

## **CSC 86010 Quickest detection and applications in finance and computer vision**

Professor Olympia Hadjiliadis, Mondays, 4:15 – 6:15 pm

The problem of detecting abrupt changes in the statistical behavior of observation arises in a variety of fields including signal processing, computer vision and finance. Using the mathematical methods of stochastic optimization and statistical sequential techniques, this course describes the fundamentals underpinning the field providing the background necessary to design analyze and understand quickest detection algorithms and stopping times. In this course we will provide a unified treatment of several different approaches to the quickest detection problem and draw examples from the field of signal processing, finance and computer vision.

In particular, we will draw the connections between CUSUM detection algorithms and drawdown measures of risk used for the quantification of risk in financial risk management. We will also describe detection algorithms and their use in algorithmic trading. We will finally investigate how we can apply detection algorithms to achieve online detection and classification of objects in point clouds of urban scenes.

Topics covered:

- 1) Statistical and sequential Hypothesis testing
- 2) The sequential probability ratio test and the CUSUM stopping time as solutions to problems of stochastic optimization
- 3) Applications to computer vision and algorithmic trading
- 4) Brownian motion, Ito calculus, martingales and Markov processes
- 5) Theory of asset pricing and portfolio optimization
- 6) Drawdown measures of risk and connections to detection