# CS5560: Probabilistic Models for ML

## Overview

This is an intermediate-level course in machine learning that exclusively studies (parametric) probabilistic models. After revising basic topics like MLE with exponential family, corresponding generative and discriminative models [4hr]; the course covers the following topics:

1. MAP, Bayesian estimation in Beta-Binomial, Dirichlet-Multinomial, Normal-Inverse-Gamma-Gaussian, conjugate prior based models in exponential family [5hr].
2. Expectation Maximization (EM) based learning in Mixture models, Hidden Markov Model, Dirichlet processes (Clustering) [6hr].
3. Representation, learning, and inference with directed (Bayes nets) and un-directed (Markov Random Fields) graphical models [remaining hours].

The lectures and assignments focus on the technical aspects of the topics and provided sufficient details as desirable for an intermediate-level course.

## Pre-requisites

The course assumes undergraduate level knowledge of probability theory,and multivariate calculus. It also assumes familiarity with machine learning models, in general. Further, expertise in statistics, and mathematical optimization, are desirable, but are not necessary pre-requisites.

## Books

The basic textbook for this course is "Machine Learning: A Probabilistic Perspective" By Kevin P. Murphy (MIT Press). The book for the main topic is "Probabilistic Graphical Models: Principles and Techniques" by Daphne Koller and Nir Friedman (MIT Press).

## Evaluation Scheme

We shall be following the "continuous evaluation model". In particular, there will be a 15min-30min quiz every week on the topics covered in the earlier week throughout the semester. This will carry 40% marks. In the end, there will be an end-semester exam, which will have three sessions: 20% each. Practice problems shall be provided, which will not be evaluated.

## Contact

Apart from regular 3 lecture hours, a 1hr tutorial will be conducted every week. Attending the tutorial is completely optional. In the tutorial, doubts from students shall be clarified, weekly quiz solutions will be discussed etc.