THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學

Department of Computing
電子計算學系

RESEARCH SEMINAR

Testing Learning-Enabled Cyber-Physical Systems: Current Approaches and Future Directions

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Date : 24 Oct 2024 (Thu)
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Venue : HJ303

Abstract

Learning-enabled Cyber-Physical Systems (LE-CPS), including autonomous vehicles and unmanned drones, hold great promise but also raise significant concerns about safety and reliability. Unlike traditional software, these LE-CPS integrate deep neural networks with logic-based modules, creating unique challenges for software testing. Despite advances in testing techniques, the practical needs of industry practitioners for safety and formal guarantees have not yet been fully addressed.

To tackle these complex challenges, I have led a team of world-leading experts to establish the Trusted Autonomy Working Group (TACPS.org). In this presentation, I will first briefly discuss two of our FSE'22 papers that provide a comprehensive study of current testing practices and test reduction strategies in autonomous vehicles. I will then highlight a recent FSE'24 paper that revives model-based testing in LE-CPS using large language models, followed by related work in TSE'24 and ICSE'25 on generating driving scenarios with large language models and creating an online testing environment to enhance drone autolanding systems. Finally, I will cover our recent paper on the neuro-symbolic paradigm, which aims to improve the interpretability, testability, and verifiability of LE-CPS. discuss two of our FSE'22 papers that provide a comprehensive study of current testing practices and testreduction strategies in autonomous vehicles. I will then highlight a recent FSE'24 paper that revives model-based testing in LE-CPS using large language models, followed by related work in TSE'24 and ICSE'25 on generating driving scenarios with large language models and creating an online testing environment to enhance drone autolanding systems. Finally, I will cover our recent paper on the neuro-symbolic paradigm, which aims to improve the interpretability, testability, and verifiability of LE-CPS.

About the Speaker

Dr Xi ZHENG earned his PhD in Software Engineering from the University of Texas at Austin in 2015. He is currently a Senior Lecturer and Director of the Intelligent Systems Research Group at Macquarie University, Australia. His research focuses on Cyber-Physical Systems, Safety Analysis, Distributed Learning, and the Internet of Things. Dr Zheng has secured over $2.4 million in competitive funding from the Australian Research Council and Data61 projects, emphasizing safety analysis, model testing and verification, and the development of trustworthy AI for autonomous vehicles.

He has received several awards, including the Deakin Industry Researcher Award in 2016 and the MQ Early Career Researcher Award in 2020. Dr Zheng has published numerous highly cited papers and served on Program Committees for leading conferences like FSE and PerCom. He has also been a visiting professor at UCLA and UT Austin in 2023 and co-founded the international workshop on trustworthy autonomous cyber-physical systems. Additionally, he serves as an associate editor for ACM Distributed Ledger Technologies and an editor for the Springer Journal of Reliable Intelligent Environments.