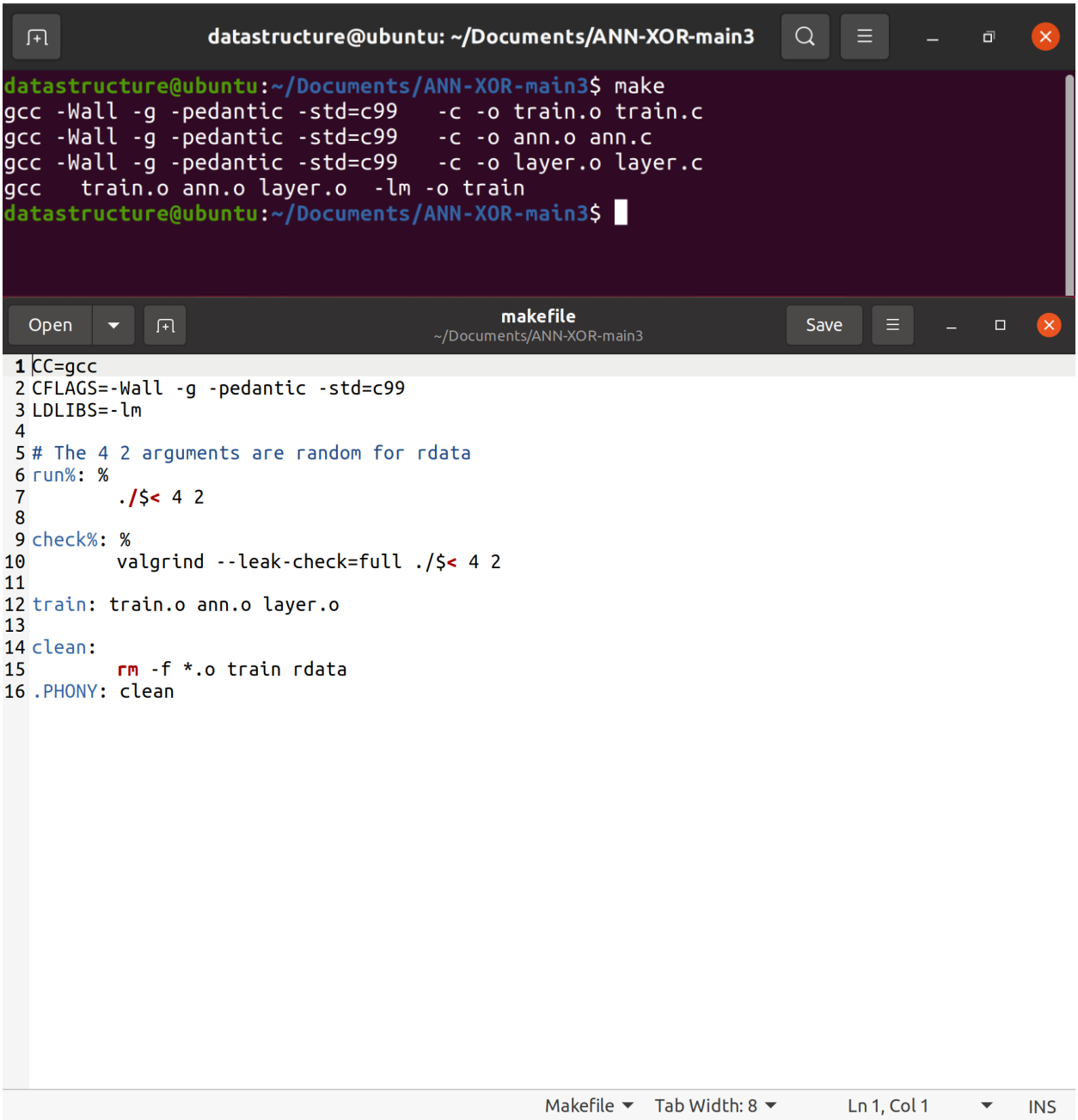
