ECE-GY Special Topics: Statistical Learning Theory

Spring 2020

Instructor:	Farhad Shirani	**Email:**	fsc265@nyu.edu
Location:	TBD	**Time:**	9:50-12:20 Monday

Course Page:

- NYUclasses Portal

Textbook/ Course Material:

- Devroye, Luc, Làszlò Györfi, and Gàbor Lugosi. A probabilistic theory of pattern recognition. Vol. 31. Springer Science & Business Media, 2013.
- Percy Liang's Lecture Notes (Stanford)
- Martin Wainwright's Lecture Notes (Berkeley)

Additional References:

1. 'Learning with Kernels,' B. Scholkopf and A. Smola, MIT Press, 2002.
2. 'Statistical Learning Theory,' Vladimir N. Vapnik, Wiley, 1998.
3. 'An Elementary Introduction to Statistical Learning Theory,' Sanjeev Kulkarni and Gilbert Harman, Wiley, 2011.

The course mostly follows the textbook 'A Probabilistic Theory of Pattern Recognition' and Percy Liang's Lecture notes. The additional references provide further explanations and examples which are useful in understanding the topics discussed in this course. Reference 1 is provides a good introduction to Kernel methods and support vector machines. Reference 2 is one of the classical textbooks used in Statistical Learning Theory classes. Reference 3 is one of the more recent publications which is sometimes used as the main textbook for this class.

Course Content:
Mathematical Background: Linear algebra, probability theory.
Asymptotics and Regression: Gaussian mean estimation, fixed design linear regression, random design.
Error analysis: Concentration inequalities (e.g. Hoeffding's inequality), PAC bounds, VC dimension
Kernel Methods: Kernel definitions, properties and relation to learning theory.
Online Learning: Online convex optimization, online sub-gradient decent

Prerequisites:
ECE-GY-6303: Probability and Stochastic Processes or equivalent graduate-level probability course.

Grading

- Homework: %15
- Midterm: %40, Date: TBD
- Final: %45, Date: TBD

Homework Policy:

- Approximately weekly homework assignments due in lecture. Each homework assignment is graded out of 100 points. Tentatively, there would be a total of 13 homework assignments, and the final grade will be calculated out of 1150 instead of 1300 (i.e. there is an extra 150 points.). You are expected to do the homework on your own without collaboration from your classmates, though you may discuss the problems in general terms. You are not allowed to use, or in any way derive advantage from solutions prepared in the prior years or otherwise available. Late Homework will not be accepted. You must attach the homework coversheet, which is available on the course website to each assignment before handing it in. Only a randomly selected subset of the problems in each assignment will be graded. Graded homework will be returned to you during the discussion sections.