

LAB3_inclass

tanh:

```
輸入 x (含偏置):  
[[1.  0.5 0.2 0.1]]  
隱藏層 pre-activation a1:  
[[0.22 0.14 0.12 0.15]]  
隱藏層輸出 z1:  
[[0.21651806 0.13909245 0.1194273  0.14888503]]  
隱藏層 (含偏置) z1_aug:  
[[1.      0.21651806 0.13909245 0.1194273  0.14888503]]  
最終輸出 y:  
[[ 0.32564833 -0.05383076]]
```

hard_tanh:

```
輸入 x (含偏置):  
[[1.  0.5 0.2 0.1]]  
隱藏層 pre-activation a1:  
[[0.22 0.14 0.12 0.15]]  
隱藏層輸出 z1:  
[[0.22 0.14 0.12 0.15]]  
隱藏層 (含偏置) z1_aug:  
[[1.  0.22 0.14 0.12 0.15]]  
最終輸出 y:  
[[ 0.327 -0.052]]
```

softplus

```
輸入 x (含偏置):  
[[1.  0.5 0.2 0.1]]  
隱藏層 pre-activation a1:  
[[0.22 0.14 0.12 0.15]]  
隱藏層輸出 z1:  
[[0.80918502 0.76559518 0.7549461  0.77095705]]  
隱藏層 (含偏置) z1_aug:  
[[1.      0.80918502 0.76559518 0.7549461  0.77095705]]  
最終輸出 y:  
[[0.82076474 0.43204936]]
```

relu && leaky_relu

```
輸入 x (含偏置):  
[[1.  0.5 0.2 0.1]]  
隱藏層 pre-activation a1:  
[[0.22 0.14 0.12 0.15]]  
隱藏層輸出 z1:  
[[0.22 0.14 0.12 0.15]]  
隱藏層 (含偏置) z1_aug:  
[[1.  0.22 0.14 0.12 0.15]]  
最終輸出 y:  
[[ 0.327 -0.052]]
```

calculate tanh:

$x = [1.0 \ 0.5 \ 0.2 \ 0.1]^T$

$a1 = [0.1 \ 0.1 \ 0.2 \ 0.3$

$0.2 \ -0.3 \ 0.4 \ 0.1$

$0.05 \ 0.2 \ -0.2 \ 0.1$

$0.0 \ 0.3 \ -0.1 \ 0.2]$

$W = a1 * x$

$a(1,1) = (0.1 \times 1.0) + (0.1 \times 0.5) + (0.2 \times 0.2) + (0.3 \times 0.1) = 0.1 + 0.05 + 0.04 + 0.03 = 0.22$

$a(2,1) = (0.2 \times 1.0) + (-0.3 \times 0.5) + (0.4 \times 0.2) + (0.1 \times 0.1) = 0.2 - 0.15 + 0.08 + 0.01 = 0.14$

$a(3,1) = (0.05 \times 1.0) + (0.2 \times 0.5) + (-0.2 \times 0.2) + (0.1 \times 0.1) = 0.05 + 0.1 - 0.04 + 0.01 = 0.12$

$a(4,1) = (0.0 \times 1.0) + (0.3 \times 0.5) + (-0.1 \times 0.2) + (0.2 \times 0.1) = 0 + 0.15 - 0.02 + 0.02 = 0.15$

$$\tanh(x) = \frac{e^x - e^{-x}}{e^x + e^{-x}}$$

$z1 = [0.2163 \ 0.1391 \ 0.1194 \ 0.149]^T$

add bias :

$$z1_{aug} = [1.0 \ 0.2163 \ 0.1391 \ 0.1194 \ 0.1494]^T$$

$$W2 = [0.2 \ 0.3 \ -0.1 \ 0.5 \ 0.1$$

$$\ -0.2 \ 0.4 \ 0.3 \ -0.1 \ 0.2]$$

$$y = W2 * z1_{aug} = [0.3256 \ -0.0538]^T$$