Week 5
Short Answers Assignment 5

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1. How do neural networks differ from logistic regression?

Neural Networks and Logistic Regression both are techniques of the machine learning used for mainly in classification hut they also vary in different ways such as complexity and interpretability.

Neural Network Information is processed and sent by layers of networked neurons. Each neuron gets input from the layer before it evaluates it and then transfers its result to the layer after it is using a nonlinear activation function. The output of the last layer represents the predicted value of the model. Neural Network can handle several tasks. It can work with the large data sets whereas unstructured data like images and text. For deploying of neural network, it requires more processing resources, and it includes in audio recognition, Natural language processing and Image recognition.

Logistic regression is mainly used in classification of binary. Class classification tasks with a primarily linear connection between the input characteristics and the output. Logistic regression models are quick and easy to implement in real-world systems. It used in including fields such as healthcare and marketing, banking sectors.

2. If we have three classes of outputs in the final layer of a neural network, how many weight vectors do we need to train in the final layer?

As mentioned, we have three classes, then we should have three weight vectors, one for each class, in the final layer of the neural network.

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3. Say that our input to an activation is -3. Show the output for the sigmoid, hyperbolic tangent, ReLU, and softplus activation functions.

Given,
Input as -3

Sigmoid(z) = 1 / (1 + exp(-z))
Sigmoid (-3) = 1 / (1 + exp (-3))
Sigmoid = 0.047

Hyperbolic Tangent ->> tanh(z) = exp(2z) – 1 / exp(2z) + 1
->> tanh (-3) = exp (2(-3)) – 1 / exp (2(-3)) + 1
Hyperbolic Tangent = - 0.995

ReLU (Rectified Linear Unit): = max (0, z)
ReLU(-3) = max (0, -3)
ReLU (Rectified Linear Unit) = 0

Softplus(z) = ln (1 + exp (z))
= ln (1 + exp (-3))
Softplus(z) = 0.048

4. What is the difference in the output layer between a neural network used for classification, and one used for regression?

A Neural Network used for classification, Objective is to classify input data points to a certain types or categories. In Neural Network for Classification Number of classes o in the classification task is normally equal to the number of output units (neurons) in the output layer.

A Neural Network used for regression is designed to predict continuous numeric values. It is used when the target variable is continuous, such as predictions. In Neural Network for Regression layer that produces data normally has one output unit because its objective is to predict a single continuous value.

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5. Describe why we need to use regularization in neural networks.

In machine learning and neural networks, regularization is essential for creating models that scale efficiently, handle complexity, and maintain stability across training, particularly when working with limited information or complex designs. It is an important tool for developing models that are accurate and adaptable when tested with new information.