Programming Assignment Unit 6

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CS 4407: Data Mining and Machine Learning

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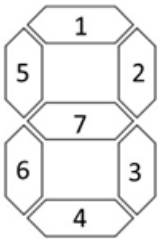
Programming Assignment Unit 6

For the Unit 6 assignment, you will be required to build and train a neural network to recognize letters of the alphabet and numbers based upon their design using a seven-segment display where each segment of the display is one input into the neural network.

Part 1. Write the pattern file

The pattern file is what the program uses to train the network. To create this file, you need to encode the input and output, and then put the data into a format that the program can analyze.

a. Encode the input (the seven segment display) in a binary format that the program can recognize. This can be done many ways, but I suggest making a seven-element vector with each index representing one location in the display.
b. Encode the output in a binary format. Since the program requires binary input and output, the values need to be converted into binary. Again, any mapping would work here, but I suggest using the ASCII values for each character. In general, you can look these up in an ASCII table, but for this assignment, the relevant codes are listed below.



Characters	ASCII	Binary	Seven Segment Value
0	48	0110000	1111110
1	49	0110001	1110000
2	50	0110010	1101011
3	51	0110011	1111001
4	52	0110100	0110101
5	53	0110101	1011101
6	54	0110110	1011111
7	55	0110111	1110100
8	56	0111000	1111111

Characters	ASCII	Binary	Seven Segment Value
9	57	0111001	1111101
A	65	1000001	1110111
B	66	1000010	1111111
C	67	1000011	1001110
D	68	1000100	1111110
E	69	1000101	1001111
F	70	1000110	1000111
H	72	1001000	0110111

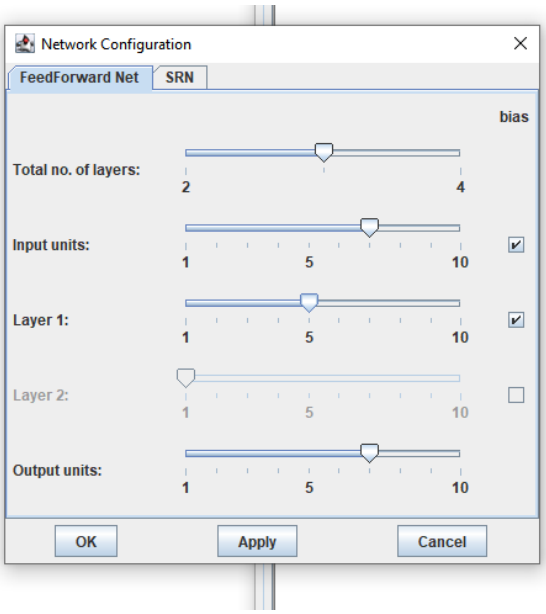
c. Create a text file to use for training the network. This file should be in the following format:

traindata.pat

```
Number of patterns = 17
Number of inputs = 7
Number of outputs = 7
[patterns]
1111110 0110000
1110000 0110001
1101011 0110010
1111001 0110011
0110101 0110100
1011101 0110101
1011111 0110110
1110100 0110111
1111111 0111000
1111101 0111001
1110111 1000001
1111111 1000010
1001110 1000011
1111110 1000100
1001111 1000101
1000111 1000110
0110111 1001000
```

Part 2. Create the network

a. Configure the network by going to the Network menu and choosing Configure Network from the list of options



