



BIG DATA

Interdisciplinary Data Sciences Consortium



* IDSC *

February 13, 2018 2:00-3:00pm

Location: NES 108

Presents

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Title: Online Nonparametric Anomaly Detection in High-Dimensional Datasets

Abstract: We consider sequentially detecting a change in the probability distribution of observations at a random time without assuming/estimating the distributions before and after the change. This problem is motivated by anomaly (or outlier or novelty) detection in high-dimensional problems, commonly known as Big Data, encountered in emerging technologies such as Internet of Things (IoT), cyber-physical systems, smart grid, smart city, intelligent transportation systems, and autonomous driving. Typical Big Data challenges are present in such problems: 1) timely and accurate detection, calling for sequential algorithms; 2) inherent uncertainty in both baseline and anomalous distributions, requiring nonparametric methods; 3) high dimensionality, necessitating computationally efficient (scalable) algorithms; and 4) ability to work with different data types (agnostic to data-type and protocol). To this end, we propose a nonparametric algorithm which geometrically learns a baseline statistic from training data, and sequentially uses it to detect significant deviations from the baseline. We show a structural similarity between the proposed algorithm and the well-known Cumulative Sum (CUSUM) detector using discrepancy theory. Hence, the proposed algorithm is called Online Discrepancy Test (ODIT). The computational complexity of ODIT is shown to be low so that it scales well to high-dimensional problems. Moreover, an asymptotic optimality result for ODIT is presented. For a certain class of problems, ODIT converges to CUSUM as the size of the training set grows. The performance of ODIT is evaluated on real-world examples such as human activity recognition, and detecting false data injection and jamming attacks in smart grid.



Biography: Dr. Yasin Yilmaz (S'11-M'14) received the B.Sc., M.Sc., and Ph.D. degrees in Electrical Engineering from Middle East Technical University, Ankara, Turkey in 2008, Koc University, Istanbul, Turkey in 2010, and Columbia University, New York, NY, in 2014, respectively. He is currently an Assistant Professor of Electrical Engineering at the University of South Florida, Tampa. He received the Collaborative Research Award from Columbia University in 2015. His research interests include statistical signal processing, machine learning, and their applications to cybersecurity, IoT networks, social networks, communication systems, and cyber-physical systems.

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