BINUS UNIVERSITY GRADUATE PROGRAM

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Assignment

Individual

Session 06 - 07

Artificial Neural Networks

Support Vector Machine

(To be Submitted Week 09)

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Case Study: The following table present the two-dimensional dataset describe an excerpt of Iris data. The dataset contains the measurements of 20 Iris flowers from two different species - Versicolor (C_1) and Virginica (C_2). Each flower example represents one row in our dataset, and the flower measurements, petal length and petal width, are stored as columns x_1 and x_2, respectively.

Teble 1. Two-dimensional dataset

	C_1		C_2	
Sample	x_1	x_2	x_1	x_2
1	4.1	1.3	5.1	1.8
2	4.2	1.3	5.1	2.4
3	4.3	1.3	5.3	1.9
4	4.4	1.4	5.3	2.3
5	4.5	1.6	5.5	2.1
6	4.6	1.4	5.5	1.8
7	4.7	1.2	5.7	2.3
8	4.7	1.5	5.8	2.2
9	4.8	1.4	5.9	2.1
10	4.9	1.5	6.1	2.5

1. **Classification using the Multi-Layer Perceptron**
   a. Design a 2-layer neural network with a bias to be trained to classify data points from C_1 and C_2 in the table above. Label the nodes in the input and output layers.
   b. Use backpropagation algorithm to train the networks with learning rate $\eta = 0.1$ and activation function of sigmoid. Initialize all weights randomly in the range $-1 < w < +1$. Show the weight values after one iteration of the backpropagation.
   c. Repeat (b) for 10 epoch, then plot a learning curve (the training error vs epoch).
   d. Plot the region boundary of the categories based on the model;
   e. Evaluate performance of the model using confusion matrix: accuracy, recall, F1-score. Write down your conclusions.

2. **Classification using the support vector machine (SVM)**
   a. Construct a classifier model based on linear-SVM given the dataset above. Train the model for 10 times, then plot a learning curve. Note: You can apply Python machine learning package such as Scikit-learn or TensorFlow;
   b. Plot the region boundary of the categories based on the model;
   c. Evaluate performance of the model using confusion matrix: accuracy, recall, F1-score.
   d. Repeat, but by using soft-margin linear SVM with $C = 50$. Compare the result with the previous results. Write down your conclusions.