Statistics Seminar

Hosted by Department of Mathematical Sciences

- Date: Thursday, February 20, 2020
- Time: 1:15pm – 2:30pm
- Room: WH-100E
- Speaker: Kexuan Li (Binghamton University)
- Title: On the Minimax Performance of the Generalized Shiryaev-Roberts Quickest Change-Point Detection in Continuous Time

Abstract

The topic of interest in the minimax performance of the Generalized Shiryaev-Roberts (GSR) quickest change-point detection in continuous time, where the aim is to control online the drift of standard Brownian motion observed ``live''. The specific minimax criterion considered is that proposed by Pollak (1985) who suggested to look at the maximal expected detection lag conditional on no false alarm having yet been sounded, with the maximization performed over all possible change-point locations. While the question as to which detection procedure minimizes Pollak's delay metric is still an open one (whether in discrete or in continuous time), the GSR procedure is currently believed to be the most promising lead in the quest for minimax optimality. Hence the interest in the GSR procedure and its various extensions. The contribution of this work is two-fold. First we offer exact closed-form formulae for the performance characteristics of the GSR procedure. With the aid of the formulae we then obtain tantalizing numerical evidence that the procedure might be nearly minimax optimal in the limit, as the false alarm risk vanishes. Potential strategies to prove this analytically are also discussed. Second, we look at the randomized version of the GSR procedure that was proposed by Pollak (1985). The idea is to sample the initial value of the GSR statistic from its so-called quasi-stationary distribution (long-term behavior conditional on extended survival). This approach is known to be nearly Pollak minimax, in discrete as well as in continuous time. However, the important question as to the rate of convergence to the unknown optimal delay is still unanswered. We obtain new tight lower- and upper-bounds for the cdf as well as for the pdf of the quasi-stationary distribution, and then use the bounds to quantify the convergence rate. On the side we also find all of the fractional moments of the quasi-stationary distribution.