PREMIER UNIVERSITY CHITTAGONG

Department of Computer Science & Engineering

Experiment Submission.

Course Title: Neural Network and Fuzzy Logic Laboratory
Course Code: CSE 452
Assignment no.: 01
Name of Assignment: Predicting 'Diabetes

Submitted to:

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Semester : 7th
Section : C7B

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I had run the code above 60 times. I had also tried run the code several times with changing activation functions, optimizers, losses, layers etc. But the dataset didn't show good result to me.

Output:

01

Using Hidden Layer 9,
Activation Function = 'sigmoid',
Optimizers = Adam,
Losses = BinaryCrossentropy,
Epochs=100,
Verbose=1

```
Epoch 94/100
20/20 [==============================] - 0s 14ms/step - loss: 0.6899 - accuracy: 0.6678 - val_loss: 0.5779 - val_accuracy: 0.7273
Epoch 95/100
20/20 [==============================] - 0s 12ms/step - loss: 0.5405 - accuracy: 0.7166 - val_loss: 0.5570 - val_accuracy: 0.7208
Epoch 96/100
20/20 [==============================] - 0s 13ms/step - loss: 0.5327 - accuracy: 0.7313 - val_loss: 0.5650 - val_accuracy: 0.7338
Epoch 97/100
20/20 [==============================] - 0s 13ms/step - loss: 0.5479 - accuracy: 0.7427 - val_loss: 0.5916 - val_accuracy: 0.7208
Epoch 98/100
20/20 [==============================] - 0s 14ms/step - loss: 0.5509 - accuracy: 0.7345 - val_loss: 0.5544 - val_accuracy: 0.7143
Epoch 99/100
20/20 [==============================] - 0s 13ms/step - loss: 0.5624 - accuracy: 0.7215 - val_loss: 0.5908 - val_accuracy: 0.7013
Epoch 100/100
20/20 [==============================] - 0s 13ms/step - loss: 0.5445 - accuracy: 0.7394 - val_loss: 0.5317 - val_accuracy: 0.7338
<keras.callbacks.History at 0x7f9e31f6c790>
```

```
1 pred = model.predict(X_test)
2 print(Y_test)
3 print(pred)
```

```
[1. 0. 0. 0. 0. 0. 1. 1. 0. 0. 1. 0. 0. 0. 0. 0. 0. 0. 1. 1. 1. 0. 0. 1.
 0. 1. 0. 1. 0. 0. 1. 0. 0. 0. 1. 1. 1. 1. 1. 0. 0. 0. 0. 0. 0. 0. 1. 0.
 1. 1. 0. 1. 1. 1. 0. 1. 0. 1. 0. 0. 0. 0. 0. 1. 1. 0. 0. 1. 1. 1. 1. 0.
 0. 0. 0. 0. 0. 1. 1. 0. 0. 0. 0. 1. 0. 0. 0. 0. 1. 0. 0. 1. 0. 0. 0. 0. 0. 0.
 0. 1. 0. 1. 0. 1. 0. 1. 0. 1. 1. 1. 0. 1. 0. 0. 0. 0. 1. 0. 0. 0. 1. 0.
 0. 0. 1. 0. 0. 1. 0. 0. 0. 0. 1. 0. 0. 0. 0. 0. 1. 0. 1. 1. 0. 0. 1. 0.
 0. 0. 0. 1. 0. 0. 0. 1. 0. 0.]
[[0.369725  ]
 [0.09187678]
 [0.21743849]
 [0.6862402 ]
 [0.10562053]
 [0.25703877]
 [0.5576631 ]
 [0.196361  ]
 [0.29418802]
```

