ResNet Problem Set
Total Points: 10

Tarushii Goel

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1. (8 points) Calculate the output of the following 2-layer residual block:

$$x = \begin{bmatrix} 1 \\ 7 \\ 4 \end{bmatrix}, w_1 = \begin{bmatrix} 2 & 5 & 2 \\ 10 & 8 & 9 \\ 2 & 6 & 1 \end{bmatrix}, b_1 = \begin{bmatrix} 6 \\ 9 \\ 4 \end{bmatrix}, w_2 = \begin{bmatrix} 1 & 1 & 1 \\ 10 & 10 & 10 \\ 3 & 3 & 3 \end{bmatrix}, b_2 = \begin{bmatrix} 7 \\ 3 \\ 2 \end{bmatrix}, \sigma(x) = \tanh(x) \quad (1)$$

For work, you must at least show all operations you applied on x to get your answer and the final matrix. However, you do not need to show intermediate matrices and may use a calculator to calculate them. (For clarity, the weights are structured as:

$$\begin{bmatrix} w_{11} & w_{21} & w_{31} \\ w_{12} & w_{22} & w_{32} \\ w_{13} & w_{23} & w_{33} \end{bmatrix}$$

where for w_{xy}, x is the number of the input node and y is the number of the output node)

2. (2 points) Why do we use ResNets?