Formal Verification, Learning and Control of Large-Scale Stochastic Cyber-Physical Systems

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Abstract:

In the past few years, large-scale stochastic cyber-physical systems (CPS) have received remarkable attentions as a beneficial modelling framework describing a wide range of real-life safety-critical systems including automotive, robotics, transportation systems, energy, healthcare, and critical infrastructures. Formal verification and controller synthesis for this type of complex systems to enforce high-level logic properties, e.g., those expressed as temporal logic formulae, are inherently very challenging mainly due to (i) large dimension of state/input sets, (ii) stochastic nature of dynamics, (iii) tight interaction between physical and cyber components, (iv) dealing with complex logic requirements, and (v) lack of closed-form mathematical models in many real-world applications. In this talk, I will present different compositional (data-driven) techniques to tackle the aforementioned difficulties and design highly-reliable CPS by bringing together interdisciplinary concepts from formal methods in computer science, control theory and data science.