STAT 972: Advanced Topics in Mathematical Statistics

MW 1:30-3:00pm @ JMHH F36

Professor: T. Tony Cai, *tcai@wharton.upenn.edu*, Office: JMHH 469.

Office hours: Monday 3:00-5:00pm.

References:

- *A Course in Large Sample Theory* by Thomas Ferguson. Chapman & Hall, 1996.
- *Elements of Large-Sample Theory* by Eric Lehmann. Springer, New York, 2004.
- *Asymptotics in Statistics: Some Basic Concepts* by Lucien Le Cam and Grace Yang. Springer-Verlag, New York, 1990.
- Additional papers and lecture notes will be given in class.

The course begins with the classical asymptotic theory. Topics include Information Inequality, delta method, variance-stabilizing transformation, Edgeworth expansion, and their applications. Likelihood inference including asymptotic properties of the MLE and superefficiency will be covered.

The second part of the course is on nonparametric and high-dimensional inference. We will discuss sparse signal detection, large-scale multiple testing, nonparametric function estimation, compressed sensing, and inference for high-dimensional linear regression. In particular, ℓ_1 minimization methods (Dantzig Selector and Lasso) are analyzed in detail. Both upper bound and lower bound techniques will be discussed. If time permits, optimal estimation of high-dimensional covariance matrices will also be covered.

Homework: There will be occasional homework assignments.

Presentation: Students are expected to give a presentation near the end of the semester.

Exam: There will be no exam.