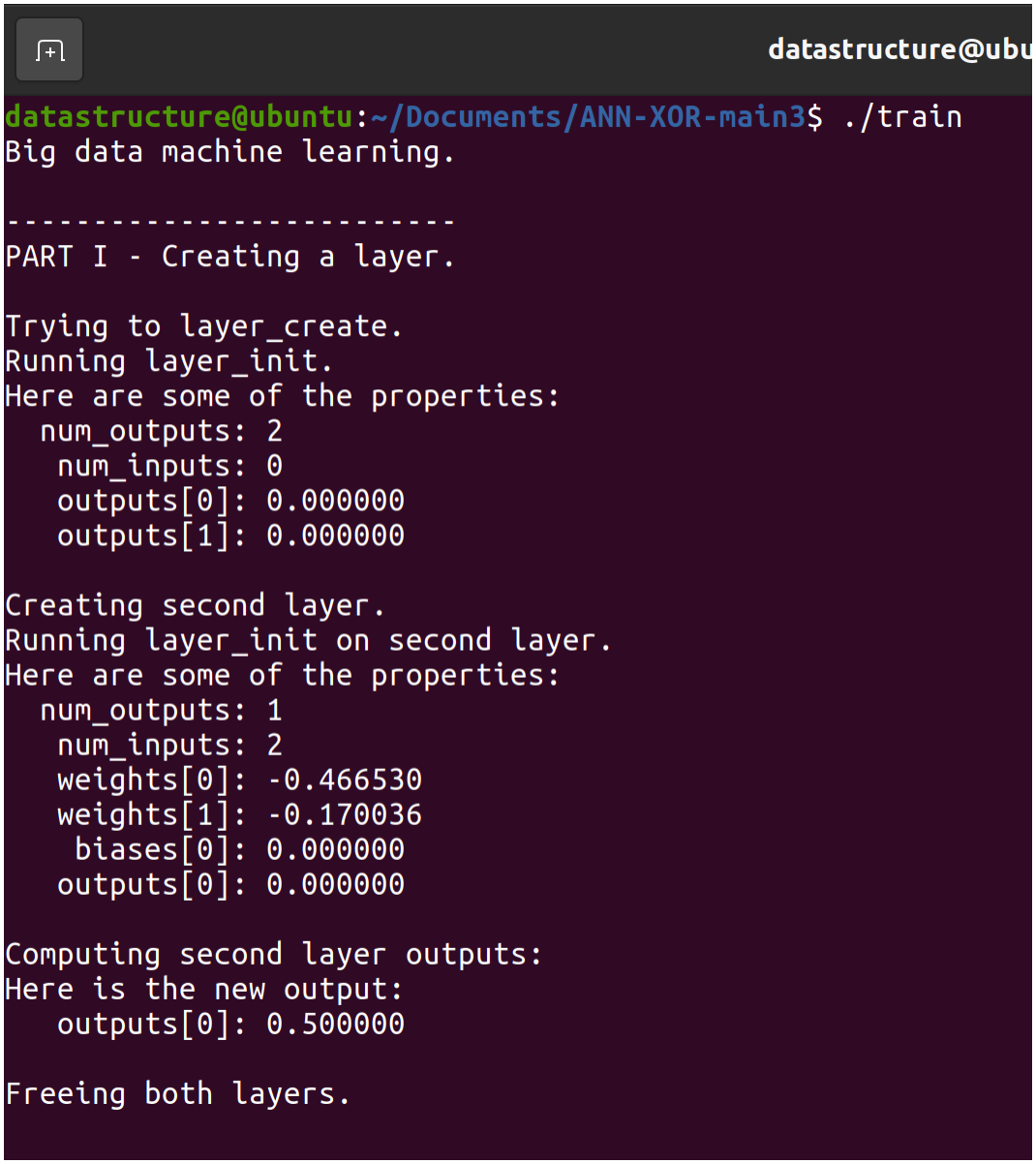
Assighment #0

