

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 difference between the three disciplines.
2. **Supervised Learning Generalization [4 points]:**
 - (a) In your own words, describe the motivation for creating a training dataset and a test dataset.
 - (b) Should there be any overlap of data between the training and test datasets? Provide a justification for your answer.
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 model parameters (i.e., bias and weights) and two tables showing resulting model parameters after each training update (i.e., training sample) for each epoch. In other words, each training sample should be processed one at a time. Perform the training steps using the order of training samples as is (i.e. no random sampling). (This is not a programming exercise)

	Sample	X_1	X_2	X_3	Y
Training	1	1	0	1	1
	2	1	1	0	1
	3	1	0	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 final model on the test data shown in Table 1.
- (c) **Model Evaluation [2 points]**: Evaluate the prediction results by showing the confusion matrix.
- (d) **Model Evaluation [4 points]**: Evaluate the prediction results by reporting the precision, recall, and accuracy.

Collaboration versus Academic Misconduct: Collaboration with other students is permitted, but the work you submit must be your own. Copying/plagiarizing work from another student is not permitted and is considered academic misconduct. For more information about University of Colorado Boulder's Honor Code and academic misconduct, please visit the [course syllabus](#).