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

# HW No. 6: Expectation MAximization (EM) and Hidden Markov Models (HMMs)

For the first part of this assignment, we will use data set 7:

*https://isip.piconepress.com/courses/temple/ece\_8527/resources/data/set\_07/*

Model each class as a mixture of multivariate Gaussian distributions, and estimate the parameters of these distributions using EM:

*https://towardsdatascience.com/gaussian-mixture-models-with-python-36dabed6212*a

Plot the support regions for the Gaussian mixture components on top of the data. Show individual plots for $N = 1, 2, 4, and 8$, where $N$ is the number of mixture components. Comment on what you observe.

For the second part of this assignment, reproduce the results shown in this tutorial:

*https://medium.com/@natsunoyuki/hidden-markov-models-with-python-c026f778dfa7*

Reproduce the plots shown in this tutorial and include those in your submission.

Hidden Markov Models (HMMs) with Gaussian mixture distributions are a very powerful way to model and classify signals that have both a temporal and spectral component, since the model learns the temporal structure of the data using a Markov process.