

STAT448 Assignment 3 Report

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Q1.A. Neural Network Diagram and Output Calculation

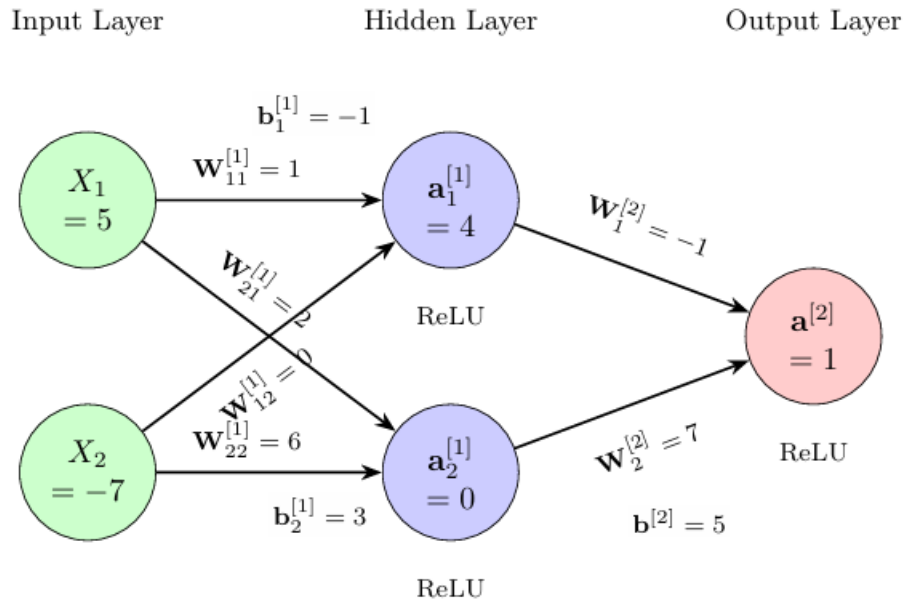


Figure 1: One hidden Layer Neural Network Diagram

Calculation process:

$$Z^{[1]} = W^{[1]}X + b^{[1]} = \begin{bmatrix} 1 & 0 \\ 2 & 6 \end{bmatrix} \begin{bmatrix} 5 \\ -7 \end{bmatrix} + \begin{bmatrix} -1 \\ 3 \end{bmatrix} = \begin{bmatrix} 1 \cdot 5 + 0 \cdot (-7) \\ 2 \cdot 5 + 6 \cdot (-7) \end{bmatrix} + \begin{bmatrix} -1 \\ 3 \end{bmatrix} = \begin{bmatrix} 4 \\ -29 \end{bmatrix}$$

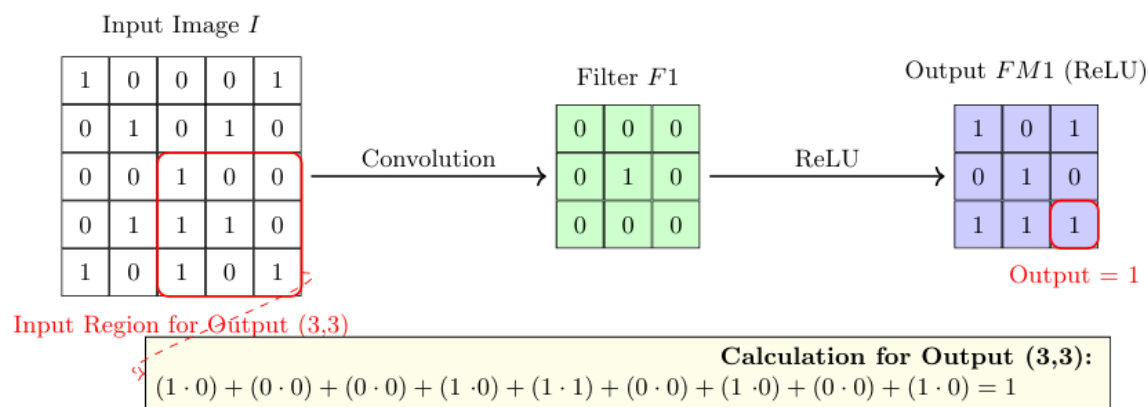
$$a^{[1]} = \text{ReLU}(Z^{[1]}) = \max(0, Z^{[1]}) = \begin{bmatrix} 4 \\ 0 \end{bmatrix}$$

$$Z^{[2]} = W^{[2]}a^{[1]} + b^{[2]} = \begin{bmatrix} -1 & 7 \end{bmatrix} \begin{bmatrix} 4 \\ 0 \end{bmatrix} + 5 = -4 + 0 + 5 = 1$$

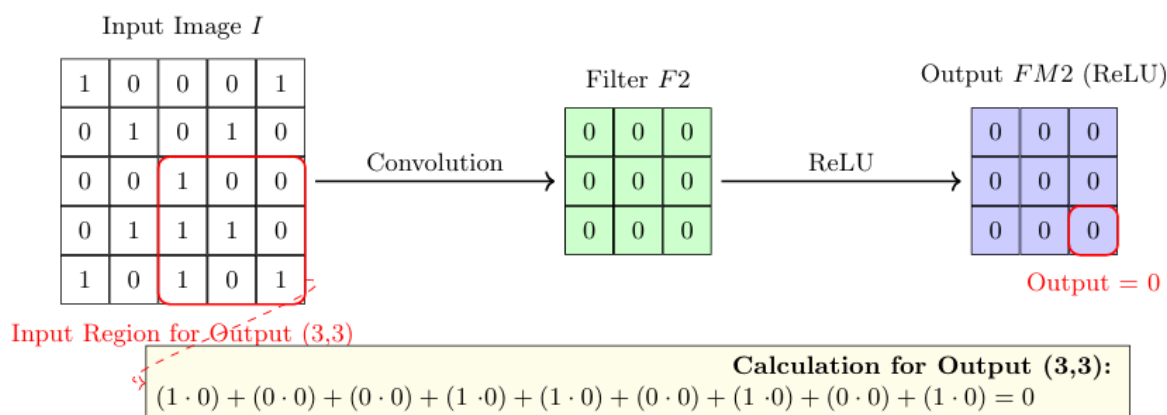
$$\text{Output} = \text{ReLU}(Z^{[2]}) = \max(0, 1) = 1$$

Q1.B. Convolution and Feature Map Generation

Filter F1 (Identity Filter)



Filter F2 (Zero Filter)



Filter F3 (Edge Detector)

