DEPARTMENT OF DATA SCIENCE & COMPUTER APPLICATIONS

DSE 3121 DEEP LEARNING TECHNIQUES: INTERNAL ASSESSMENT 2

1. Consider an input RGB image of **width=100px** and **height=150px**, to which a Convolutional Neural Network (CNN) containing **three convolutional layers with 32, 64, and 128** filters of size **[3 x 5]**, respectively, with **stride=1** and **no padding**, is applied. After each convolution, a max pooling operation is applied with a pool size of **[2 x 2]** and **stride=2**. For this network, starting from the input layer to the final max pool layer, do the following:

   a. Compute the number of parameters between each layer (including bias).
   b. Compute the output shape after each layer/operation.

   [2.5 marks]

2. Consider a feed-forward neural network with a **single hidden layer having 3 nodes, 1 output node** and the following characteristics:

   - The input vector is **[2, 3, 1]**.
   - The weights of the hidden layer nodes are $\begin{bmatrix} 0.2 & 0.4 & 0.6 \\ 0.3 & 0.4 & 0.5 \\ 0.7 & 0.8 & 0.9 \end{bmatrix}$.
   - The bias of the hidden layer nodes is **[0.2, 0.3, 0.1]**.
   - The weight of the output node is **[0.4, 0.6, 0.7]**.
   - The bias of the output node is **0**.
   - The activation function used in the output layer is sigmoid.
   - The loss function used is mean squared error and actual output value is **1**.

Compute the output of the above network for each of the following activation functions used in the hidden layers. Compare their prediction performances:

   a. ReLU
   b. tanh

   [2.5 marks]