CSCE 758 – Probabilistic System Analysis
Fall 2013

Instructor: Dr. Gabriel Terejanu
Credit: 3
Office: SWGN 3A50
Time: TTh 4:25PM-5:40PM
Email: terejanu@cec.sc.edu
Location: SWGN 2A24
Office Hours: F 3:00PM-4:00PM

Course Objective
The course introduces the basic probabilistic concepts and their application in the construction of models for physical and engineering systems. There is a strong emphasis on the Bayesian machinery with the objective to analyze the behavior of a wide range of practical problems described by computational models. Bayesian inference is a powerful and increasingly popular statistical approach, which allows one to deal with complex problems in a conceptually simple and unified way. The course addresses topics such as model calibration, state estimation, uncertainty propagation, sensitivity analysis, model comparison, and optimal experimental design. By the end of this course, students will be able to apply the algorithms and the concepts taught to analyze the behavior of computational models.

Prerequisite
Students should be able to program using a high-level language such as Matlab, R, C++ etc.

Student Work and Grading
1. (20%) Homework: 3-4 homework assignments – individual work
2. (15%) Reading assignments: 2-3 research papers to be summarized – individual work
3. (20%) Midterm: take home test – individual work
4. (10%) Final project presentation – working in a small group (2-3 students)
5. (30%) Final project report – working in a small group (2-3 students)
6. (5%) Attendance and participation

Grades
A (90-100%), B+ (85-90%), B (80-85%), C+ (75-80%), C (70-75%), D+ (65-70%), D (60-65%), F (0-60%)

Tentative Schedule
Week 1. Introduction
Week 2. Elementary Probability
Week 3. Random Variables
Week 4. Expected Values
Week 5. Information Theoretic Measures
Week 6. Bayesian Inference & Kalman Filtering
Week 7. Extended Kalman Filtering
Week 8. Gaussian Sum Filtering
Week 9. Monte Carlo Integration & Project Proposal
Week 10. Particle Filters
Week 11. Markov Chain Monte Carlo
Week 12. Decision Theory
Week 13.  Model Averaging and Model Selection
Week 14.  Optimal Experimental Design
Week 15.  Gaussian Processes & Inference in the presence of model error
Week 16.  Student Presentations & Review

**Bibliography – no primary text**


**Lecture Notes/Assignments/Readings**
Lecture notes, homework assignments will be available at dropbox.cse.sc.edu. You will be responsible for downloading them to prepare for class and homework.

**Academic Integrity**
Homework and examinations are expected to be the sole effort of the student submitting the work. Students are expected to follow the Code of Student Academic Responsibility. Every instance of a suspected violation will be reported. Students found guilty of violations of the Code will receive the grade of F for the course in addition to whatever disciplinary sanctions are applied.