New Problems on Learning and Data Science in Control Theory

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Motivation and Objectives

The objective of this workshop is to start a dialogue on whether data science and control theory can benefit from each other. We intend to have a clear understanding of why the value of *data* has traditionally been under-utilized and under-emphasized in the controls community, what new dimensions can control theory gain from machine learning, and what primary analytical and experimental tools are needed to make this marriage more successful. We will invite twelve distinguished control theorists working in various aspects and applications of data-driven algorithms to give talks on their recent research findings on this subject. The discussions will span the underlying fundamentals in control, optimization, state estimation, system identification, inferencing, and learning with applications ranging from power grids, transportation, urban mobility, and smart cities. The importance of security and privacy of data in each of these domains will be emphasized.

Workshop Agenda

Tuesday, June 26, 2018, Hilton Milwaukee City Center Hotel (conference venue)

1. **8.30 am - 9 am**: Coffee and Registration

2. **9 am - 9.10 am**: Introductory remarks by Aranya Chakrabortty (NC State) and Anthony Kuh (NSF)

3. **9.10 am - 10 am**: Keynote speech by Pramod Khargonekar (UC Irvine)
   Title: Visions for Systems and Control in the Era of Learning and Data Science

4. **10 am - 10.50 am**: Keynote speech by Anuradha Annaswamy (MIT)
   Title: Parameter Estimation, Adaptive Control, and Machine Learning: Intersections and Analytical Foundations

5. **10.50 am - 11 am**: Coffee break

6. **11 am - 11.20 am**: Ufuk Topcu (Univ of Texas Austin)
   Title: Data-Driven Cyber-Physical Systems

7. **11.20 am - 11.40 am**: Dennice Gayme (Johns Hopkins University)
   Title: State Estimation for Model-Based Wind Farm Control

8. **11.40 am - 12 noon**: Dileep Kalathil (Texas A&M)
   Title: Online Learning Algorithm for Sequential Scheduling

9. **12 noon - 2 pm**: Lunch

10. **2 pm - 2.50 pm**: Keynote speech by R. Srikant (Univ of Illinois Urbana Champaign)
    Title: Network Inference and Discrete System Identification

11. **2.50 pm - 3.10 pm**: Lilian Ratliff (Univ of Washington Seattle)
    Title: Learning and Incentive Design with Applications to Urban Mobility

12. **3.10 pm - 3.20 pm**: Coffee break

13. **3.20 pm - 3.40 pm**: Sayan Mitra (Univ of Illinois Urbana Champaign)
    Title: Entropy and Minimal Data Rates from Model Detection for Uncertain Dynamics

14. **3.40 pm - 4 pm**: Kyriakos Vamvoudakis (Virginia Tech)
    Title: A Cooperative Q-learning Framework in Unknown Networked Systems

15. **4 pm - 4.20 pm**: Aranya Chakrabortty (NC State Univ)
    Title: Data-Driven Control of Very Large Networks using Ideas of Model Reduction

16. **4.20 pm - 4.40 pm**: Anthony Kuh (NSF)
    Title: Challenges in Big Data Research: Perspectives from NSF

17. **4.40 pm - 5.10 pm**: Discussions, Q&A, and Next Steps

18. **5.10 pm - 5.20 pm**: Final remarks by the organizers

Workshop Speakers

1. Pramod Khargonekar, *University of California Irvine*

2. Anuradha Annaswamy, *Massachusetts Institute of Technology*

3. R. Srikant, *University of Illinois Urbana-Champaign*

4. Ufuk Topcu, *University of Texas at Austin*

5. Sayan Mitra, *University of Illinois Urbana-Champaign*

6. Dennice Gayme, *Johns Hopkins University*

7. Lilian Ratliff, *University of Washington Seattle*

8. Dileep Kalathil, *Texas A& M University*

9. Kyriakos Vamvoudakis, *Virginia Tech*

10. Aranya Chakrabortty, *North Carolina State University*

11. Anthony Kuh, *National Science Foundation*