

Data Structure Result Report-HW1

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1. 簡介

此程式展示了透過動態記憶體配置使用反向傳播學習算法的 XOR 神經網絡模擬。在輸入層，有兩個輸入層神經元，分別是 1 和 0。理想情況有 4 種，分別是 $0^0=0$ 、 $0^1=1$ 、 $1^0=1$ 、 $1^1=0$ 。有 3 個隱藏層，分別有 3、4、3 個隱藏層神經元。最後還有一個輸出層神經元，就是模擬結果。在每個時期(Epoch)，我還添加了與理想情況和模擬結果相關的損失函數。在最終表示中，可以看到理想情況和模擬結果。

2. 編譯

輸入 make

```
~/Downloads/assignment_1-AquaCW24 / on main at 23:23:06
> make
gcc -Wall ./src/main.c -I ./inc -c
gcc ./obj/main.o -o ./bin/main
```

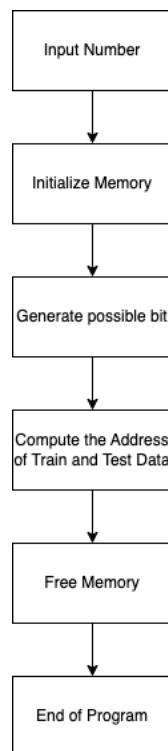
3. 執行

輸入 ./bin/main

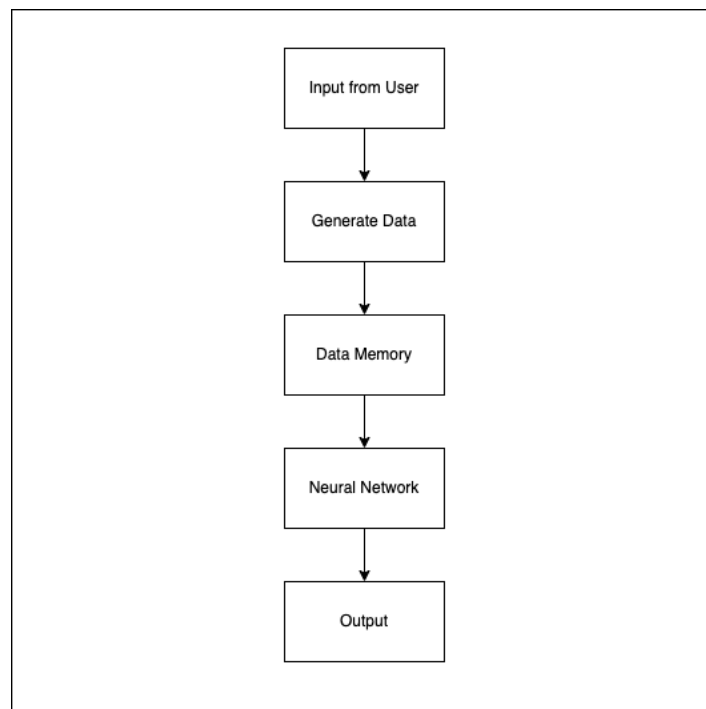
```
~/Downloads/assignment_1-AquaCW24 / on main t3 at 23:23:51
> ./bin/main
epoch 0, sample 0, loss 5.213776
epoch 0, sample 1, loss 0.411022
epoch 0, sample 2, loss 0.119143
epoch 0, sample 3, loss 0.050228
epoch 5, sample 0, loss 0.102302
epoch 5, sample 1, loss 0.103813
epoch 5, sample 2, loss 0.034727
epoch 5, sample 3, loss 0.019765
epoch 10, sample 0, loss 0.077664
epoch 10, sample 1, loss 0.068830
epoch 10, sample 2, loss 0.020835
epoch 10, sample 3, loss 0.007917
epoch 15, sample 0, loss 0.049109
epoch 15, sample 1, loss 0.040767
epoch 15, sample 2, loss 0.013112
epoch 15, sample 3, loss 0.003814
epoch 20, sample 0, loss 0.027180
epoch 20, sample 1, loss 0.020849
epoch 20, sample 2, loss 0.008150
epoch 20, sample 3, loss 0.001882
epoch 25, sample 0, loss 0.013461
epoch 25, sample 1, loss 0.009097
epoch 25, sample 2, loss 0.004870
epoch 25, sample 3, loss 0.000877
epoch 30, sample 0, loss 0.006085
epoch 30, sample 1, loss 0.003357
epoch 30, sample 2, loss 0.002797
epoch 30, sample 3, loss 0.000377
epoch 35, sample 0, loss 0.002553
epoch 35, sample 1, loss 0.001016
epoch 35, sample 2, loss 0.001564
epoch 35, sample 3, loss 0.000150
```

```
epoch 975, sample 0, loss 0.000000
epoch 975, sample 1, loss 0.000000
epoch 975, sample 2, loss 0.000000
epoch 975, sample 3, loss 0.000000
epoch 980, sample 0, loss 0.000000
epoch 980, sample 1, loss 0.000000
epoch 980, sample 2, loss 0.000000
epoch 980, sample 3, loss 0.000000
epoch 985, sample 0, loss 0.000000
epoch 985, sample 1, loss 0.000000
epoch 985, sample 2, loss 0.000000
epoch 985, sample 3, loss 0.000000
epoch 990, sample 0, loss 0.000000
epoch 990, sample 1, loss 0.000000
epoch 990, sample 2, loss 0.000000
epoch 990, sample 3, loss 0.000000
epoch 995, sample 0, loss 0.000000
epoch 995, sample 1, loss 0.000000
epoch 995, sample 2, loss 0.000000
epoch 995, sample 3, loss 0.000000
epoch 1000, sample 0, loss 0.000000
epoch 1000, sample 1, loss 0.000000
epoch 1000, sample 2, loss 0.000000
epoch 1000, sample 3, loss 0.000000
input: (0.000, 0.000) output: (-0.000) ground_truth: (0.000)
input: (0.000, 1.000) output: (1.000) ground_truth: (1.000)
input: (1.000, 0.000) output: (1.000) ground_truth: (1.000)
input: (1.000, 1.000) output: (0.000) ground_truth: (0.000)
```

4. 流程



5. 架構



6. 分析

在一開始的訓練中前面幾個 epoch 都還有 loss，到大約幾百次的 epoch 時，訓練的成果幾近完美，loss 降為 0。訓練出來的結果也跟一般我們認知的 XOR 結果是相符合的。