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

# HW No. 2: Bayesian DEcision Theory

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

*https://www.isip.piconepress.com/courses/temple/ece\_8527/resources/data/set\_13/*

We will focus on the files *train.csv* and *eval.csv*, which contain training and evaluation data. You can assume the loss function weighs all errors equally.

The tasks to be accomplished in this homework assignment are:

1. Load the data into IMLD and classify the data using the algorithm named “class-dependent principal components analysis”. Report the errors rates in a table (algorithm: IMLD-PCA-CD, train error rate, eval error rate).
2. Assume the priors are equal and write Python code to classify the data using a maximum likelihood classifier (assume the priors are equal). Compute the “experimental” error rate by classifying each point in the training and dev sets and scoring them against the true class assignment.
3. Demonstrate that your approach is comparable to the approach in step (1).
4. Estimate the mean and covariance of each class and plot the corresponding support regions. Compare your plot to IMLD. Explain how the support regions relate to the error rate that you computed.
5. Assume the priors are not equal. Compute and plot the error rate as you vary the prior of class “dog” over the range [0,1] (the prior for class “cat” is obviously $1-P\left("dog"\right)$. Write a loop that samples the prior in steps of 0.01 over the range [0,1].