**ECE 8527: Introduction to  
Machine Learning and Pattern Recognition**

# HW No. 3: Nonlinear DEcision Surfaces

For this assignment, you will use the data generator located here:

*https://www.isip.piconepress.com/courses/temple/ece\_8527/resources/data/set\_05/yinyang.py*

This tool generates data that follows the shape of a yin yang (Taijitu) symbol. The interface is simple:

*python3 yinyang.py N0 N1 <overlap>*

where N0 is the number of points in class “0”, N1 is the number of points in class “1”, and <overlap> is a parameter that controls the overlap between the two classes. Its range is [-1,1].

The tasks to be accomplished in this homework assignment are:

1. Generate a training set with 10,000 points in each class using an overlap of -1. Train a maximum likelihood classifier on this data. Generate an independent evaluation set of 5,000 points per class. Evaluate it using your classifier trained only on the training data. Measure performance on both the training set and the evaluation set. Draw the decision surface that corresponds to your classifier. Superimpose this over a scatter plot of the data.
2. Repeat this for overlap parameter values of -0.25, -0.10, 0.0, 0.10, 0.25. Generate a table of performance on the training and evaluation sets as a function of this parameter.

Discuss the performance of this classifier based on what you have observed in these experiments. What could you do to improve performance?