02

Using Hidden Layer 14,
Activation Function = 'sigmoid',
Optimizers = Adam,
Losses = BinaryCrossentropy,
Epochs=100,
Verbose = 1

```
20/20 [==============================] - 0s 13ms/step - loss: 0.5925 - accuracy: 0.7036 - val_loss: 0.5901 - val_accuracy: 0.7013
Epoch 23/100
20/20 [==============================] - 0s 13ms/step - loss: 0.5887 - accuracy: 0.6906 - val_loss: 0.5981 - val_accuracy: 0.7078
Epoch 24/100
20/20 [==============================] - 0s 12ms/step - loss: 0.5881 - accuracy: 0.7101 - val_loss: 0.5686 - val_accuracy: 0.7013
Epoch 25/100
20/20 [==============================] - 0s 12ms/step - loss: 0.5806 - accuracy: 0.7085 - val_loss: 0.5679 - val_accuracy: 0.7143
Epoch 26/100
20/20 [==============================] - 0s 13ms/step - loss: 0.5832 - accuracy: 0.6938 - val_loss: 0.5673 - val_accuracy: 0.7403
Epoch 27/100
20/20 [==============================] - 0s 13ms/step - loss: 0.5852 - accuracy: 0.7020 - val_loss: 0.6068 - val_accuracy: 0.7078
Epoch 28/100
20/20 [==============================] - 0s 13ms/step - loss: 0.5874 - accuracy: 0.7020 - val_loss: 0.5602 - val_accuracy: 0.7143
Epoch 29/100
20/20 [==============================] - 0s 13ms/step - loss: 0.5774 - accuracy: 0.7329 - val_loss: 0.5514 - val_accuracy: 0.7338
Epoch 30/100
20/20 [==============================] - 0s 13ms/step - loss: 0.5789 - accuracy: 0.7248 - val_loss: 0.5736 - val_accuracy: 0.6948
```

```
1 pred = model.predict(X_test)
2 print(Y_test)
3 print(pred)
```

```
[1. 0. 1. 0. 0. 1. 0. 1. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 1. 1.
 0. 0. 0. 1. 0. 0. 0. 1. 0. 0. 0. 0. 0. 1. 0. 1. 0. 0. 1. 0. 0. 0. 1. 0.
 1. 0. 0. 1. 1. 1. 0. 0. 0. 1. 0. 0. 1. 1. 1. 0. 0. 0. 0. 1. 1. 0. 0. 0.
 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 1. 0. 1. 1. 0. 0. 0. 1. 0. 0. 0. 1. 1.
 1. 1. 0. 0. 0. 0. 1. 1. 0. 1. 0. 0. 0. 0. 1. 1. 0. 1. 0. 0. 0. 0. 1. 0.
 1. 0. 0. 1. 0. 0. 0. 0. 0. 0. 0. 0. 0. 1. 1. 0. 0. 0. 1. 0. 0. 0. 0. 0.
 0. 0. 0. 0. 0. 1. 1. 1. 0. 0.]
[[0.56165844]
 [0.4519432 ]
 [0.3522953 ]
 [0.1495953 ]
 [0.20477197]
 [0.551866  ]
 [0.7043745 ]
 [0.8868203 ]
```

03

Using Hidden Layer 14,
Activation Function = 'sigmoid',
Optimizers = Adamax,
Losses = BinaryCrossentropy,
Epochs=2500,
Verbose = 1

```
Epoch 2494/2500
20/20 [==============================] - 0s 20ms/step - loss: 0.4873 - accuracy: 0.7801 - val_loss: 0.4467 - val_accuracy: 0.8052
Epoch 2495/2500
20/20 [==============================] - 0s 20ms/step - loss: 0.4893 - accuracy: 0.7769 - val_loss: 0.4468 - val_accuracy: 0.8052
Epoch 2496/2500
20/20 [==============================] - 0s 18ms/step - loss: 0.4823 - accuracy: 0.7752 - val_loss: 0.4506 - val_accuracy: 0.7792
Epoch 2497/2500
20/20 [==============================] - 0s 20ms/step - loss: 0.4865 - accuracy: 0.7671 - val_loss: 0.4467 - val_accuracy: 0.7987
Epoch 2498/2500
20/20 [==============================] - 0s 20ms/step - loss: 0.4939 - accuracy: 0.7573 - val_loss: 0.4513 - val_accuracy: 0.7857
Epoch 2499/2500
20/20 [==============================] - 0s 19ms/step - loss: 0.4963 - accuracy: 0.7557 - val_loss: 0.4461 - val_accuracy: 0.7922
Epoch 2500/2500
20/20 [==============================] - 0s 21ms/step - loss: 0.4886 - accuracy: 0.7704 - val_loss: 0.4475 - val_accuracy: 0.7922
<keras.callbacks.History at 0x7f520f9e0a10>
```

```
1 pred = model.predict(X_test)
2 print(Y_test)
3 print(pred)
```

```
[0. 1. 0. 0. 1. 0. 0. 0. 0. 0. 1. 0. 0. 0. 1. 0. 1. 1. 0. 0. 0. 0. 0. 1.
 0. 1. 1. 0. 1. 0. 0. 1. 0. 1. 1. 1. 0. 0. 0. 0. 1. 0. 0. 1. 0. 0. 0. 0.
 1. 0. 0. 0. 1. 1. 1. 0. 0. 0. 0. 0. 0. 0. 1. 1. 0. 0. 0. 0. 0. 0. 1. 0.
 1. 1. 1. 0. 0. 0. 0. 1. 0. 0. 0. 0. 1. 1. 0. 1. 0. 0. 1. 0. 1. 0. 1. 1.
 0. 0. 0. 1. 0. 1. 0. 1. 0. 0. 1. 0. 0. 0. 1. 0. 1. 0. 1. 0. 0. 1. 0. 0.
 0. 0. 0. 0. 0. 0. 1. 1. 1. 0. 0. 1. 0. 0. 1. 1. 0. 0. 0. 0. 0. 0. 1. 0.
 0. 1. 1. 0. 0. 1. 0. 0. 1. 0.]
[[0.2563382 ]
 [0.70193124]
 [0.10757459]
 [0.2851517 ]
 [0.38976634]
 [0.03783531]
 [0.0200705 ]
 [0.42946273]
 [0.20391811]
 [0.38947952]
```

