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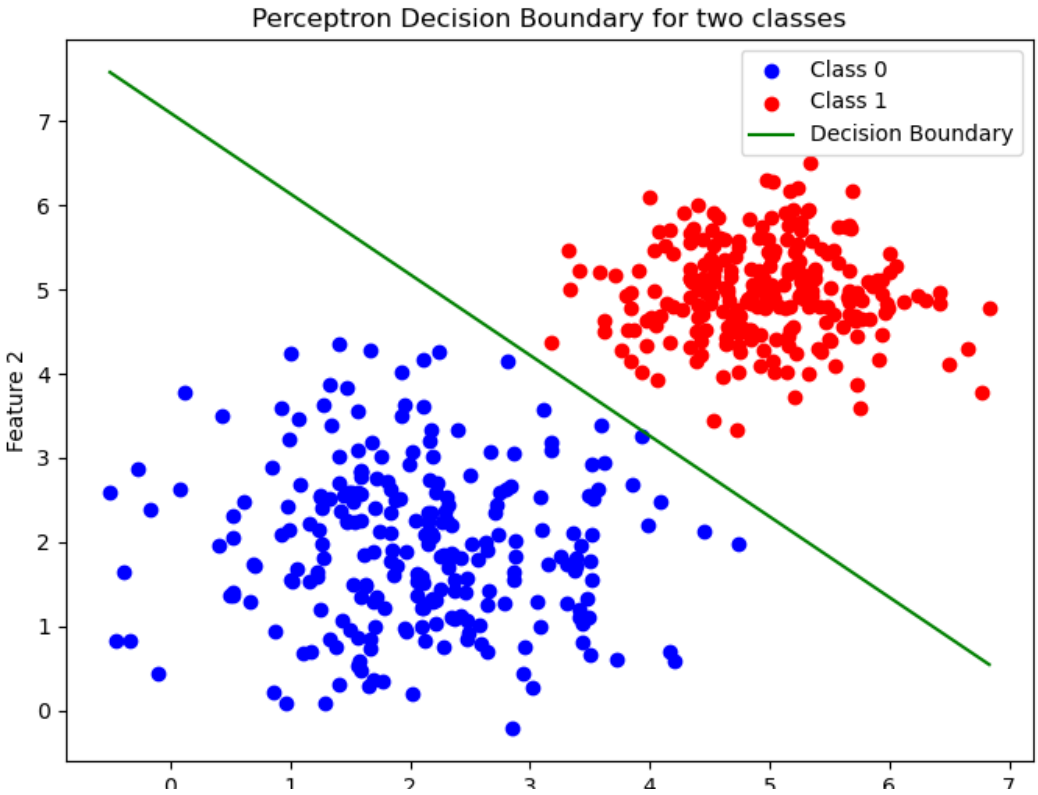
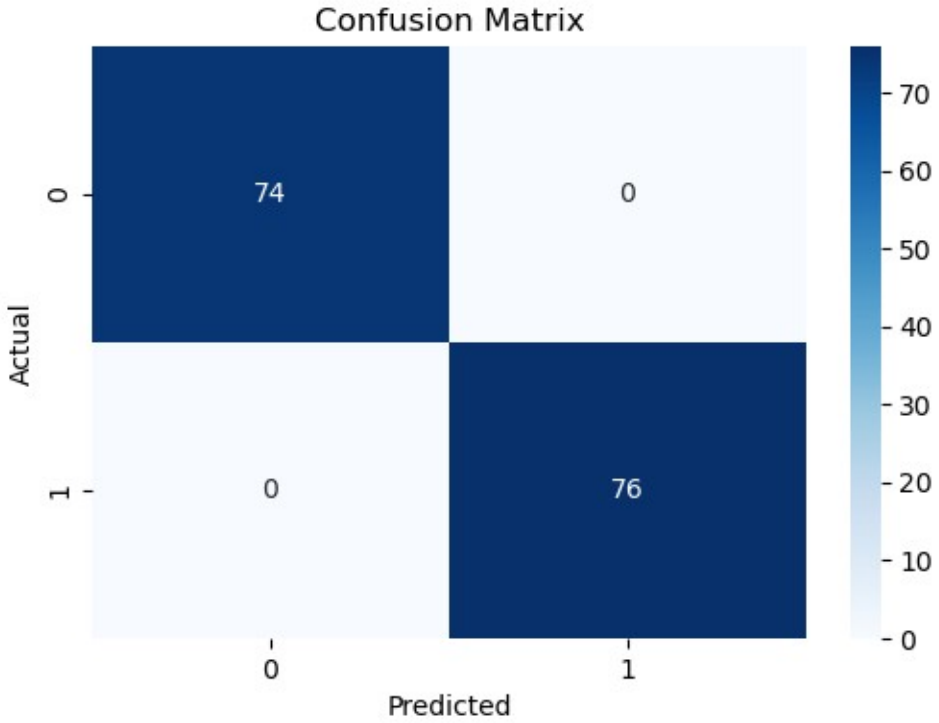
Lab10: Neural Network and Perceptron





QUESTIONS

1. What are the parallels between Biological NNs and Artificial NNs? List any three.
   i. They both use neurons for processing information though one is artificial.
   ii. They both are able to recognize patterns and complex behaviour.
   Iii. They both have the ability to learn through experience.

2. What was the McCulloch-Pitts Neuron model? List any two of its limitations.
   i. It cannot be used to create complex model that requires non linear activation function.
   ii. It is unable to model continuous-valued inputs and output

3. How does a perceptron learn?

   A perceptron learns by adjusting its weights based on the error in its predictions.

4. List any three activation functions and their respective output ranges.

   Hyperbolic tangent (tanh) function: Output range is (-1, 1).
   Rectified Linear Unit (ReLU) function: Output range is [0, ∞).
   Identity f(x)=x: Output range is (-∞, ∞)

5. Why was the classical perceptron not able to solve the XOR problem? Can you suggest a way to solve the XOR problem using neural networks but without going into a higher dimensional space?

The classical perceptron, with a linear activation function, cannot solve the XOR problem because XOR is not a linearly separable problem. A single perceptron can only learn linearly separable patterns, and XOR requires a non-linear decision boundary.

Solution without going into a higher dimensional space:

One way to solve the XOR problem without going into a higher dimensional space is to use a multi-layer perceptron (MLP) with at least one hidden layer. The hidden layer(s) introduce non-linearity, allowing the network to learn the XOR function.