Ahsanullah University of Science and Technology
Department of Computer Science and Engineering

Soft Computing
CSE4238

Assignment-2 Report

Topic: Deep Neural Network(Linear Layer)

Submitted by

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5 September 2021

Contents

1 Dataset 1

Download the dataset from the given link in the assignment question pdf. Then delete the following columns

- original filename.
- scanid.
- database name original.
- contributing team.
- database name.

1.1 Experiment 1:

1.1.1 Parameter :

This is an experiment on dataset 1. In this experiment hyperparameters were following:-

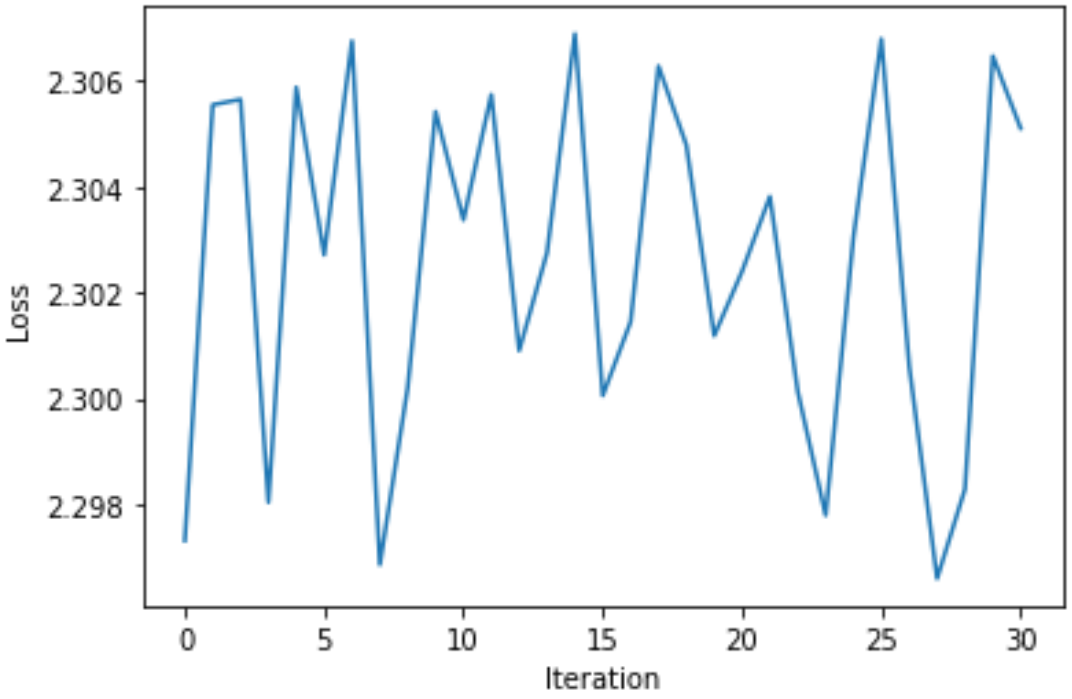
- Batch size = 20
- Iteration number = 20000
- Learning Rate = 0.01
- Number of Hidden layer = 6

