Syllabus for Penn State STAT 540, Fall 2019
Computationally Intensive Statistical Inference

Instructor: Murali Haran, Professor, Department of Statistics, Penn State University, University Park, Pennsylvania.
Office: 326 Thomas Building
Office Hours: Tuesdays 1-2 pm or by appointment

Grader: Vincent Pisztora, PhD Student
Office Hours: by appointment

Email communication: You can reach me and the TA through email via Canvas.

Class Times: TuThu 10:35-11:50 am in Boucke 306.

Prerequisites: STAT 513 and 514 or equivalent Casella and Berger level mathematical statistics sequence, and at least one course in computer programming (undergraduate level would suffice)

Textbook: None; occasional lecture notes posted on Canvas (please do not distribute).

Coverage: The main topics covered in the course are:

- Statistics-relevant computing basics; matrix computations
- Numerical integration, Laplace approximations
- Monte Carlo methods: foundations, importance sampling, Markov chain Monte Carlo
- Bootstrap
- Optimization: unconstrained; second and first order methods, including stochastic gradient
- Surrogate methods: EM/MM
- Advanced topics (time permitting)

Course Website: Main: [http://personal.psu.edu/muh10/540/540.html](http://personal.psu.edu/muh10/540/540.html)
Course schedule: [http://personal.psu.edu/muh10/540/schedule540.Fall2019.html](http://personal.psu.edu/muh10/540/schedule540.Fall2019.html) Please bookmark these website. I will use the course website in tandem with Canvas for course related communications.
Course Requirements:

- Homework (50%). You may discuss them but they must be written up independently. The homework assignments may vary in length and difficulty, and hence may differ in the number of points they are worth.

- Course project (50%: proposal + reports + presentation). I expect this to be a substantial project. Possibilities include: original research, review of existing methods, extensive simulation studies, or some combination of all of the above. I will determine whether the scope of your project is appropriate for this course. Important: (1) The project must be focused on algorithms used for statistics/probability; (2) You must obtain my approval for the topic; (3) You may not submit a project from a different class for this class. Also, your project cannot be thesis research that you were planning to do before you began this course.

Course Rules:

1. Homework will be due online on Canvas. Unless you contact me with a good reason ahead of time (at least 1 day in advance), the following late policies hold: submit your homework by midnight on the same day with a 20% reduction or 10:30 am the next day with a 50% reduction in your score. No late homework will be accepted after that time under any circumstance. You have 1 week to appeal any grade. No grade changes will be made 1 week after a graded homework is returned.

2. You are welcome to use any computer language you like, as long as you make it easy for the TA to grade your work, and run your code. I strongly recommend you use R since most of the class examples will be in R.

3. Homework submissions: All students are required to submit typed computing assignments. Statistics graduate students are required to use LaTeX to write up assignments.

4. Academic Integrity and Mutual Respect: All Penn State University, College of Science, and Department of Statistics policies regarding ethics, honorable behavior, and mutual respect apply in this course.

   - Penn State’s Policies [https://studentaffairs.psu.edu/support-safety-conduct/student-conduct/code-conduct](https://studentaffairs.psu.edu/support-safety-conduct/student-conduct/code-conduct)
   - College of Science’s Academic Integrity Policy [http://science.psu.edu/current-students/Integrity/Policy.html](http://science.psu.edu/current-students/Integrity/Policy.html)

5. If you have a disability-related need for reasonable academic adjustments in this course, contact the Student Disability Resources (SDR) at 814-863-1807 or visit their website [http://equity.psu.edu/student-disability-resources](http://equity.psu.edu/student-disability-resources)