Assignment #1

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1. 編譯結果

```
richie0203@RichieG15:~/workspace/NN$ make
cc -g -Wall -Werror -c src/layer.c -o build/layer.o
cc -g -Wall -Werror -c src/main.c -o build/main.o
cc -g -Wall -Werror -c src/neuron.c -o build/neuron.o
cc -pthread -lpthread -o bin/backprop build/layer.o build/main.o build/neuron.o -lm
```

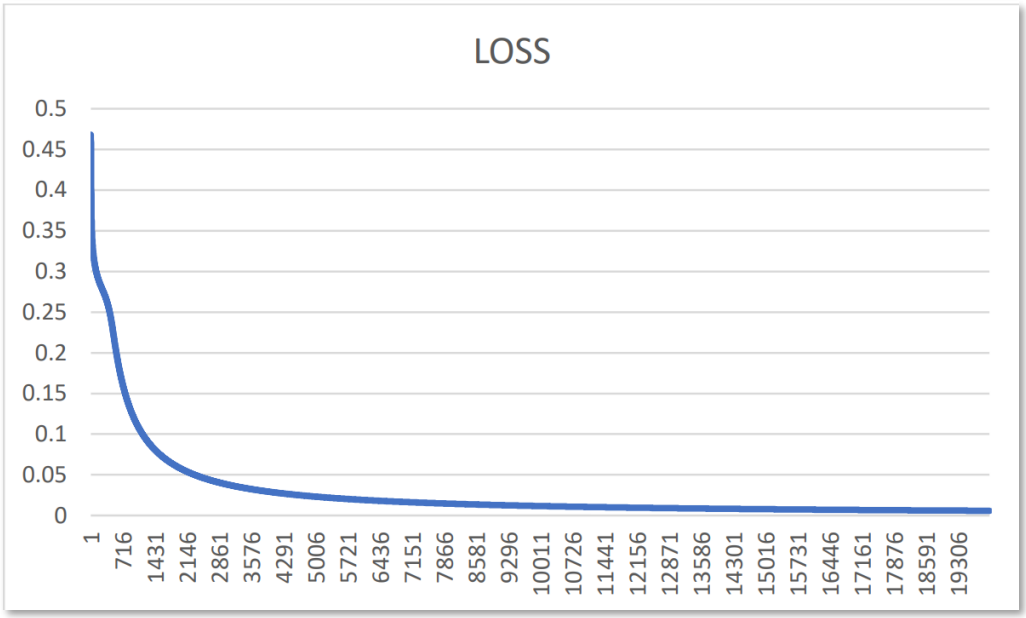
2. 執行結果

```
richie0203@RichieG15:~/workspace/NN$ make nn
./bin/backprop
Enter the number of Layers in Neural Network:
4
Enter number of neurons in layer[1]:
2
Enter number of neurons in layer[2]:
4
Enter number of neurons in layer[3]:
4
Enter number of neurons in layer[4]:
1

Created Layer: 1
Number of Neurons in Layer 1: 2
Neuron 1 in Layer 1 created
Neuron 2 in Layer 1 created

Created Layer: 2
Number of Neurons in Layer 2: 4
Neuron 1 in Layer 2 created
Neuron 2 in Layer 2 created
Neuron 3 in Layer 2 created
Neuron 4 in Layer 2 created

Created Layer: 3
Number of Neurons in Layer 3: 4
Neuron 1 in Layer 3 created
Neuron 2 in Layer 3 created
Neuron 3 in Layer 3 created
Neuron 4 in Layer 3 created

Created Layer: 4
Number of Neurons in Layer 4: 1
Neuron 1 in Layer 4 created
```

```
Initializing weights...
0:w[0][0]: 0.074696
1:w[0][0]: 0.544616
2:w[0][0]: 0.561802
3:w[0][0]: 0.068298
0:w[0][1]: 0.895093
1:w[0][1]: 0.861073
2:w[0][1]: 0.347419
3:w[0][1]: 0.343581
0:w[1][0]: 0.560164
1:w[1][0]: 0.913361
2:w[1][0]: 0.215226
3:w[1][0]: 0.974575
0:w[1][1]: 0.456874
1:w[1][1]: 0.333024
2:w[1][1]: 0.433045
3:w[1][1]: 0.836566
0:w[1][2]: 0.616634
1:w[1][2]: 0.740254
2:w[1][2]: 0.338284
3:w[1][2]: 0.771273
0:w[1][3]: 0.386030
1:w[1][3]: 0.909407
2:w[1][3]: 0.639970
3:w[1][3]: 0.174994
0:w[2][0]: 0.431038
0:w[2][1]: 0.037657
0:w[2][2]: 0.124463
0:w[2][3]: 0.574031

Neural Network Created Successfully...
```

```
Input: 1.000000
Output: 0
Input: 0.000000
Input: 0.000000
Output: 0
Input: 0.000000
Input: 1.000000
Output: 1
Input: 1.000000
Input: 0.000000
Output: 1
Input: 1.000000
Input: 1.000000
Output: 0
Input: 0.000000
Input: 0.000000
Output: 0
Input: 0.000000
Input: 1.000000
Output: 1
Input: 1.000000
Input: 0.000000
Output: 1
Input: 1.000000
Input: 1.000000
Output: 0
Enter input to test:
```

3. 分析



Loss Function 使用 Mean Square Error (MSE)計算。

$$MSE = \frac{1}{N}\sum_{i=1}^{N}(y_i - \hat{y}_i)$$

隨 Training 次數逐漸趨近於 20000 組(80000 筆資料)，Loss 逐漸趨近於 0 (0.005807)。

Num	MSE
19995	0.005808
19996	0.005808
19997	0.005808
19998	0.005808
19999	0.005807
20000	0.005807

- 問題：Enter Input to Test 階段無法脫離，需要持續輸入。
  - 解決：修改為當偵測到輸入「2」時便會脫離迴圈，結束程式。