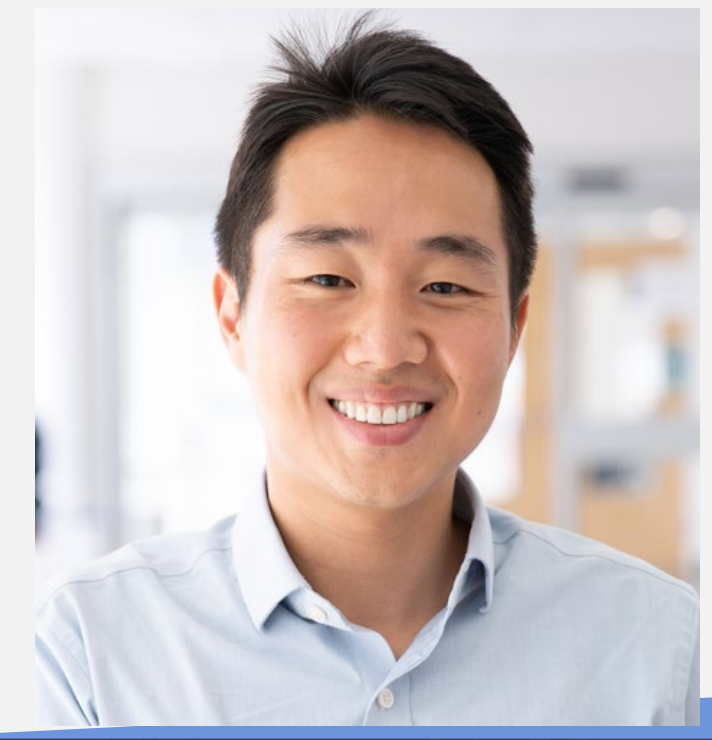
PennState College of Engineering

Systems, Controls, and Robotics Seminar Series

Safe Composition through Dynamic Feature Interaction Resolution in Cyber-Physical Systems



Dr. Eunsuk Kang

Assistant Professor

Software and Societal Systems Department

School of Computer Science

Carnegie Mellon University

Seminar: Thursday, Oct. 12, 2:00 PM, 125 Reber

ABSTRACT

The feature interaction problem occurs when two or more independently developed components interact with each other in unexpected ways, causing undesirable effect on the system performance and safety. For example, unexpected interactions between a pair of braking features was found to be one of the contributing factors to the incidents involving unintended acceleration on Toyota vehicles. Feature interactions are major obstacles to building large, complex systems out of heterogenous components, and pose new challenges in emerging cyber-physical systems (CPS), such as intelligent vehicles, unmanned aerial vehicles (UAVs), and the Internet-of-Things (IoT).

In this talk, I will describe our on-going work on techniques for safely managing and resolving undesirable interactions between CPS components. I will first introduce the state-of-the-art methods for managing feature interactions and argue that the existing approaches are not sufficient to deal with the highly dynamic, evolving nature of modern CPS domains. I will then describe a new type of feature composition framework that leverages techniques from runtime verification and synthesis to dynamically detect and resolve undesirable interactions between features. I will describe how our approach is capable of resolving interactions even when (1) the system evolves over time with newly added or modified features, and (2) none of the conflicting features may be satisfactory with respect to the overall system safety. I will demonstrate our approach using case studies on safety features in autonomous systems. I will also present some of the remaining challenges and future directions towards enabling safe, seamless composition of heterogenous systems in CPS.

BIOGRAPHY

Eunsuk Kang is an Assistant Professor in the Software and Societal Systems Department, School of Computer Science at Carnegie Mellon University. His research interests include software engineering and formal methods, with applications to system safety and security. He is interested in developing modeling techniques, design methodologies, and automated verification to construct safe and secure software and cyber-physical systems (CPS). He has applied his work to a diverse range of systems, including intelligent vehicles, unmanned aerial vehicles (UAVs), medical devices, water treatment plants, and mobile applications. He's a winner of the NSF CAREER Award and 3 ACM SIGSOFT Distinguished Paper Awards.