04

Using Hidden Layer 14,
Activation Function = 'softsign',
Optimizers = Adamax,
Losses = BinaryCrossentropy,
Epochs=100,
Verbose = 1

```
+ Code  + Text

[9]  20/20 [==============================] - 0s 14ms/step - loss: 5.4012 - accuracy: 0.6498 - val_loss: 5.3086 - val_accuracy: 0.6558
     Epoch 95/100
     20/20 [==============================] - 0s 13ms/step - loss: 5.4012 - accuracy: 0.6498 - val_loss: 5.3086 - val_accuracy: 0.6558
     Epoch 96/100
     20/20 [==============================] - 0s 13ms/step - loss: 5.4012 - accuracy: 0.6498 - val_loss: 5.3086 - val_accuracy: 0.6558
     Epoch 97/100
     20/20 [==============================] - 0s 13ms/step - loss: 5.4012 - accuracy: 0.6498 - val_loss: 5.3086 - val_accuracy: 0.6558
     Epoch 98/100
     20/20 [==============================] - 0s 13ms/step - loss: 5.4012 - accuracy: 0.6498 - val_loss: 5.3086 - val_accuracy: 0.6558
     Epoch 99/100
     20/20 [==============================] - 0s 13ms/step - loss: 5.4012 - accuracy: 0.6498 - val_loss: 5.3086 - val_accuracy: 0.6558
     Epoch 100/100
     20/20 [==============================] - 0s 14ms/step - loss: 5.4012 - accuracy: 0.6498 - val_loss: 5.3086 - val_accuracy: 0.6558
     <keras.callbacks.History at 0x7f694c4be0d0>

     1 pred = model.predict(X_test)
     2 print(Y_test)
     3 print(pred)

     [1. 1. 0. 0. 1. 0. 0. 0. 1. 0. 0. 0. 1. 0. 0. 1. 0. 0. 0. 1. 1. 0. 1. 0.
      1. 1. 0. 0. 1. 0. 0. 1. 0. 1. 0. 0. 0. 1. 1. 0. 0. 1. 0. 1. 1. 0. 0. 1.
      1. 0. 0. 0. 1. 0. 1. 1. 1. 0. 1. 0. 0. 0. 1. 1. 1. 0. 0. 0. 0. 0. 1. 0.
      0. 0. 0. 0. 1. 0. 0. 0. 1. 0. 1. 1. 1. 0. 0. 1. 0. 0. 0. 1. 0. 1. 0. 1.
      0. 0. 0. 1. 1. 0. 1. 0. 0. 1. 0. 0. 1. 0. 0. 0. 1. 1. 0. 0. 1. 0. 0. 0.
      0. 0. 1. 0. 0. 0. 0. 0. 0. 0. 0. 0. 1. 1. 0. 0. 1. 0. 0. 0. 0. 0. 0. 0.
      0. 1. 0. 0. 0. 1. 0. 0. 0. 0.]
     [[-0.9999912 ]
      [-0.9999824 ]
      [-0.99998   ]
      [-0.9999821 ]
      [-0.9999802 ]
      [-0.99997634]
      [-0.9999808 ]
      [-0.99998605]
      [-0.9999876 ]
      [-0.9999899 ]
```

