23-S1-Q3

(a)(i) Q: vector-matrix form and scalar form input and output?

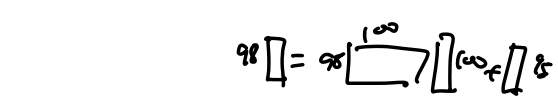
$x = [x_1\ x_2\ x_3 \cdots x_{100}]^T$

$y = [y_1\ y_2 \cdots y_{98}]^T$

$y_1 = w_{11}x_1 + w_{12}x_2 + \cdots + \theta_1$

$W = [w_{ij}]$ 98×100

$\theta = [\theta_1\ \theta_2 \cdots \theta_{98}]^T$



vector-matrix form

$y = Wx + \theta$

scalar form

$y_i = \sum_{j=1}^{100} w_{ij}x_j + \theta_i \quad i = 1, 2, \cdots 98$

(ii) Q parameters? multiplications? summations?

Solution

parameters: $98 \times 100 + 98 = 9898$

multiplications: $98 \times 100 = 9800$

summations: $98 \times (99+1) = 9800$

100個加99次
加1次

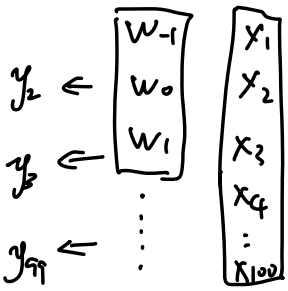
(iii) Q: ratio

Solution Ratio $= \frac{98}{9898} \approx 0.0099$

(b)(i) $y_i^{(k)} = w_{-1}^{(k)} x_{i-1} + w_0^{(k)} x_i + w_1^{(k)} x_{i+1} + \theta^{(k)}$

$k = 1, 2, \cdots, 20$

$i = 1, 2, \cdots 99$



(ii) parameters: $20 \times (3+1) = 80$

20个(3权重+1个bias)

multiplications: $3 \times 98 \times 20 = 5880$

每个y乘3次，98个y共20个

summations: $(2+1) \times 98 \times 20 = 5880$

每个y加2权加1θ

98个y，20个

(iii) Ratio $= \dfrac{98 \times 20}{80} = 24.5$