Activation functions are
- RelU.
- 1.1.2

Result :

```
Epoch:  1
Iteration: 500. Loss: 2.29731822013855. Accuracy: 9.734513274336283
Epoch:  2
Iteration: 1000. Loss: 2.305549144744873. Accuracy: 9.487548878370035
Iteration: 1500. Loss: 2.305652141571045. Accuracy: 10.22844206626878
Epoch:  3
Iteration: 2000. Loss: 2.2980403900146484. Accuracy: 9.487548878370035
Iteration: 2500. Loss: 2.3058807849884033. Accuracy: 9.775674006997324
Epoch:  4
Iteration: 3000. Loss: 2.3027138710021973. Accuracy: 10.660629759209714
Iteration: 3500. Loss: 2.3067569732666016. Accuracy: 9.487548878370035
Epoch:  5
Iteration: 4000. Loss: 2.296861410140991. Accuracy: 10.125540234616176
Iteration: 4500. Loss: 2.3002097606658936. Accuracy: 9.775674006997324
Epoch:  6
Iteration: 5000. Loss: 2.3054213523864746. Accuracy: 9.734513274336283
Iteration: 5500. Loss: 2.3033759593963623. Accuracy: 9.734513274336283
Epoch:  7
Iteration: 6000. Loss: 2.30574369430542. Accuracy: 9.487548878370035
Iteration: 6500. Loss: 2.3009068965911865. Accuracy: 10.063799135624613
Epoch:  8
Iteration: 7000. Loss: 2.3027570247650146. Accuracy: 9.487548878370035
Iteration: 7500. Loss: 2.306892156600952. Accuracy: 9.487548878370035
Epoch:  9
Iteration: 8000. Loss: 2.3000569343566895. Accuracy: 9.899156204980448
Iteration: 8500. Loss: 2.3014512062072754. Accuracy: 10.475406462235028
Epoch:  10
Iteration: 9000. Loss: 2.3062806129455566. Accuracy: 9.487548878370035
Iteration: 9500. Loss: 2.3047895431518555. Accuracy: 10.434245729573986
Epoch:  11
Iteration: 10000. Loss: 2.301187753677368. Accuracy: 9.734513274336283
Iteration: 10500. Loss: 2.3024044036865234. Accuracy: 11.031076353159087
Epoch:  12
Iteration: 11000. Loss: 2.3038175106048584. Accuracy: 9.487548878370035
Iteration: 11500. Loss: 2.3001317977905273. Accuracy: 9.487548878370035
Epoch:  13
Iteration: 12000. Loss: 2.297795057296753. Accuracy: 10.310763531590862
Iteration: 12500. Loss: 2.303060531616211. Accuracy: 9.487548878370035
Epoch:  14
Iteration: 13000. Loss: 2.3067965507507324. Accuracy: 9.734513274336283
Iteration: 13500. Loss: 2.300607919692993. Accuracy: 12.492282362626055
Epoch:  15
Iteration: 14000. Loss: 2.296600818634033. Accuracy: 13.294916649516361
Iteration: 14500. Loss: 2.2982900142669678. Accuracy: 9.487548878370035
Epoch:  16
Iteration: 15000. Loss: 2.306471347808838. Accuracy: 9.837415105988887
Iteration: 15500. Loss: 2.305104970932007. Accuracy: 9.487548878370035
```

1.1.3 Graph :



1.2 Experiment 2-1:

1.2.1 Parameter :

This is an experiment on dataset 1. In this experiment hyperparameters were following:-

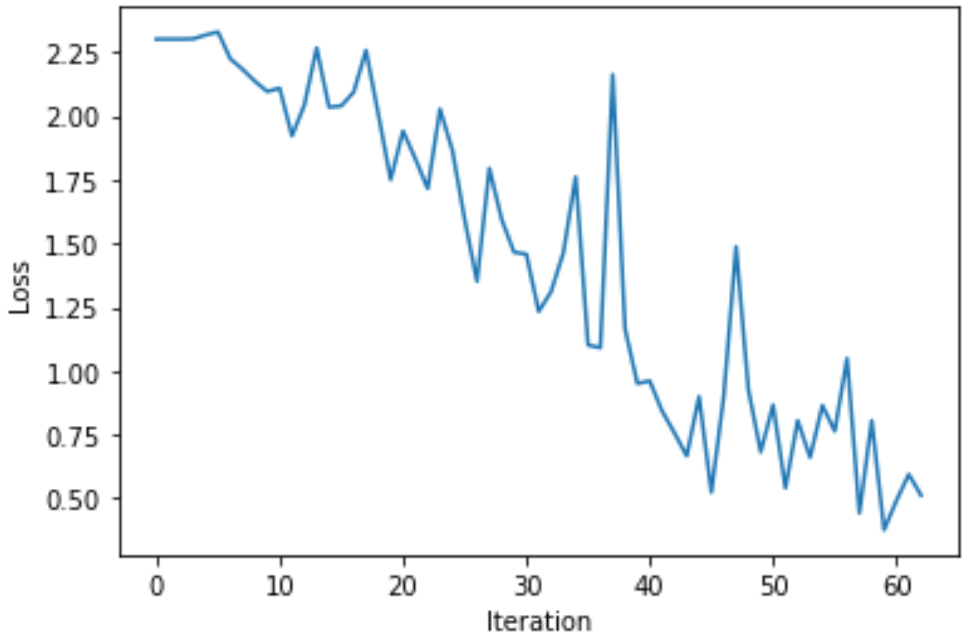
- Batch size = 90
- Iteration number = 42000
- Learning Rate = 0.09
- Number of Hidden layer = 300

Activation functions are
- RelU
- TanH.

