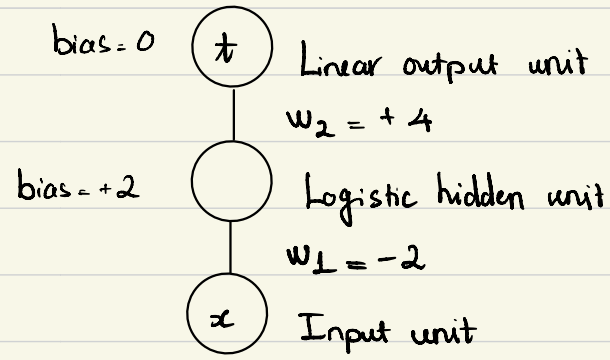
Computer Vision - Assignment 2

Task 1



a) Output of hidden unit:

$$y_1 = \sigma(w_1 x + b_1)$$

Output of output unit:

$$y_2 = y_1 \cdot w_2 + b_2$$

For training case: $x = 1$

$$y_1 = \sigma(-2 \cdot 1 + 2) = \sigma(0) = \frac{1}{2}$$

$$y_2 = \frac{1}{2} \cdot 4 + 0 = 2$$

b) The loss $E = \frac{1}{2}(1-2)^2 = \frac{1}{2}(-1)^2 = \frac{1}{2}$

c) Derivative of loss function with respect to w2:

$$\frac{\partial E}{\partial w_2} = \frac{\partial\left(\frac{1}{2}\left(1-\frac{1}{2}w_2\right)^2\right)}{\partial w_2} = \frac{1}{2} \cdot 2\left(1-\frac{1}{2}\cdot w_2\right)\cdot\left(-\frac{1}{2}\right) = \frac{1}{2}\left(1-\frac{1}{2}w_2\right)$$

d) Derivative of loss function with respect to w_1:

$$\frac{\partial E}{\partial w_1} = \frac{\partial\left(\frac{1}{2}(1-y)^2\right)}{\partial w_1} = \frac{\partial\left(\frac{1}{2}(1-w_2\cdot\sigma(w_1+2))^2\right)}{\partial w_1}$$

$$= \frac{1}{2}\cdot 2\left(1-4\sigma(w_1+2)\right)\cdot\frac{\partial(1-4\sigma(w_1+2))}{\partial w_1}$$

$$= \left(1-4\sigma(w_1+2)\right)\frac{\partial(-4\sigma(w_1+2))}{\partial w_1}$$

$$= -4\left(1-4\sigma(w_1+2)\left(1-\sigma(w_1+2)\right)\right)$$

Task 2:

a) $Q = [2 \quad 1 \quad 6 \quad 4 \quad 2]^T$

$A = [1 \quad 2 \quad 3 \quad 4 \quad 1]^T$

$B = [3 \quad 1 \quad 4 \quad 1 \quad 5]^T$

Euclidean distance:

$d(Q,A) = 3.464$

$d(Q,B) = 4.79$

Cosine Similarity

$C(Q,A) = 0.9198$

$C(Q,B) = 0.7989$

As $d(Q,A) < d(Q,B)$ and $c(Q,A) > C(Q,B)$, image A is more similar to query image Q than image B