Week 1
Short Answers Assignment1

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1 Explain what machine learning is.

Machine Learning is advanced and growing technology in the latest era. It allows computers to automatically learn from historical data. Machine learning is the process of creating mathematical models using past information and generating predictions using various types of algorithms. It is used in many different tasks. Whereas solving of real-world problems such as speech recognition, image processing and in many business predictions.

Some types of Machine Learning are Supervised Machine Learning, Unsupervised Machine Learning, Reinforcement Learning, and Semi-Supervised Learning.

2 If we have labelled pairs of training examples, is it probably better to use unsupervised or supervised learning? Which do you think is better and why?

Obviously Supervised Learning is the better for the labelled pairs of training. Because In Supervised Machine Learning the Machines are trained using labelled training data based on data then machine can predict the output. Labelled data means they are provided with input-output pairs.

3 Explain the "dimensions of a supervised learning algorithm": model, loss function, and optimization procedure in your own words.

Model is the main component of the algorithm where it is a mathematical representation of the algorithm it is used to make Predictions by using the depended input data.

Loss Function is like the algorithm's analyzer. It is a mathematical equation that measures the distance between the algorithm's predictions and the actual values of the targets in the training data. During training, the objective is to minimize this loss function, which effectively means getting the algorithm's predictions as near to the real values as possible.

optimization Procedure functions similarly to the algorithm's learner. It is the process of adjusting the parameters of the model to reduce the loss function. This frequently happens by an iterative process in which the algorithm makes predictions on the training data, estimates the loss, and then incrementally modifies the model's parameters to lower the loss.

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4 Say our confusion matrix is as follows, calculate precision, recall, and accuracy. Interpret the results for the positive class.

[25 4
3 25]

Precision:

TP = True Positives = 25: FP = False Positives = 4: TN: True Negative = 25: FN: False Negative = 3

It is the ratio of true positives (TP) to the total predicted positives.
Precision = TP / (TP + FP) = 25 / (25 + 4) = 25 / 29 = 0.86

Recall:

It is the ratio of true positives (TP) to the total actual positives.
Recall = TP / (TP + FN) = 25 / (25 + 3) = 25 / 28 = 0.89

Accuracy:

It's the ratio of all correct predictions to the total number of predictions.
Accuracy = (TP + TN) / Total Predictions = (25 + 25) / (25 + 4 + 3 + 25) = 50 / 57 = 0.87

5 Explain why the Perceptron does not come to what we would think of as an optimal solution between two classes of samples. How does using gradient descent with a mean squared error loss function with an MCP neuron solve this problem?

The Perceptron's limitations include a requirement for linear separability, inability to converge on non-linearly separable data, and usage of a discontinuous step function. Gradient descent using a Mean Square Error loss function and more complex neural network topologies, such as Multi-Layer Perceptron, can handle non-linear input and more efficiently improve the model's weights.

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6 Occam's Razor tells us that we should use the simplest possible model for a given dataset. What are the advantages to using simpler models?

According to Occam's Razor, may give several benefits in various kinds of sectors and problem-solving:

- More Complex Models
- Easy in Communication
- Resource efficiency
- Stability
- Cost-Effectiveness