1.2.2 Result :

```
Epoch:  114
Iteration: 24500. Loss: 0.92644864320755. Accuracy: 72.25766618645812
Epoch:  115
Epoch:  116
Iteration: 25000. Loss: 0.6823495030403137. Accuracy: 68.98538793990534
Epoch:  117
Epoch:  118
Epoch:  119
Iteration: 25500. Loss: 0.8666448593139648. Accuracy: 65.71310969335254
Epoch:  120
Epoch:  121
Iteration: 26000. Loss: 0.5412343740463257. Accuracy: 77.17637373945256
Epoch:  122
Epoch:  123
Iteration: 26500. Loss: 0.8054453730583191. Accuracy: 67.75056596007408
Epoch:  124
Epoch:  125
Iteration: 27000. Loss: 0.6609691977500916. Accuracy: 77.42333813541882
Epoch:  126
Epoch:  127
Epoch:  128
Iteration: 27500. Loss: 0.8649237155914307. Accuracy: 47.58180695616382
Epoch:  129
Epoch:  130
Iteration: 28000. Loss: 0.7639445066452026. Accuracy: 71.45503189956781
Epoch:  131
Epoch:  132
Iteration: 28500. Loss: 1.048959493637085. Accuracy: 45.976538382383204
Epoch:  133
Epoch:  134
Epoch:  135
Iteration: 29000. Loss: 0.44293472170829773. Accuracy: 78.39061535295328
Epoch:  136
Epoch:  137
Iteration: 29500. Loss: 0.8054913878440857. Accuracy: 63.22288536735954
Epoch:  138
Epoch:  139
Iteration: 30000. Loss: 0.3770069181919098. Accuracy: 77.75262399670714
Epoch:  140
Epoch:  141
Epoch:  142
Iteration: 30500. Loss: 0.49199268221855164. Accuracy: 80.38691088701378
Epoch:  143
Epoch:  144
Iteration: 31000. Loss: 0.5945347547531128. Accuracy: 73.24552377032312
Epoch:  145
Epoch:  146
Iteration: 31500. Loss: 0.5121959447860718. Accuracy: 80.48981271866639
Epoch:  147
Epoch:  148
```

1.2.3 Graph :



2 Dataset 2

The dataset was in idx3-ubyte file format. Then I do the following work for using Dataset 2 in my model. Among the experiments, the best 2 models were taken for dataset 2.

- convert idx3-ubyte to numpy.
- convert values into 28*28 image and save it.
- convert image into 200*200 and save it.
- create a csv file based on that.

2.1 Experiment 1:

2.1.1 Parameter :

This is an experiment on dataset 2. In this experiment hyperparameters were following:-

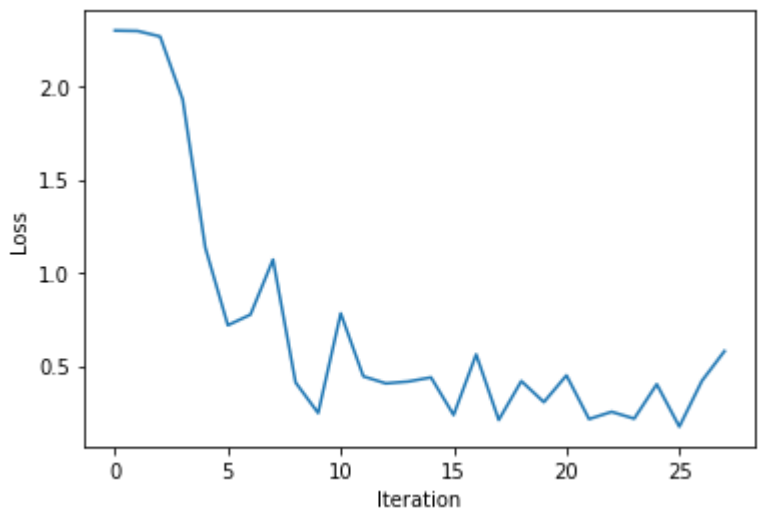
- Batch size = 20
- Iteration number = 20000
- Learning Rate = 0.01
- Number of Hidden layer = 6

