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Preface to the Special Issue: "Complex Adaptive Systems," Malvern, Pennsylvania, November 13-15, 2019

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Complex Adaptive Systems Conference with Theme:
Leveraging AI and Machine Learning for Societal Challenges, CAS 2019

Preface

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Cyber physical systems and socio-technical systems are nonlinear, distributed, and adaptive to their environment in both space and time. These systems are key enablers for addressing today's societal challenges. For example, growing human populations and growing demand for limited natural resources necessitate sustainable cities that require efficient and effective energy generation and transportation infrastructures. Smart grid, autonomous vehicles within a connected networked infrastructure, and Internet of Things (IoT) applications are evolving to address these societal needs. Healthcare systems are changing as well. Smart medical devices, wearable sensors, connected home monitoring systems are all part of the modern healthcare systems.

AI and machine learning methods provide adaptability capability for many of these complex systems that are continuously evolving in time. Big data and data analytics are vital for managing these systems. Designing these systems necessitates systems thinking perspective which we can attain through modelling and simulation. Resilience, cyber security, and safety are some of the systemic properties for these systems. This year, the conference theme concentrates on bringing these concepts together to address societal challenges.

This publication of the Complex Adaptive Systems Proceedings series contains the edited versions of the technical papers presented during the Complex Adaptive Systems conference held in November 13-15, 2019, in Malvern, Pennsylvania, U.S.A. The extended version of each selected paper was reviewed by two referees, then revised, edited and condensed to the format herein.

The proceeding is organized into six topical parts:
- AI and machine learning applications
- Data analytics
- Modelling socio-technical systems
- Cyber physical systems
- Safety, reliability, and resilience
- Cyber security

The 2019 Complex Adaptive Systems conference plenary speakers presented various perspectives on applications of AI, machine learning, and data analytics for a wide range of societal problems. These include:

- "Natural Language Processing: Interpretability, Trust, and Robustness" by Prasenjit Mitra, Ph.D., The Pennsylvania State University, Associate Dean for Research and Professor of Information Sciences and Technology
- "Smarter Safer Cities using AI and Machine Learning" by Eric B. Smith, Co-founder and CFO of Kognition, LLC
- "Changing the way we operate through technology and innovation" by John J. DeGiovanni "JJ", Managing Director of Quality Assurance, Regulatory Compliance & Safety, United Airlines
- "AI and Machine Learning in Drug-to-Drug Interaction" by Soundar Kumara, Ph.D., The Pennsylvania State University, Allen E. Pearce and Allen M. Pearce Professor of Industrial Engineering, Professor of IST (Affiliate)
- "Quantum Blockchain & Society 5.0-Cyber Resilience of the Future" by Nii Attoh-Okine, Ph.D., University of Delaware, Professor of Civil and Environmental Engineering, Electrical and Computer Engineering, Interim Academic Director (University of Delaware Cybersecurity Initiative)

Industry panel speakers; Boris Vishnevsky (Principal Slalom Consulting, Adjunct Professor at Thomas Jefferson University), Aeron Proietti (Author of *Today's Innovator* and Former Chief Innovation Officer at Transamerica), Eric Smith (Co-founder and CFO, Kognition), and Bob Biglin (CEO and Senior Partner, The Center for Advanced Emotional Intelligence) discussed the 2019 CAS conference theme from various perspectives by sharing their real life experiences and insights.

As the 2019 conference chair, I would like to express my gratitude to the plenary speakers and industry panel speakers for their invaluable contributions through their presentations. I also want to thank all authors for their contributions to this volume of proceedings and for their presentations at the conference, and the referees for their technical expertise, comments and suggestions provided during paper reviews. I would like to mention our appreciation to the conference sponsors for bringing real life dimension, issues and engineering problems to the meeting. I would also like to thank Lee Doughterty, Cai Pyle, Erica McLoed, and Kate McConnell for their support that enabled me in the organization of this conference and Sue Turner for her support during the production of this volume.