CSCI 5922 - Problem Set 1

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1. Artificial Intelligence v/s Machine Learning v/s Deep Learning

Artificial Intelligence (AI) can have innumerable definitions from multiple perspectives. One way to define ut is "the science of the development of intelligent machines". These intelligent machines can range from something as common-place and day-to-day like the auto-correct and auto-complete technology in your phones, to bigger concepts like talking robots and fully self-driving cars.

Machine Learning is the division of Artificial Intelligence which focuses on approaches for machines and artificial agents to improve the decision-making, perception, knowledge, or actions based on "experience" or data. The Machine Learning community derives concepts from computer science, statistics, psychology, neuroscience, economics and control theory.

Deep Learning is a subspace of Machine Learning, or a specific approach to solving Machine Learning problems. It involves the usage of large multi-layer artificial neural networks that compute using their nodes and layers by means of continuous number representations, also called "weights" or "parameters". Deep Learning, in recent years, has proven to be the most successful ML approach for a wide range of problems, including vision, text and speech.

Artificial Intelligence can be thought of as a superset for Machine Learning, and Machine Learning is a superset for Deep Learning.

Put another way, $DL \subset ML \subset AI$

2. Supervised Learning Generalization

Training sets are used to make models learn from the "experience" of the past. In supervised learning, the data is collected as a set of features and a label. Each feature encodes a different aspect or property of the data, and each training data point (or training example) has varying values for all these features. To make the machine "see" the examples, with their labels, and have it deduce the underlying patterns and intra-dependencies in the features is why we need training data.

The test set, like the training set is also split from the same dataset, although one must ensure that examples that are in the test set do not also occur in the training set. In other words, your ML model should not be tested on data that it has already seen. This is because the entire purpose of the testing process is

to *test* the generalization ability of the model to unseen data points, after it has learned from the training data.

3. Artificial Neurons

This section is handwritten and has been attached in the other file submitted.

P.S. - Ideally I would have written this section in LaTeX too, but because of time constraints, I was unable to do it this time. My sincere apologies to the grader and the professor.