Assignment Eleven: Perceptron and MLP

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**Perceptron and MLP**

1. **Using your own words, explain what a perceptron is.**

The perceptron is a one-layer neural network with a hard-threshold activation function, introduced by Frank Rosenblatt in 1957 and popularized in the late 1950s and early 1960s. It operates by taking multiple input values, applying weights to them, and then summing these weighted inputs. If the sum exceeds a certain threshold, the perceptron outputs a "1" (positive class); otherwise, it outputs a "0" (negative class). The perceptron was initially recognized for its ability to model linear relationships between input features and the output. However, it soon faced criticism because it could only represent linearly separable functions, meaning it could not solve problems where data points were not linearly divisible. Despite these limitations, the perceptron laid the groundwork for future advancements in neural network research, particularly the development of multi-layer networks capable of handling more complex patterns. (Artificial Intellligence: A Modern Approach, 2021, pp. 785-786)

1. **What is the difference between a perceptron and a MLP?**

Multi-Layer Perceptron (MLP) builds upon the single-layer perceptron concept. Unlike a perceptron, which consists of just one input and one output layer, an MLP includes one or more hidden layers positioned between the input and output layers. Each neuron in a layer connects to every neuron in the following layer, enabling the MLP to solve more complex, non-linear problems.

1. **What happens to a MLP when we add more hidden layers and more neurons within the**

**hidden layers? Explain in terms of how the function f() used to express the output y as a function in the input X changes. Refer to the video/classroom discussion for details.**

When more hidden layers and neurons are added, the MLP's ability to model complex patterns in input data increases. The function f(X), which represents the transformation of 𝑋 into the output y, becomes increasingly complex and non-linear with the addition of layers and neurons. This enables the MLP to create more intricate decision boundaries and capture deeper relationships within the input data, allowing it to approximate more complex functions. In summary, adding more hidden layers and neurons enhances the MLP’s expressiveness and learning capacity, making it capable of modeling sophisticated relationships in data. However, this also introduces higher computational demands and the potential risk of overfitting if not managed appropriately.

# References

Artificial Intellligence: A Modern Approach. (2021). In S. Russell, & P. Norvig. Hoboken, NJ: Pearson.