Activation functions are
- RelU.

2.1.2 Result :

```
Epoch:  1
Iteration: 500. Loss: 2.299828290939331. Accuracy: 16.483333333333334
Iteration: 1000. Loss: 2.297426223754883. Accuracy: 12.883333333333333
Iteration: 1500. Loss: 2.267861843109131. Accuracy: 20.616666666666667
Iteration: 2000. Loss: 1.9292958974838257. Accuracy: 26.275
Epoch:  2
Iteration: 2500. Loss: 1.1349800825119019. Accuracy: 44.391666666666666
Iteration: 3000. Loss: 0.7181354761123657. Accuracy: 65.74166666666666
Iteration: 3500. Loss: 0.7749776840209961. Accuracy: 70.11666666666666
Iteration: 4000. Loss: 1.0704723596572876. Accuracy: 69.775
Iteration: 4500. Loss: 0.4109187722206116. Accuracy: 76.30833333333334
Epoch:  3
Iteration: 5000. Loss: 0.24706034362316132. Accuracy: 79.10833333333333
Iteration: 5500. Loss: 0.781778872013092. Accuracy: 78.3
Iteration: 6000. Loss: 0.4438822865486145. Accuracy: 80.23333333333333
Iteration: 6500. Loss: 0.4058869779109955. Accuracy: 76.99166666666666
Iteration: 7000. Loss: 0.4161556363105774. Accuracy: 81.175
Epoch:  4
Iteration: 7500. Loss: 0.4380320608615875. Accuracy: 82.25
Iteration: 8000. Loss: 0.23655208945274353. Accuracy: 84.225
Iteration: 8500. Loss: 0.5613423585891724. Accuracy: 82.23333333333333
Iteration: 9000. Loss: 0.20996466279029846. Accuracy: 84.60833333333333
Iteration: 9500. Loss: 0.41820359230041504. Accuracy: 84.64166666666667
Epoch:  5
Iteration: 10000. Loss: 0.30563846230506897. Accuracy: 83.475
Iteration: 10500. Loss: 0.448943555355072. Accuracy: 83.65833333333333
Iteration: 11000. Loss: 0.2145303189754486. Accuracy: 85.46666666666667
Iteration: 11500. Loss: 0.25344133377075195. Accuracy: 84.63333333333334
Iteration: 12000. Loss: 0.2168407142162323. Accuracy: 85.96666666666667
Epoch:  6
Iteration: 12500. Loss: 0.4017353653907776. Accuracy: 85.60833333333333
Iteration: 13000. Loss: 0.17390838265419006. Accuracy: 86.16666666666667
Iteration: 13500. Loss: 0.41955918073654175. Accuracy: 86.15
Iteration: 14000. Loss: 0.5792661309242249. Accuracy: 85.40833333333333
```

2.1.3 Graph :



2.2 Experiment 2:

2.2.1 Parameter :

- Batch size = 80
- Iteration number = 50000
- Learning Rate = 0.05
- Number of Hidden layer = 900

