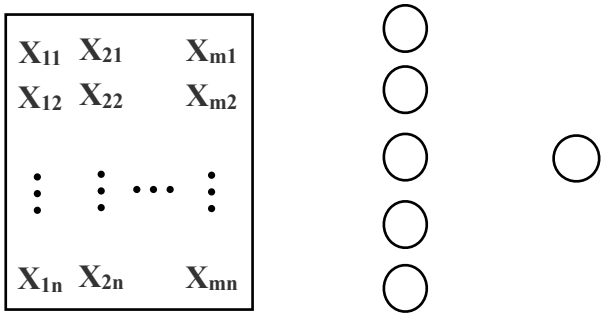
SC201 Lecture 12

Classification

<Binary classification>



K1 = np.dot(W1.T, X) + B1

A1 = np.maximum(0, K1)

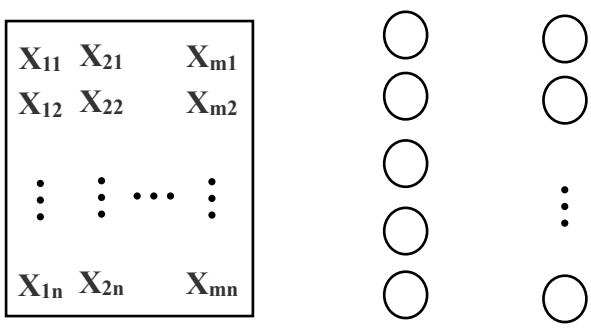
K2 = np.dot(W2.T, A1)+B2
(scores)

H = _____

L = _____

<Multiclass classification>

假設 ___ 個類別(class)



K1 = np.dot(W1.T, X) + B1

A1 = np.maximum(0, K1)

K2 = np.dot(W2.T, A1)+B2
(scores)

H = _____

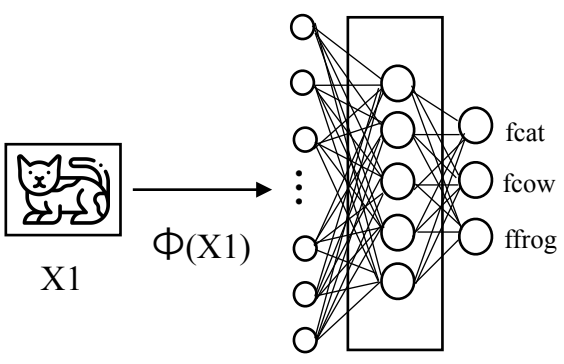
L = _____

softmax $\sigma(fj) =$ _____

prediction

fully connected NN

(_____)



X1

$\Phi(X1)$

σ

$$\frac{e^{fcat}}{e^{fcat}+e^{fcow}+e^{ffrog}} = \frac{164}{188.68} \sim 0.869 \rightarrow 1$$

$$\frac{e^{fcow}}{e^{fcat}+e^{fcow}+e^{ffrog}} = \frac{0.18}{188.68} \sim 0.001 \rightarrow 0$$

$$\frac{e^{ffrog}}{e^{fcat}+e^{fcow}+e^{ffrog}} = \frac{24.5}{188.68} \sim 0.13 \rightarrow 0$$

(one hot vector)

for _____

$$\frac{e^{fcat}/e^{fcat}}{e^{fcat}/e^{fcat} + e^{fcow}/e^{fcat} + e^{ffrog}/e^{fcat}} = \frac{e^{fcat-fcat}}{e^{fcat-fcat} + e^{fcow-fcat} + e^{ffrog-fcat}} = \frac{1}{1.1507} \sim 0.869 \longrightarrow 1$$

$$\frac{e^{fcow}/e^{fcat}}{e^{fcat}/e^{fcat} + e^{fcow}/e^{fcat} + e^{ffrog}/e^{fcat}} = \frac{e^{fcow-fcat}}{e^{fcat-fcat} + e^{fcow-fcat} + e^{ffrog-fcat}} = \frac{0.001}{1.1507} \sim 0.001 \longrightarrow 0$$

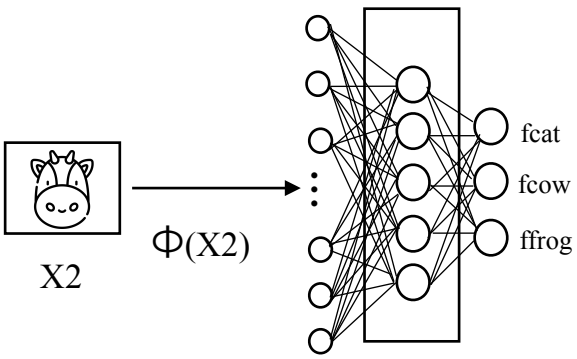
$$\frac{e^{ffrog}/e^{fcat}}{e^{fcat}/e^{fcat} + e^{fcow}/e^{fcat} + e^{ffrog}/e^{fcat}} = \frac{e^{ffrog-fcat}}{e^{fcat-fcat} + e^{fcow-fcat} + e^{ffrog-fcat}} = \frac{0.15}{1.1507} \sim 0.13 \longrightarrow 0$$

Cross Entropy loss

$L = -\log(\_\_\_\_\_)$

$$\#\ L(X1) = -\log\left(\frac{\_\_\_\_\_}{e^{fcat} + e^{fcow} + e^{ffrog}}\right) = -\log(\_\_\_\_\_) =$$

$$\#\ L(X2) = -\log\left(\frac{\_\_\_\_\_}{e^{fcat} + e^{fcow} + e^{ffrog}}\right)$$



$$\xrightarrow[\sigma]{} \frac{0.905}{2.0876} \sim 0.43 \qquad \frac{1}{2.0876} \sim 0.48 \qquad \frac{0.1826}{2.0876} \sim 0.08$$

$-\log(\_\_\_\_\_) =$

Foward Prop

K = np.dot(W1.T, X) + B1

A = np.maximum(0, K)

F = np.dot(W1.T, A)+B2

H = _____

L = _____

Colab

Colab (Colaboratory) 是Google所提供的Python雲端IDE，只要有Google Drive, 打開瀏覽器就可以運作。

使用方法

1. 第一次使用：Google搜尋Colab → 點擊 Welcome to Colabortory 網站 → 選擇_____
2. 至Google drive, 找到“Colab Notebooks”資料夾，將解壓縮的資料夾(如：SC201_Assignment 4-2)上傳至Colab Notebooks資料夾內
   (注意：請小心_____)
3. 開啟資料夾內檔案，執行(shift+enter)第一格檔案以進行 _____ → 選擇使用的Google account進行驗證
4. 認證後，執行所有cell
5. 點擊左側🗀圖案，展開 drive 及 MyDrive ，找到Colab Notebooks, 找到對應資料夾 (如SC201_Assignment 4-2)中欲編輯的py檔案，如(SC201→Classifier→neural_net.py)，檔案會出現在視窗右側。
6. py檔案編輯完成後請記得_____(command/ctrl + s)，並回到視窗左側檔案，執行檔案中的cell。

Back Prop

$$dW2 = \frac{dL}{dF}\frac{dF}{dW2}$$

$$dB2 = \frac{dL}{dF}\frac{dF}{dB2}$$

$$dW1 = \frac{dL}{dF}\frac{dF}{dA}\frac{dA}{dK}\frac{dK}{dW1}$$

$$dB1 = \frac{dL}{dF}\frac{dF}{dA}\frac{dA}{dK}\frac{dK}{dB1}$$

Back Prop $\frac{dL}{dF} = \begin{bmatrix} \frac{dL}{dFcat} \\ \frac{dL}{dFcow} \\ \frac{dL}{dFfrog} \end{bmatrix}$

$\frac{dL}{dFcat} =$

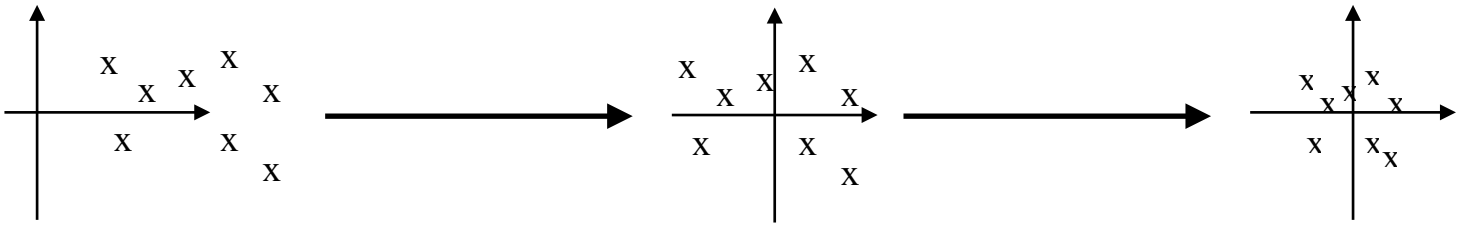
$\frac{dL}{dFcow} =$

$\frac{dL}{dFfrog} =$

$\frac{dL}{dFj} = \begin{cases} \_\_\_\_\_ \text{ if j == y (true\_label)} \\ \_\_\_\_\_ \text{ if j != y} \end{cases}$

