Course ID: 43010

Course Title: Practical Bayesian Modeling and Inference

Course Summary: In this course, I will start with basic probability and distribution theory, and cover a wide range of topics related to Bayesian modeling, computation, and inference. Significant amount of effort will be directed to teaching students on how to build and apply hierarchical models and perform posterior inference. The first half of the course will be focused on basic theory, modeling, and computation using Markov chain Monte Carlo methods, and the second half of the course will be about advanced models and applications. Computation and application will be emphasized so that students will be able to solve real-world problems with Bayesian techniques.

Topics to be discussed

1. Basic Probability and Distribution Theory (3 hours) 1 wk
2. Hierarchical Models (3 hours) 1 wk
3. Bayesian Computation (6 hours) 2 wk
4. Applications to Clinical Trial Designs (3 hours) 1 wk
5. Nonparametric Bayesian Methods (9 hours) 3 wk
6. Applications to Genomics Research (3 hours) 1 wk
7. Student Presentation (3 hours) 1 wk

Total: 30 hours (10 weeks)

The course will be 3 credits. There will be a mid-term in class closed-book exam, and a final project. Students will be asked to present in groups at the end about their projects.

References:

Carlin and Louis (2008) Bayesian Methods for Data Analysis (3rd Edition);
Gelman et al. (2013) Bayesian Data Analysis (3rd Edition);

Prerequisite: Students are expected to have master level training in statistics or equivalence. Previous master-level mathematical statistics courses are required. Familiarity of scientific programming language such as R is preferred.