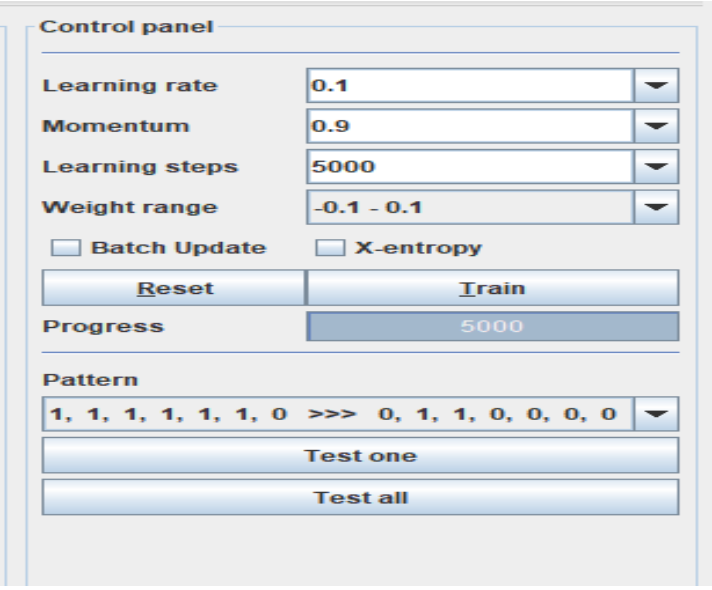
Number of layers =3

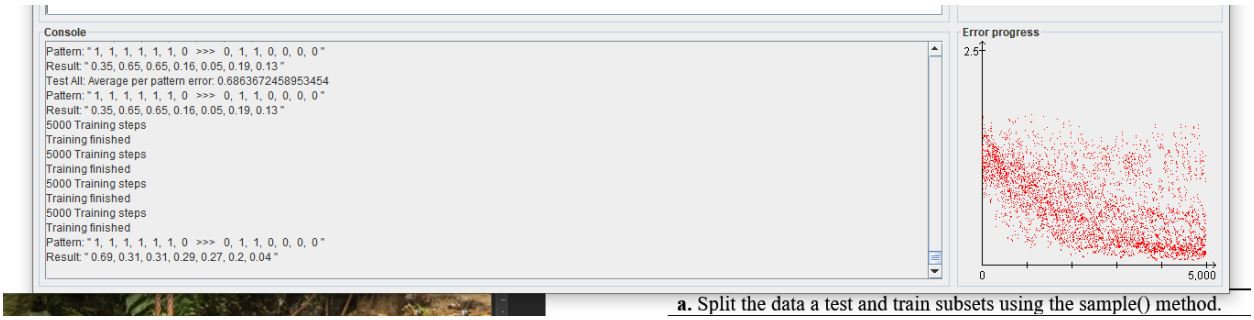
Number of input = 7

Layer1 = 5

Number of output = 7

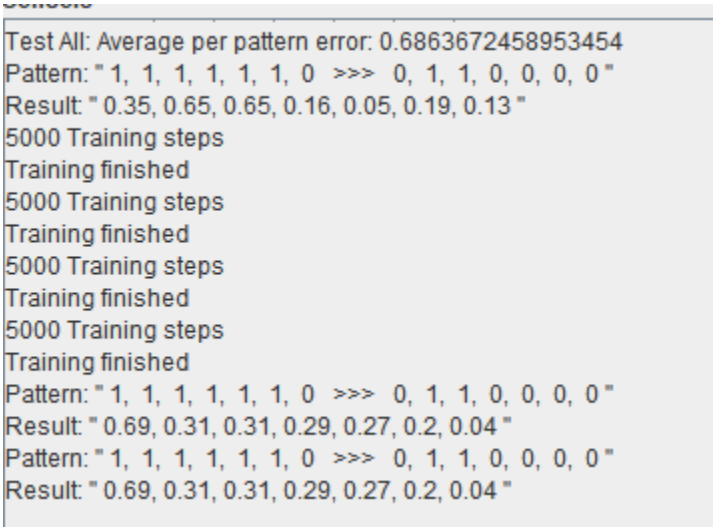
b. Train the network by loading in your pattern file. This can be done by going to the Patterns dropdown menu and choosing Load Patterns. Then choose the file that you created from part 1.

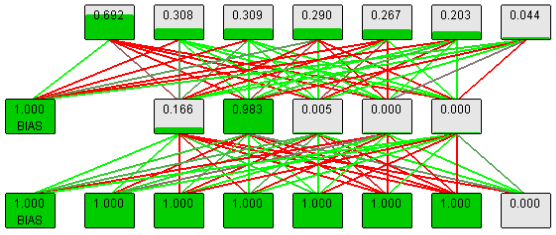




a. Split the data a test and train subsets using the sample() method.

c. Test the model by choosing individual patterns and Clicking the Test one button.





Saved weights:

```
[Weights]
Number of layers = 2
[Layer0]
Number to = 5
Number from = 8
2.448  4.829  -2.282  -1.332  1.421  -1.992  -4.705  -4.286
1.397  -3.131  1.354  7.034  7.65  -4.892  -5.327  0.363
0.899  1.418  -1.952  0.717  1.938  -1.487  -6.768  2.412
-1.837  -0.295  2.031  -1.837  3.042  -6.833  -1.925  2.395
2.426  2.117  -9.255  2.174  -5.262  4.493  -4.4  0.622
[Layer1]
Number to = 7
Number from = 6
5.399  -0.551  -4.551  -3.621  -3.546  -2.335
-5.398  0.552  4.55  3.624  3.535  2.334
-5.409  0.565  4.561  3.59  3.543  2.343
0.55  -4.348  -0.752  3.761  -3.475  -6.645
-2.652  -2.762  2.139  -0.833  -3.586  8.63
-3.021  2.602  1.271  -6.364  8.504  4.846
1.63  7.959  -6.171  5.228  -0.084  -3.106
```