IE4497 RA5 SUBMISSION

Student Name: Nguyen Tuan Anh

Matric No: U2120070G

1. What is “universal approximation” of neural networks for function approximation/regression?

The "universal approximation" theorem for neural networks states that a feedforward network with a single hidden layer containing a finite number of neurons can approximate continuous functions on compact subsets of R^n, given appropriate activation functions. This means such networks can theoretically model any function no matter how complex, within a certain error margin.

2. How would you prove “universal approximation” of neural networks for function approximation/regression?

Proving the "universal approximation" theorem involves showing that for any given continuous function and any e > 0, there exists a neural network configuration (with a single hidden layer and non-linear activation functions) that can approximate the function within an error of e across its domain. This is typically done by constructing specific functions using the activation functions of the network and demonstrating they can densely cover the space of continuous functions.

3. Is the neural network in the figure a 4-layer neural network? Why?

No, it’s not a 4-layer neural network. This neural network can be considered a “3-layer Neural Net” or “2-hidden-layer Neural Net”. It consists of one input layer, two hidden layers, and one output layer.

4. Why do we use SoftMax?

We use SoftMax in multi-class classification tasks to convert the neural network outputs into a probability distribution, where the output for each class is a probability between 0 and 1, and the sum of all the outputs is 1, making it easy to interpret the outputs as probabilities.

5. Why do we need Leaky ReLU?

We need Leaky ReLU to mitigate the "dying ReLU" problem where neurons can become inactive and only output zero, which stops learning in those neurons due to zero gradients. Leaky ReLU allows a small, consistent gradient when the input is negative, thus keeping the neurons alive and continuing the learning process.