Advances in Statistical Learning

From Deep Networks to Graphs and Evolving Cities

Room 611, 14:00 Hrs, 10 May 2019.

Electrical Engineering Department, Imperial College.

Organisers

Prof. Danilo Mandic: d.mandic@imperial.ac.uk

Prof. Tony Constantinides: a.constantinides@imperial.ac.uk

14:00-14:35 – Prof. Zhi Tian (George Mason University), USA

Title: Energy-Efficient Decentralized Optimization and Learning

Abstract: In decentralized learning, a number of distributed nodes collaboratively carry out a common learning task in an autonomous manner. In such a big-data paradigm, communication has become a common bottleneck in implementing efficient parallel and distributed algorithms. An ideal decentralized algorithm is expected to reach the optimal solution with minimal communication and computation costs. This talk presents some recent results on the design and analysis of energy-efficient schemes for decentralized consensus optimization through event-triggered control and communication censoring. These communication-saving strategies are illustrated via several optimization and learning problems including non-parametric kernel learning.

14:35-15:10 – Prof. David Miller (Penn State University), USA

Title: Adversarial Learning in Statistical Classification: State-of-the-art Defenses Against Test-time Evasion, Reverse Engineering, and Backdoor Attacks

Abstract: Adversarial learning (AL) attacks on machine learning based classifiers may seek to evade correct classification, discover the classifier's decision rule, or poison its training set. We provide novel insights that challenge conventional AL wisdom and that target unresolved issues, including, but not limited to: 1) robust classification versus anomaly detection (AD) as a defense strategy; 2) the belief that attack success increases with attack strength, which ignores susceptibility to AD; 3) small perturbations for test-time evasion attacks: a fallacy or a requirement?

15:10-15:30 – Coffee Break

15:30-16:05 – Dr. Anthony Kuh (NSF and University of Hawaii), USA

Title: Graphical Tree Models: Covariance Approximation, Assessment, and Extensions

Abstract: Data is often very high dimensional and simpler sparse approximations are needed to represent the data to reduce computational complexity. The covariance matrix can be represented by an undirected graph and a common approximation is the tree approximation. We look at existing algorithms such as the Chow-Liu tree approximation algorithm using the Kullback Leibler (KL) Divergence and discuss the quality of approximation algorithms by formulating the problem as a detection problem. Results show that the KL divergence is not always sufficient in assessing the approximation quality. Second, we look at more complex approximation models using a cascade of tree models. We show that our approximation algorithm converges to the original covariance matrix.

16:05-16:40 – Dr. Stanislava Boskovic and Prof. Tony Constantinides (Imperial)

Title: Graphs for Cities: A framework for future urban transition

Abstract: The entire urban evolution has been based on the gradual improvement of citizens' safety and wellbeing through an inexhaustible repertoire of innovative technologies. Modern cities are greatly affected by the impacts of climate change that put an enormous strain on the infrastructure, basic services, and human livelihoods. In addition, we are witnessing growing concerns with regards to the scarcity of resources and risks of natural disasters. To tackle these issues, we first illuminate that, through the prism of Graph Theory, is possible to explore the main drivers of urban development, climate change mitigation and urban resilience. Next, we show that a Graph Theoretic umbrella can serve to simultaneously account for diverse and multifaceted aspects of maintaining a city in its equilibrium state.

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