1	779.5425	8.0
2	50.925228125	72.0	2	111.630575	37.0
3	29.321125	79.0	3	60.044825	58.0
4	21.19270937	85.0	4	46.0877625	63.0

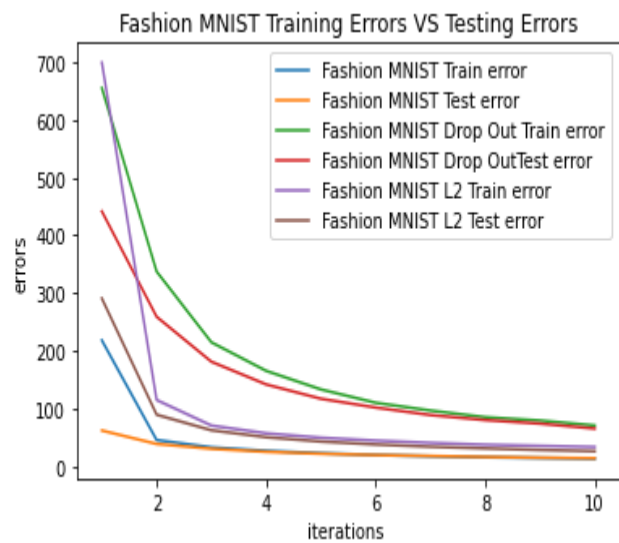
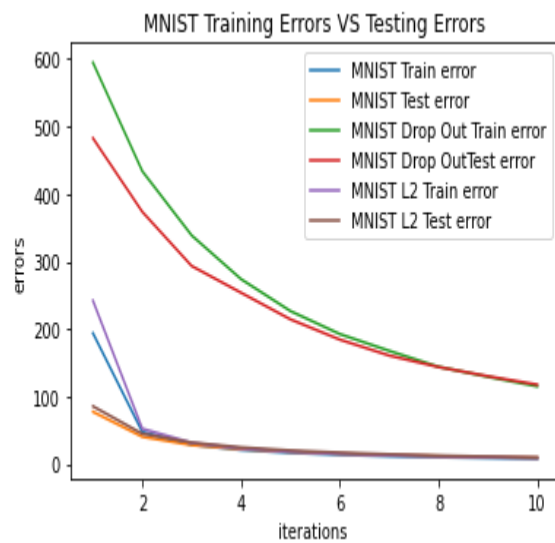
	5				
5	16.727675	86.0	5	39.995953125	65.0
6	13.7705375	88.0	6	35.920640625	69.0
7	11.664209375	90.0	7	33.287571875	72.0
8	10.10768203125	91.0	8	31.40558125	75.0
9	8.8842375	90.0	9	29.8371625	74.0
10	7.91251640625	94	10	27.86725	72.0
Total time taken (in seconds): 40.36			Total time taken (in seconds): 22.76		

One Step Inference						
	Default Mode for MNIST			Default Mode for Fashion MNIST		
	Without Regularization	Drop out	L2	Without Regularization	Drop out	L2
Average MSE	944.5451	840.1211	571.42185	1154.2479	1077.8289	726.5764
Accuracy	13.0	5.0	6.0	6.0	10.0	10.0

Graphs:



Training and Testing Errors:



One Step Inference table

For GPU without Regularization					
MNIST			Fashion MNIST		
Seed	TEST MSE	accuracy	Seed	TEST MSE	accuracy
5097	560.53085	9.0	5097	721.93635	1.0
1111	560.53085	9.0	1111	721.93635	1.0
1234	560.53085	8.0	1234	721.93625	1.0
5678	560.5309	9.0	5678	721.93625	0.0
199991	560.5309	8.0	199991	721.93635	0.0
99999	560.53085	8.0	99999	721.9363	1.0
3421	560.53085	8.0	3421	721.93635	0.0
6642	560.5309	7.0	6642	721.9363	0.0
8754	560.5309	7.0	8754	721.9363	1.0
3454444	560.5309	9.0	3454444	721.9363	1.0

For GPU with Drop Out					
MNIST			Fashion MNIST		
seed	TEST MSE	accuracy	seed	TEST MSE	accuracy
5097	509.8893	12.0	5097	855.7167	5.0
1111	513.6394	14.0	1111	849.6413	5.0
1234	507.24065	17.0	1234	851.3892	8.0
5678	506.80385	9.0	5678	845.3278	3.0
199991	517.0044	13.0	199991	854.2049	8.0

99999	518.2454	12.0	99999	849.4479	8.0
3421	505.3408	9.0	3421	850.2121	6.0
6642	514.2289	13.0	6642	842.8346	5.0
8754	514.31055	13.0	8754	843.832	9.0
3454444	516.25785	14.0	3454444	845.2228	7.0

For GPU Regularization L2					
MNIST			Fashion MNIST		
seed	TEST MSE	accuracy	seed	TEST MSE	accuracy
5097	1104.2849	10.0	5097	1372.9331	15.000001
1111	1104.2848	10.0	1111	1372.933	15.000001
1234	1104.2848	10.0	1234	1372.933	15.000001
5678	1104.2848	10.0	5678	1372.933	15.000001
199991	1104.2847	10.0	199991	1372.933	15.000001
99999	1104.2847	10.0	99999	1372.9331	15.000001
3421	1104.2847	10.0	3421	1372.9331	15.000001
6642	1104.2847	10.0	6642	1372.9331	15.000001
8754	1104.2847	10.0	8754	1372.933	15.000001
3454444	1104.2848	10.0	3454444	1372.9329	15.000001

Graphs for one step inference:

