

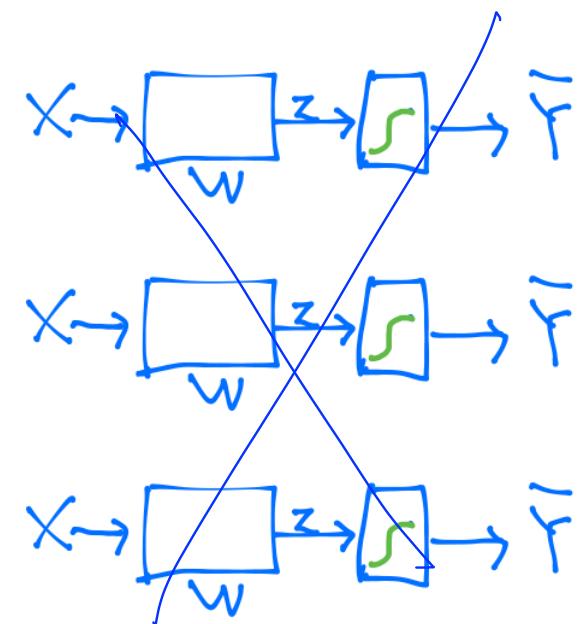
Lecture 6-2

Softmax classification: softmax and cost function

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Where is sigmoid?

$$\begin{bmatrix} w_{A1} & w_{A2} & w_{A3} \\ w_{B1} & w_{B2} & w_{B3} \\ w_{C1} & w_{C2} & w_{C3} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} w_{A1}x_1 + w_{A2}x_2 + w_{A3}x_3 \\ w_{B1}x_1 + w_{B2}x_2 + w_{B3}x_3 \\ w_{C1}x_1 + w_{C2}x_2 + w_{C3}x_3 \end{bmatrix} = \begin{bmatrix} \bar{y}_A \\ \bar{y}_B \\ \bar{y}_C \end{bmatrix}$$



Where is sigmoid?

$$\begin{bmatrix} w_{A1} & w_{A2} & w_{A3} \\ w_{B1} & w_{B2} & w_{B3} \\ w_{C1} & w_{C2} & w_{C3} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} w_{A1}x_1 + w_{A2}x_2 + w_{A3}x_3 \\ w_{B1}x_1 + w_{B2}x_2 + w_{B3}x_3 \\ w_{C1}x_1 + w_{C2}x_2 + w_{C3}x_3 \end{bmatrix} = \begin{bmatrix} \bar{y}_A \\ \bar{y}_B \\ \bar{y}_C \end{bmatrix}$$

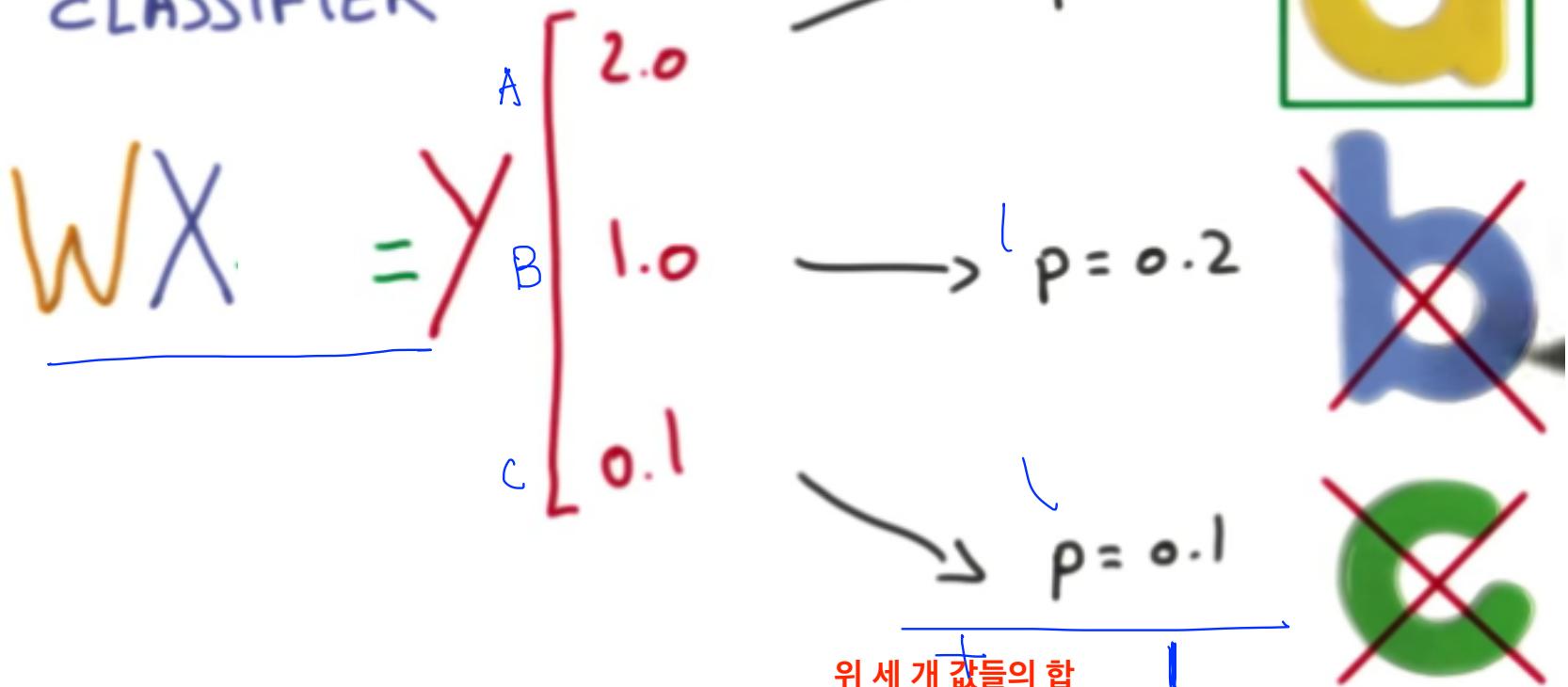
0 ~ 1
↓



sigmod란 여기 있는 값들이 0~1 사이의 값들로 나왔으면 해서 사용하는 것

Sigmoid?

LOGISTIC
CLASSIFIER

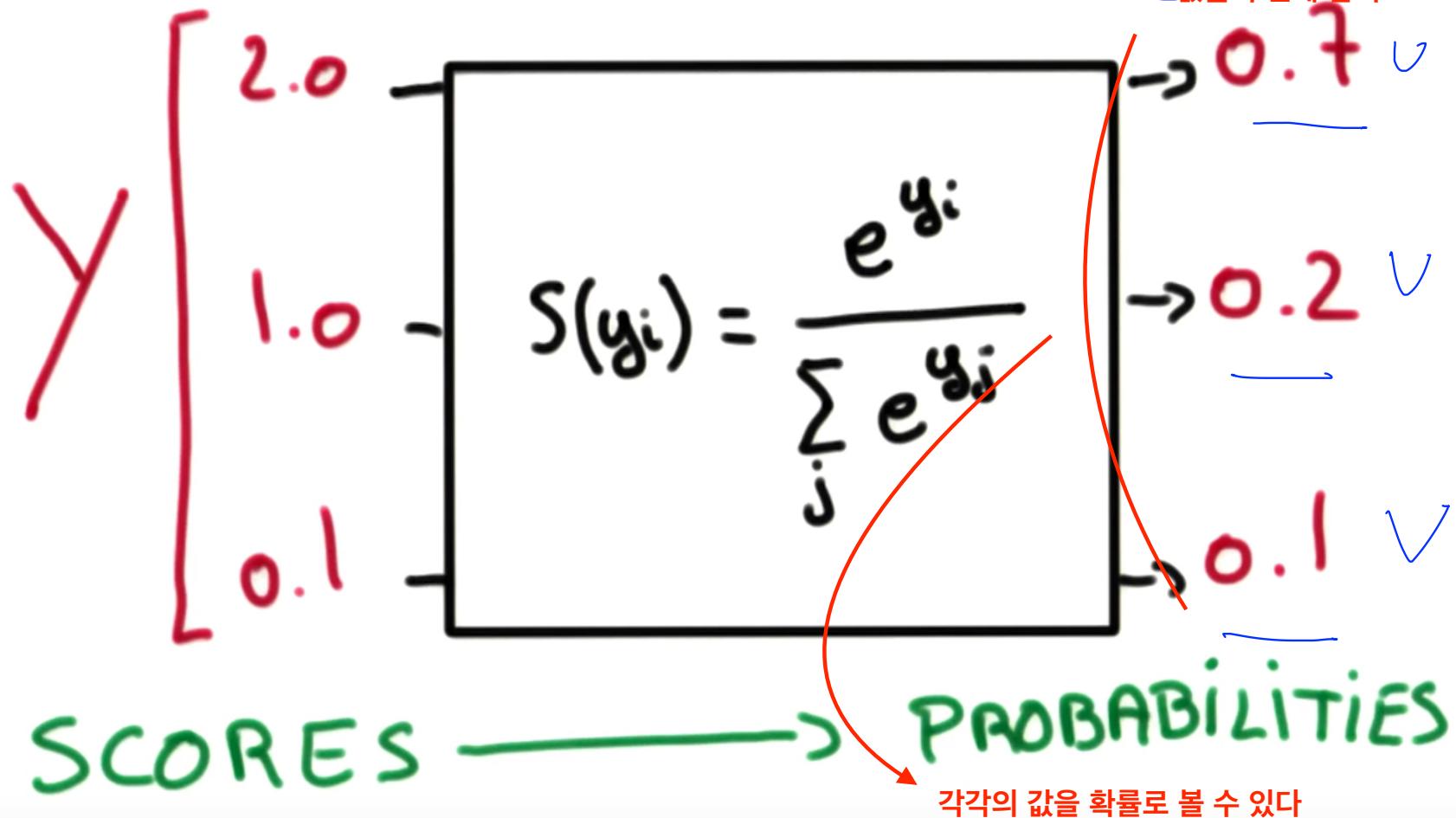


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SOFTMAX

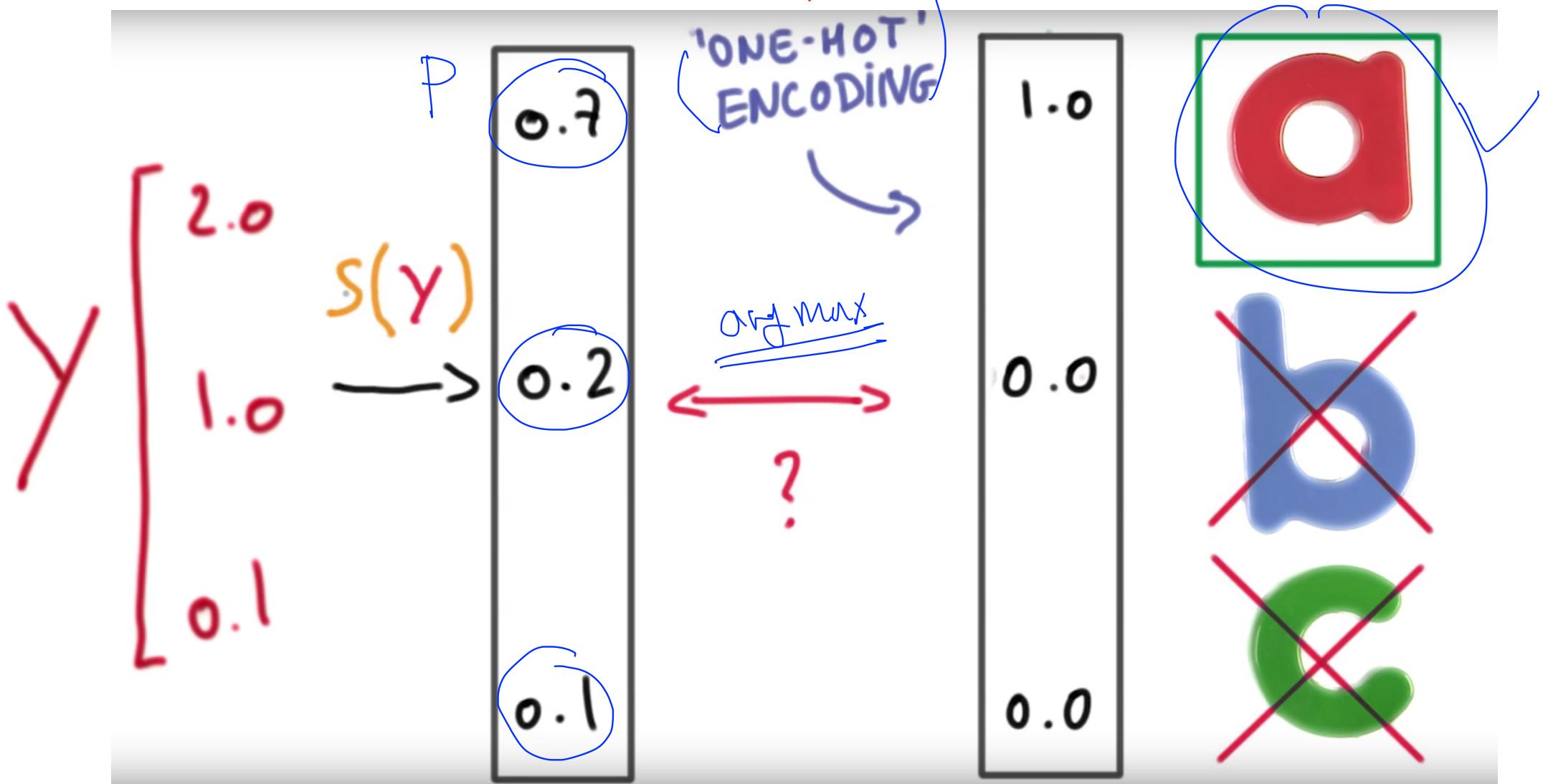
특징

- ① $y_i \sim 1$
0~1 사이의 값이 됨
- ② $\sum = 1$
값들의 전체 합이 1



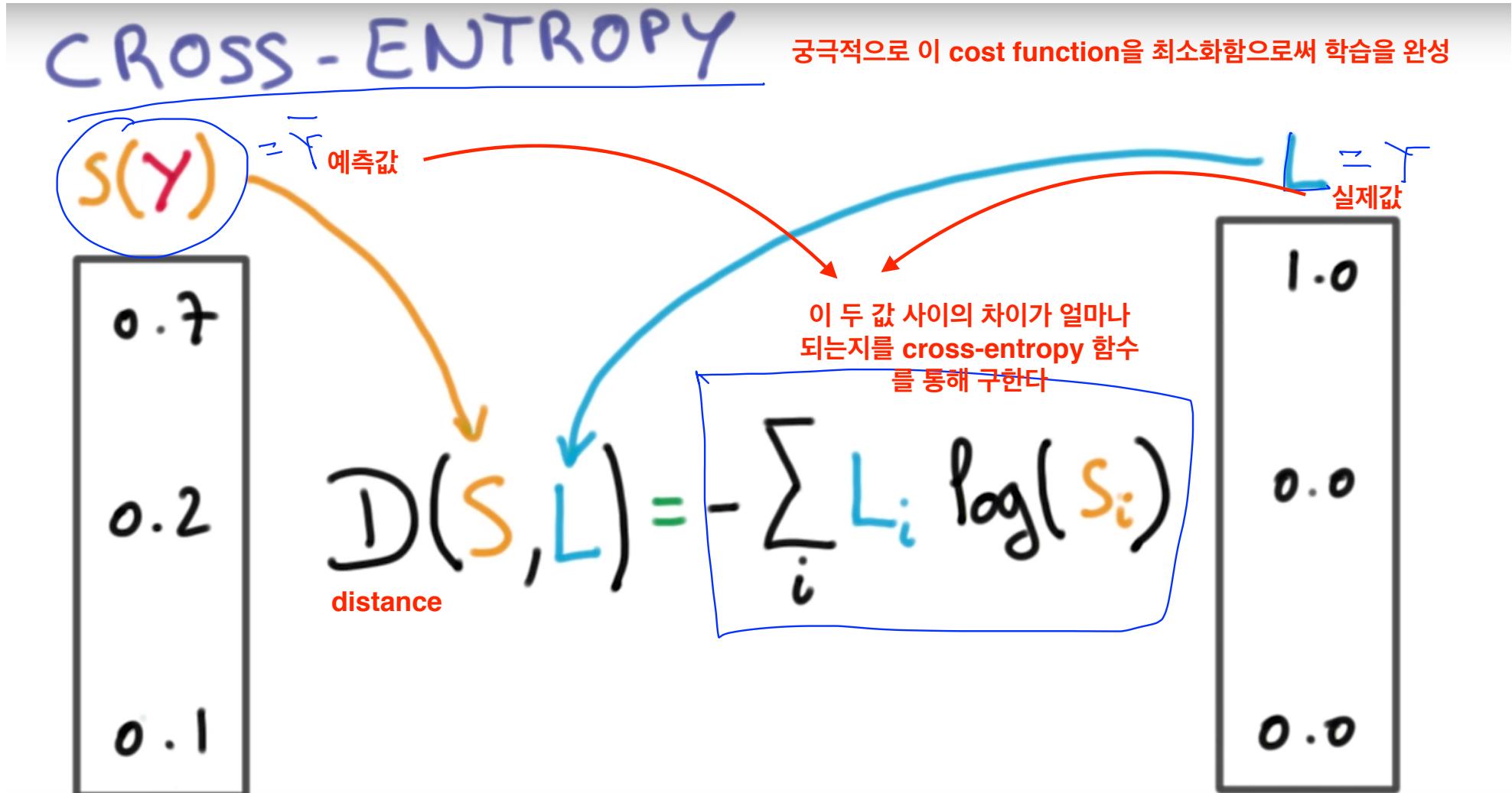
이 값을 확률로 볼 수 있다
그래서 a가 나올 확률은
0.7, b는 0.2, c는 0.1

가장 큰 값만 1로 하고 나머지는 0으로



예측한 값과 실제의 값이 얼마나 차이나는지 나타내는

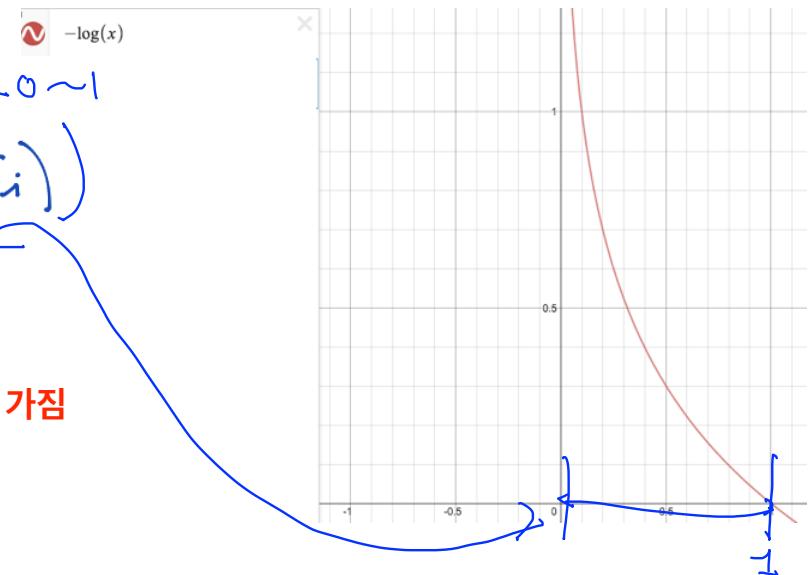
Cost function



Cross-entropy cost function

$$-\sum_i L_i \log(s_i) = -\sum_i L_i \log(\bar{y}_i) = \sum_i (L_i) \times (-\log(\bar{y}_i))$$

softmax를 통과한 값이라 항상 0에서 1사이의 값을 가짐



Cross-entropy cost function

matrix의 곱이 아니라 element의 곱

$$-\sum_i L_i \log(S_i) \quad [0 \quad 1]$$

$$-\sum_i L_i \log(\bar{y}_i) = \sum_i L_i * -\log(\bar{y}_i)$$

의 의미는 'B의 값을 갖고 있다.'

실제의 y값 (정답)

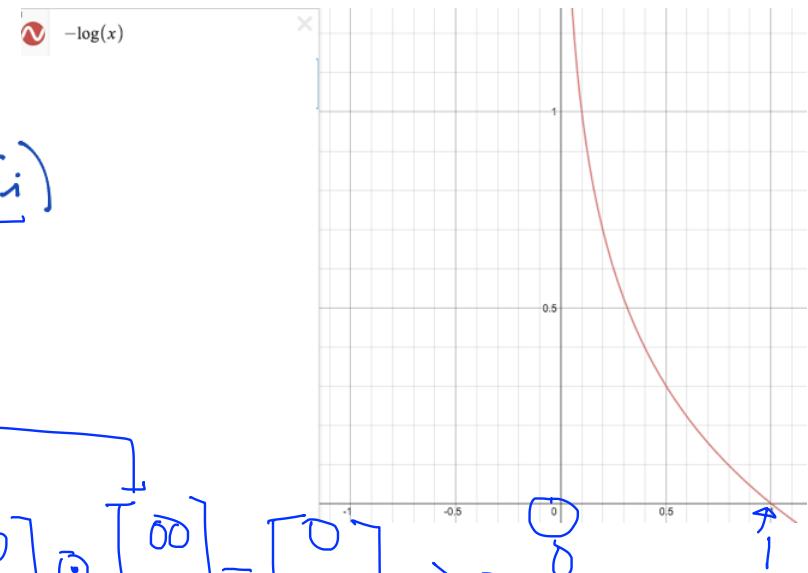
$$\bar{Y} = L = \begin{bmatrix} 0 \\ 1 \end{bmatrix} = B$$

예측 1. $\bar{Y} = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$ 맞은 예측

$$\begin{bmatrix} 0 \\ 1 \end{bmatrix} \odot \begin{bmatrix} 0 \\ 1 \end{bmatrix} = \begin{bmatrix} 0 \\ 1 \end{bmatrix} \odot \begin{bmatrix} \infty \\ 0 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix} \Rightarrow 0$$

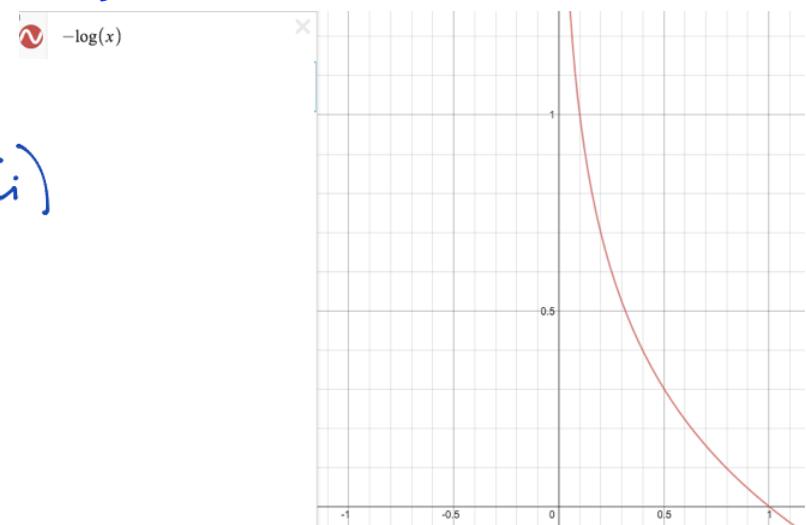
예측 2. $\bar{Y} = \begin{bmatrix} 1 \\ 0 \end{bmatrix} = A$ 틀린 예측

$$\begin{bmatrix} 0 \\ 1 \end{bmatrix} \odot -\log \begin{bmatrix} 1 \\ 0 \end{bmatrix} = \begin{bmatrix} 0 \\ 1 \end{bmatrix} \odot \begin{bmatrix} 0 \\ \infty \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix} \Rightarrow \infty$$



cost function의 의미는 맞은 예측의 경우
작게 되고 틀린 경우 크게 되는 것인데 되는
지 확인하는 과정

Cross-entropy cost function



$$-\sum_i L_i \log(s_i)$$

$$-\sum_i L_i \log(\bar{y}_i) = \sum_i L_i * -\log(\bar{y}_i)$$

$$L = \begin{bmatrix} A \\ B \end{bmatrix} = A$$

A의 값을 갖고 있다

$$\cancel{\bar{Y} = \begin{bmatrix} 1 \\ 0 \end{bmatrix}}_{=A} (0) \circ \begin{bmatrix} 1 \\ 0 \end{bmatrix} \odot \begin{bmatrix} 0 \\ 0 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix} \Rightarrow 0$$

$$\bar{Y} = \begin{bmatrix} 0 \\ 1 \end{bmatrix}_{=B} (\times) \circ \begin{bmatrix} 1 \\ 0 \end{bmatrix} \odot \begin{bmatrix} 0 \\ 0 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix} \Rightarrow 0$$

sum을 취하면

Logistic cost VS cross entropy

$$C(H(x), y) = y \log(H(x)) - (1 - y) \log(1 - H(x))$$

$$D(S, L) = - \sum_i L_i \log(S_i)$$

두 가지 방식이 실제로 같은 것을 의미

Cost function

The diagram illustrates the cost function J as a sum of individual losses LOSS_i over a training set. The formula is:

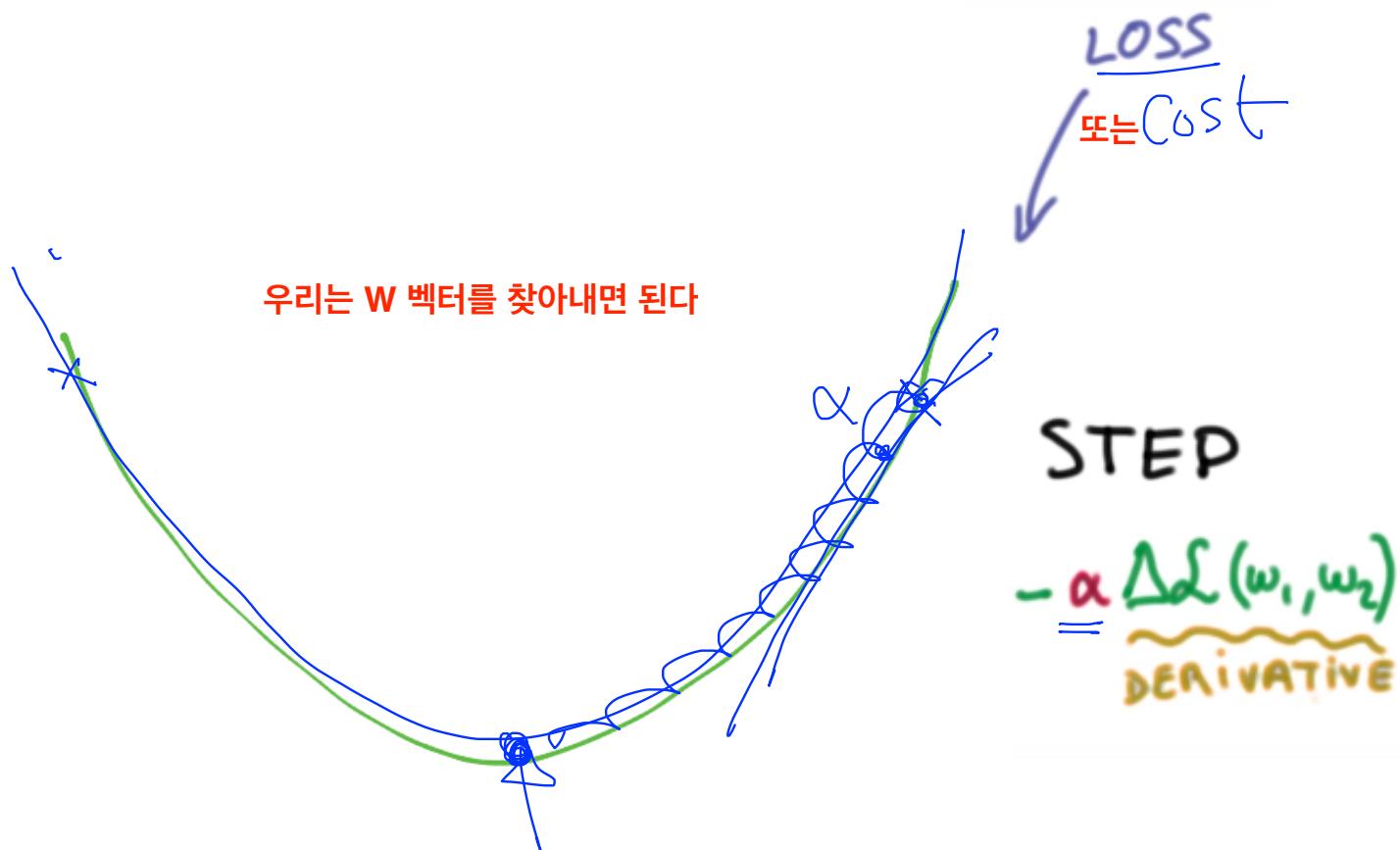
$$J = \frac{1}{N} \sum_i \text{LOSS}_i$$

A red arrow points from the text "여러 개일 경우 전체의 거리(차이 - Distance)를 구하고 그 합을 평균으로" to the summation symbol \sum_i . A blue arrow points from the word "TRAINING SET" to the term \sum_i . A blue arrow also points from the word "LOSS" to the first term LOSS_i .

The right side of the equation shows the calculation of LOSS_i as the distance between the predicted value $s(wx_i + b)$ and the target value L_i .

A graph below shows a blue curve representing the cost function J as a function of the parameters, starting from the origin and increasing as the parameters change.

Gradient descent



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