Problem Set 1

The required weekly readings and lecture slides should be helpful in completing the assignment. You can find these on our course website.

1. **Artificial Intelligence versus Machine Learning versus Deep Learning [6 points]:** In your own words, define artificial intelligence, define machine learning, and define deep learning. Then describe the relationship between the three disciplines.

2. **Supervised Learning Generalization [4 points]:** Describe the motivation for splitting data into a training dataset and test dataset and the purpose of each subset for developing deep learning algorithms.

3. **Artificial Neurons:**

   (a) **Model Training [6 points]**: Show the mathematical steps of learning a Perceptron model over two epochs, using the training data shown in Table 1, model weights initialized to 0, and learning rate of 0.1. For full credit, you must include the mathematical steps used to derive the weights and two tables showing resulting weights after each training update round (i.e., after each training example) for each epoch. (This is not a programming exercise)

	Sample	X_1	X_2	X_3	Y
Training	1	0	0	0	1
	2	1	0	0	1
	3	1	1	0	-1
Test	1	1	1	0	-1
	2	1	0	1	-1
	3	1	1	1	1
	4	0	0	0	1

Table 1: Training and test datasets.

(b) **Model Testing [3 points]**: Report prediction results for the test data shown in Table 1.

(c) **Model Evaluation [3 points]**: Evaluate the prediction results by showing the confusion matrix.

(d) **Model Evaluation [3 points]**: Evaluate the prediction results by reporting the precision and recall.