05

Using Hidden Layer 14,
Activation Function = 'selu',
Optimizers = Adamax,
Losses = BinaryCrossentropy,
Epochs=100,
Verbose = 1

```
20/20 [==============================] - 0s 13ms/step - loss: 9.7605 - accuracy: 0.3599 - val_loss: 10.5953 - val_accuracy: 0.3052
Epoch 94/100
20/20 [==============================] - 0s 13ms/step - loss: 9.7605 - accuracy: 0.3599 - val_loss: 10.5953 - val_accuracy: 0.3052
Epoch 95/100
20/20 [==============================] - 0s 14ms/step - loss: 9.7605 - accuracy: 0.3599 - val_loss: 10.5953 - val_accuracy: 0.3052
Epoch 96/100
20/20 [==============================] - 0s 13ms/step - loss: 9.7605 - accuracy: 0.3599 - val_loss: 10.5953 - val_accuracy: 0.3052
Epoch 97/100
20/20 [==============================] - 0s 13ms/step - loss: 9.7605 - accuracy: 0.3599 - val_loss: 10.5953 - val_accuracy: 0.3052
Epoch 98/100
20/20 [==============================] - 0s 13ms/step - loss: 9.7605 - accuracy: 0.3599 - val_loss: 10.5953 - val_accuracy: 0.3052
Epoch 99/100
20/20 [==============================] - 0s 13ms/step - loss: 9.7605 - accuracy: 0.3599 - val_loss: 10.5953 - val_accuracy: 0.3052
Epoch 100/100
20/20 [==============================] - 0s 13ms/step - loss: 9.7605 - accuracy: 0.3599 - val_loss: 10.5953 - val_accuracy: 0.3052
<keras.callbacks.History at 0x7f694c10e550>
```

```
1 pred = model.predict(X_test)
2 print(Y_test)
3 print(pred)
```

```
[1. 0. 1. 0. 1. 1. 0. 0. 1. 1. 1. 0. 0. 1. 1. 0. 0. 0. 1. 1. 0. 0. 1. 0.
 1. 0. 1. 0. 0. 1. 0. 0. 1. 0. 0. 0. 0. 0. 1. 1. 0. 1. 0. 1. 0. 0. 0. 1.
 0. 0. 0. 1. 0. 0. 0. 1. 0. 0. 1. 0. 0. 1. 0. 1. 0. 1. 0. 0. 1. 1. 1. 0.
 0. 0. 0. 1. 0. 0. 0. 0. 1. 0. 1. 0. 1. 0. 1. 0. 0. 0. 0. 0. 1. 0. 0. 0.
 1. 0. 1. 0. 0. 0. 0. 0. 0. 1. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
 0. 0. 0. 0. 0. 0. 0. 1. 0. 0. 0. 0. 0. 0. 0. 0. 0. 1. 1. 0. 0. 1. 0. 0.
 0. 0. 1. 1. 0. 0. 0. 0. 1. 1.]
[[ 36.5969  ]
 [ 37.153103]
 [ 76.19305 ]
 [ 43.03832 ]
 [ 18.867048]
 [ 97.410645]
 [ 30.031017]
 [ 35.305473]
```

06 Best Model

Using Hidden Layer 14,
Activation Function = 'sigmoid',
Optimizers = Adamax,
Losses = BinaryCrossentropy,
Epochs=4000,
Verbose = 1

```
20/20 [==============================] - 2s 106ms/step - loss: 0.4783 - accuracy: 0.7720 - val_loss: 0.4841 - val_accuracy: 0.7857
Epoch 3996/4000
20/20 [==============================] - 2s 106ms/step - loss: 0.4853 - accuracy: 0.7785 - val_loss: 0.4846 - val_accuracy: 0.7727
Epoch 3997/4000
20/20 [==============================] - 2s 107ms/step - loss: 0.4776 - accuracy: 0.7687 - val_loss: 0.4824 - val_accuracy: 0.7792
Epoch 3998/4000
20/20 [==============================] - 2s 105ms/step - loss: 0.4740 - accuracy: 0.7850 - val_loss: 0.4882 - val_accuracy: 0.7727
Epoch 3999/4000
20/20 [==============================] - 2s 105ms/step - loss: 0.4779 - accuracy: 0.7704 - val_loss: 0.4853 - val_accuracy: 0.7727
Epoch 4000/4000
20/20 [==============================] - 2s 106ms/step - loss: 0.4758 - accuracy: 0.7671 - val_loss: 0.4901 - val_accuracy: 0.7792
<keras.callbacks.History at 0x7f958c530390>
```

```
1 pred = model.predict(X_test)
2 print(Y_test)
3 print(pred)
```

```
[0. 0. 1. 0. 1. 0. 0. 1. 0. 1. 1. 1. 0. 0. 1. 1. 0. 0. 0. 1. 0. 0. 0. 1.
 0. 0. 1. 1. 0. 0. 0. 0. 0. 0. 0. 1. 0. 1. 1. 1. 0. 1. 1. 1. 0. 0. 1. 1.
 0. 0. 1. 0. 0. 1. 0. 1. 0. 0. 0. 0. 1. 0. 0. 0. 0. 1. 1. 0. 0. 0. 0. 0.
 0. 0. 0. 0. 1. 0. 0. 0. 0. 0. 1. 0. 0. 1. 0. 1. 0. 1. 1. 1. 1. 0. 1. 0.
 1. 1. 0. 0. 1. 1. 0. 0. 0. 0. 0. 0. 0. 1. 0. 0. 1. 0. 0. 1. 0. 0. 1. 0.
 0. 1. 0. 0. 0. 0. 0. 0. 0. 0. 1. 1. 0. 1. 0. 0. 0. 0. 1. 0. 0. 1. 0. 0.
 1. 0. 0. 0. 0. 1. 0. 0. 0. 1.]
[[0.09317261]
 [0.06183803]
 [0.67729515]
 [0.06882006]
 [0.8085135 ]
 [0.04326332]
 [0.27186036]
 [0.8976911 ]
 [0.10191745]
 [0.16190767]
 [0.23854291]
 [0.27889648]
```