1. 編譯結果



2. 執行結果


datastructure@ubu
datastructure@ubuntu:~/Documents/ANN-XOR-main3$ ./train
Big data machine learning.

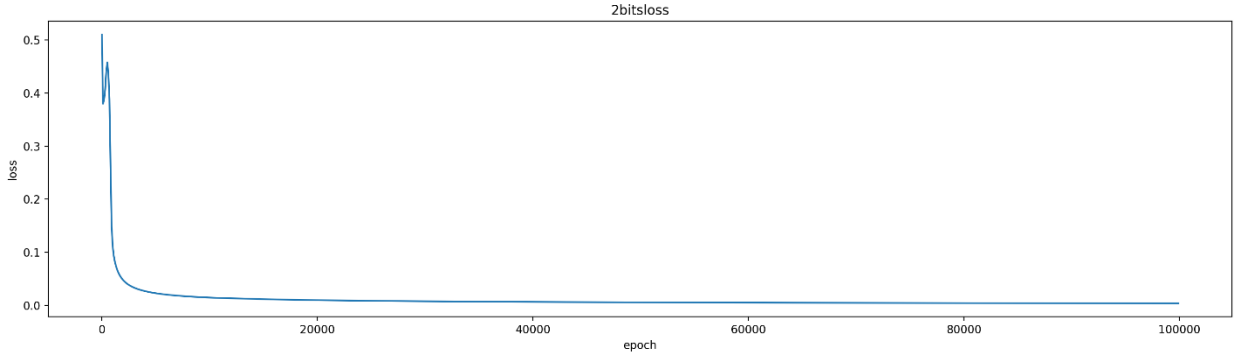
PART I - Creating a layer.
Trying to layer_create.
Running layer_init.
Here are some of the properties:
num_outputs: 2
num_inputs: 0
outputs[0]: 0.000000
outputs[1]: 0.000000
Creating second layer.
Running layer_init on second layer.
Here are some of the properties:
num_outputs: 1
num_inputs: 2
weights[0]: -0.466530
weights[1]: -0.170036
biases[0]: 0.000000
outputs[0]: 0.000000
Computing second layer outputs:
Here is the new output:
outputs[0]: 0.500000
Freeing both layers.

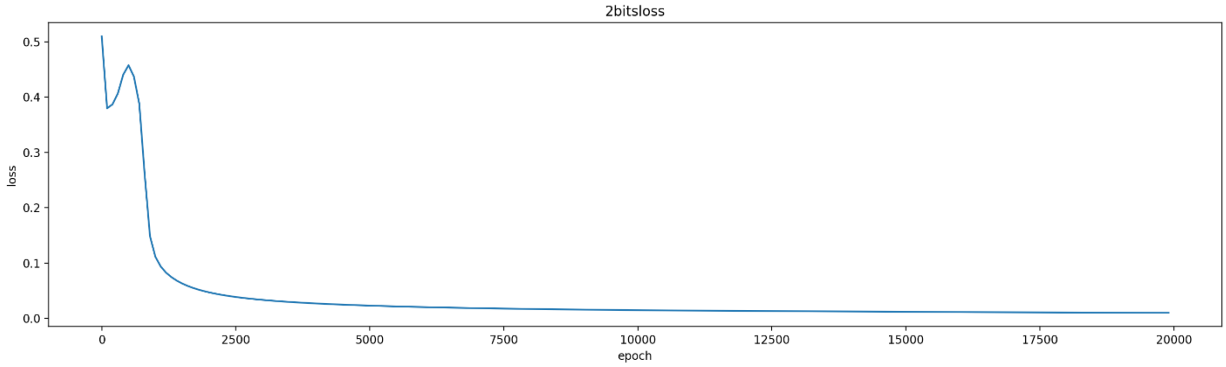
```
datas
-------------------------
PART II - Creating a neural network.
2 inputs, 8 hidden neurons and 1 output.

 * - * \
        * -
 * - * /

Initialising network with random weights...
The current state of the hidden layer:
  weights[0][0]: 0.190636
  weights[0][1]: -0.077513
  weights[0][2]: -0.293735
  weights[0][3]: -0.249872
  weights[0][4]: 0.136559
  weights[0][5]: 0.363622
  weights[0][6]: -0.198344
  weights[0][7]: -0.475076
  weights[1][0]: -0.135007
  weights[1][1]: 0.265381
  weights[1][2]: -0.182140
  weights[1][3]: -0.364272
  weights[1][4]: -0.393255
  weights[1][5]: 0.260672
  weights[1][6]: -0.418328
  weights[1][7]: 0.050956
  biases[0]: 0.000000
  biases[1]: 0.000000
  biases[2]: 0.000000
  biases[3]: 0.000000
  biases[4]: 0.000000
  biases[5]: 0.000000
  biases[6]: 0.000000
  biases[7]: 0.000000
  outputs[0]: 0.000000
  outputs[1]: 0.000000
  outputs[2]: 0.000000
  outputs[3]: 0.000000
  outputs[4]: 0.000000
  outputs[5]: 0.000000
  outputs[6]: 0.000000
  outputs[7]: 0.000000
Current random outputs of the network:
  [0, 0] -> 0.575744
  [0, 1] -> 0.579658
  [1, 0] -> 0.568582
  [1, 1] -> 0.572521
```

```
Training the network...
The current state of the hidden layer:
  weights[0][0]: 805.945472
  weights[0][1]: -682.349229
  weights[0][2]: -660.547427
  weights[0][3]: -607.748128
  weights[0][4]: 476.325807
  weights[0][5]: 743.268419
  weights[0][6]: -186.919007
  weights[0][7]: -696.847884
  weights[1][0]: -808.984264
  weights[1][1]: 679.236940
  weights[1][2]: 657.421482
  weights[1][3]: -607.764541
  weights[1][4]: -479.572707
  weights[1][5]: -746.344704
  weights[1][6]: -186.927165
  weights[1][7]: 693.744485
  biases[0]: 2.073698
  biases[1]: 2.174701
  biases[2]: 2.193165
  biases[3]: 606.070053
  biases[4]: 2.354378
  biases[5]: 2.125172
  biases[6]: 185.300611
  biases[7]: 2.162651
  outputs[0]: 0.290233
  outputs[1]: 0.293651
  outputs[2]: 0.294258
  outputs[3]: 0.000000
  outputs[4]: 0.299416
  outputs[5]: 0.291989
  outputs[6]: 0.000000
  outputs[7]: 0.293252

After training magic happened the outputs are:
  [0, 0] -> 0.002612
  [0, 1] -> 0.997584
  [1, 0] -> 0.997284
  [1, 1] -> 0.002324
datastructure@ubuntu:~/Documents/ANN-XOR-main3$
```