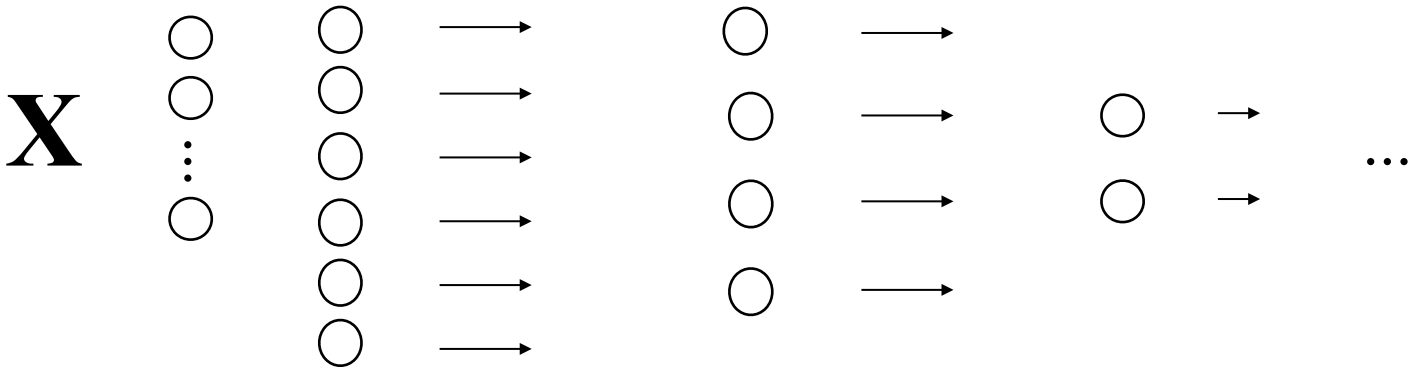
Recipe for Training NN

< 1 > Date Preprocessing

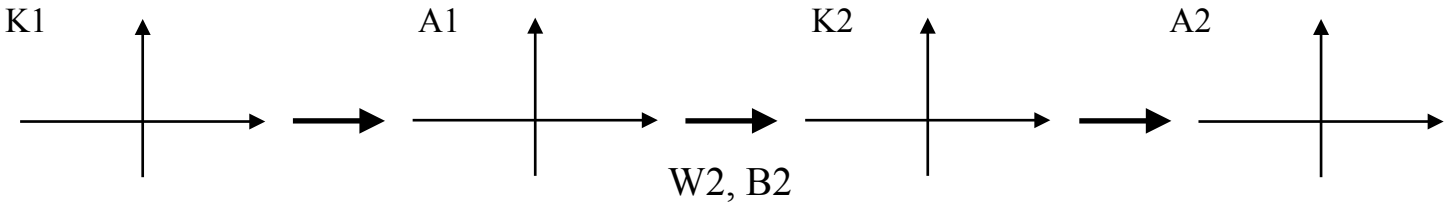


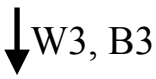
X

< 2 > Weight initialization



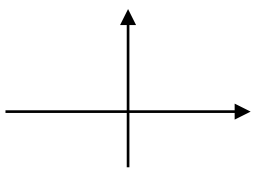
∵ W 數值都是 _____, ∴ K 數值也會趨近 _____





✪ relu → *W 會讓 K數值很接近 ____

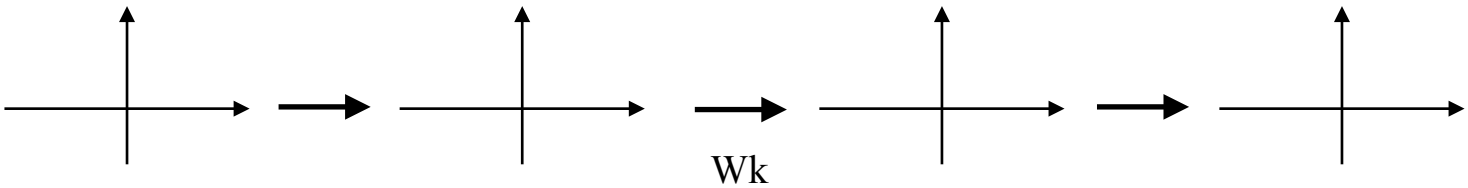
K3



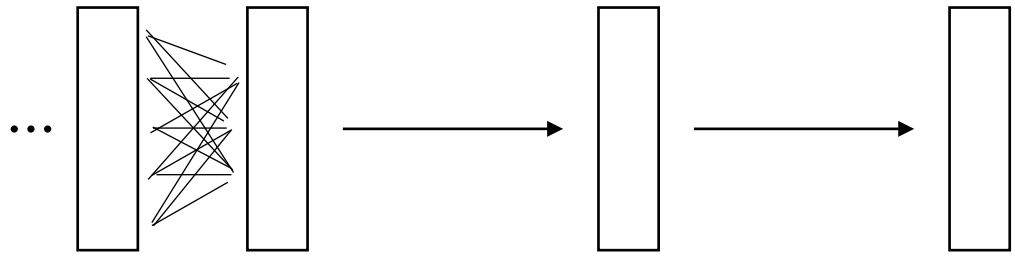
→ _____

< Kaiming Initialization >

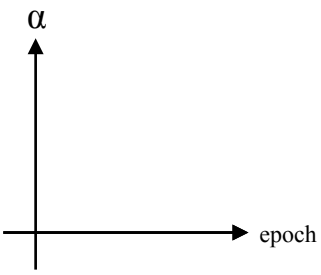
Wk =



< 3 > Normalization Layer



< 4 > Hyperparameter Tuning



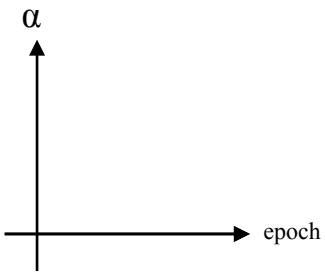
→ parameters machine cannot learn

① α learning rate

② learning rate decay schedule

① _____ = _____

② _____ = _____



③ _____ = _____