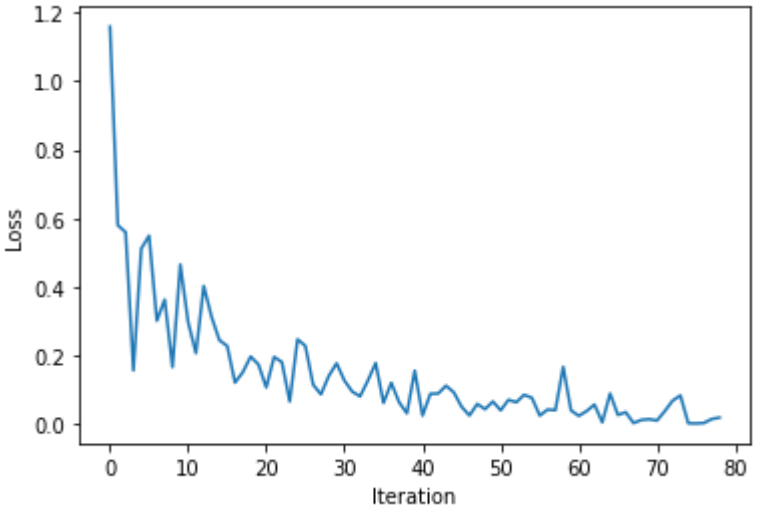
Activation functions are

- RelU.

2.2.2 Result :

```
Epoch:  44
Iteration: 26000. Loss: 0.06959208101034164. Accuracy: 89.09166666666667
Epoch:  45
Iteration: 26500. Loss: 0.06234128028154373. Accuracy: 89.74166666666666
Iteration: 27000. Loss: 0.0842268243432045. Accuracy: 89.43333333333334
Epoch:  46
Iteration: 27500. Loss: 0.07525581121444702. Accuracy: 89.2
Epoch:  47
Iteration: 28000. Loss: 0.023571116849780083. Accuracy: 89.30833333333334
Epoch:  48
Iteration: 28500. Loss: 0.041069019585847855. Accuracy: 89.18333333333334
Epoch:  49
Iteration: 29000. Loss: 0.03942003473639488. Accuracy: 89.90833333333333
Epoch:  50
Iteration: 29500. Loss: 0.16581179201602936. Accuracy: 89.25
Iteration: 30000. Loss: 0.03851495683193207. Accuracy: 89.63333333333334
Epoch:  51
Iteration: 30500. Loss: 0.02273341454565525. Accuracy: 89.88333333333334
Epoch:  52
Iteration: 31000. Loss: 0.036737680435180664. Accuracy: 89.85833333333333
Epoch:  53
Iteration: 31500. Loss: 0.05569620057940483. Accuracy: 89.04166666666667
Epoch:  54
Iteration: 32000. Loss: 0.003910871222615242. Accuracy: 89.61666666666666
Epoch:  55
Iteration: 32500. Loss: 0.08803849667310715. Accuracy: 88.31666666666666
Iteration: 33000. Loss: 0.025364568457007408. Accuracy: 89.71666666666667
Epoch:  56
Iteration: 33500. Loss: 0.0334484800696373. Accuracy: 88.90833333333333
Epoch:  57
Iteration: 34000. Loss: 0.0017258409643545747. Accuracy: 89.875
Epoch:  58
Iteration: 34500. Loss: 0.01079382561147213. Accuracy: 89.68333333333334
Epoch:  59
Iteration: 35000. Loss: 0.013108862563967705. Accuracy: 90.24166666666666
Epoch:  60
Iteration: 35500. Loss: 0.008943496271967888. Accuracy: 89.875
Iteration: 36000. Loss: 0.0365353599190712. Accuracy: 88.79166666666667
Epoch:  61
Iteration: 36500. Loss: 0.06713442504405975. Accuracy: 89.31666666666666
Epoch:  62
Iteration: 37000. Loss: 0.0823284164071083. Accuracy: 89.65
Epoch:  63
Iteration: 37500. Loss: 0.0012986536603420973. Accuracy: 89.84166666666667
Epoch:  64
Iteration: 38000. Loss: 0.0005455426871776581. Accuracy: 90.30833333333334
Epoch:  65
Iteration: 38500. Loss: 0.0018262891098856926. Accuracy: 90.24166666666666
Iteration: 39000. Loss: 0.01343185268342495. Accuracy: 89.95
Epoch:  66
Iteration: 39500. Loss: 0.01765311136841774. Accuracy: 90.19166666666666
```

2.2.3 Graph :



Github link: https://github.com/gunner73/Deep-Neural-Network-Assignment-Soft-Computing-.git