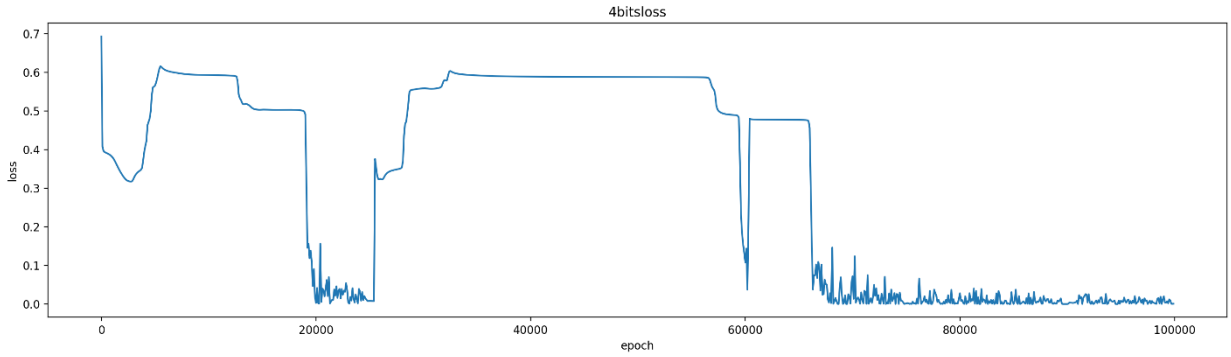
3. 分析

2bits 2x8x1 Neural network

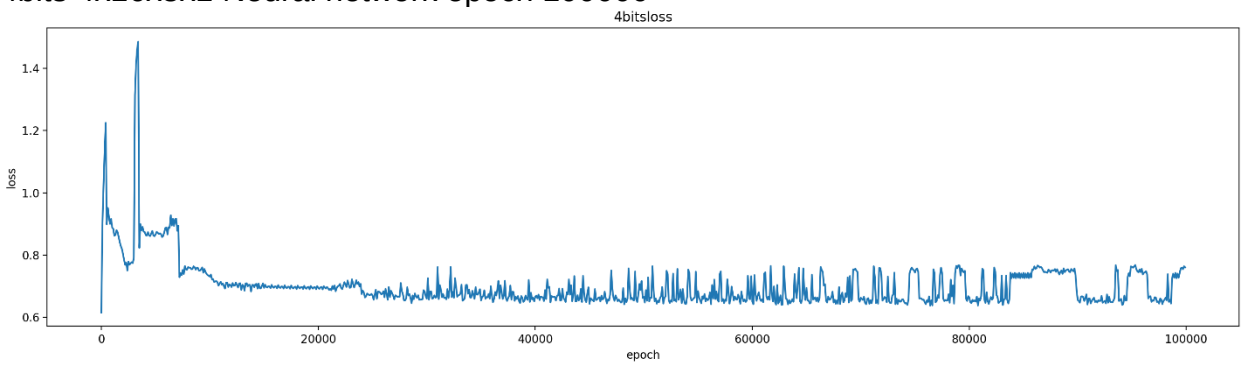




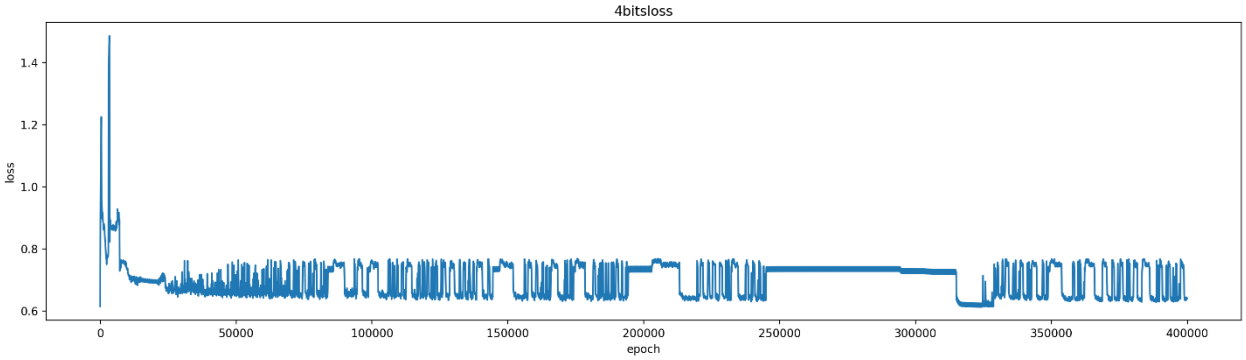
4bits 4x32x1 Neural network



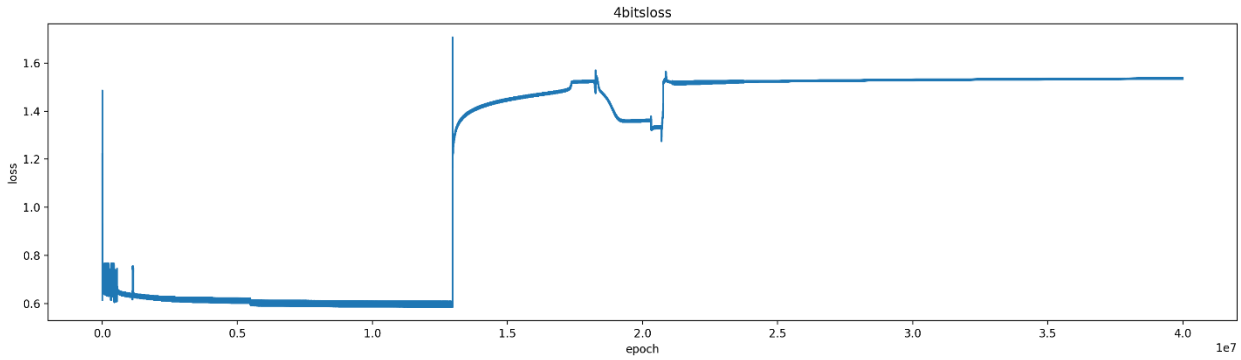
4bits 4x16x8x1 Neural network epoch 100000



4bits 4x16x8x1 Neural network epoch 400000



4bits 4x16x8x1 Neural network epoch 40000000



- 2bits
  - 資料用一層 8 個 neuron 即可 train 起來。
  - 在 1000epoch 左右 loss 有提升，推測可能是找到 local minima 後又進入搜尋。
- 4bits
  - 最後用一層 32 個的 neuron 有 train 起來。
  - 原本已 2bits 的想法去推估 4x16x8x1 的應該要 train 出來，但結果與實際願為，不管 train 多久，好像都沒有辦法達到很好的表現。

結論:

Fully connected 的 network 可能不太適合做 XOR 運算，若運用 RNN 或者 CNN 這類的網路應該可以降低複雜度提升準確度。