Stanley Bak Becomes the CS Department's Third 2023 CAREER Awardee

Earlier this year, the department announced National Science Foundation (NSF) CAREER awards for computer science professors Shubham Jain [LINK: https://www.cs.stonybrook.edu/about-us/News/Shubham-Jain-Earns-NSF-CAREER-Award-Wearable-Device-Research] and Shuai Mu [LINK: https://www.cs.stonybrook.edu/about-us/News/2023-CAREER-Awardee-Shuai-Mu-Rethinking-Replication] . Recently, NSF also awarded Professor Stanley Bak [LINK: http://stanleybak.com/] a CAREER award, which is the third award this year for the department. Overall, the department is pleased to have 20+ NSF CAREER awardees as part of the faculty.



Recent CAREER awardee, Stanley Bak

The Faculty Early Career Development (CAREER) award is the National Science Foundation's most prestigious award [LINK: https://new.nsf.gov/funding/opportunities/faculty-early-career-development-program-career] in support of early-career faculty. The award recognizes faculty who hold the potential of becoming influential academic figures in both research and education. Bak's award provides $550K in funding over five years for the project titled *Verified AI in Cyber-Physical Systems Through Input Quantization* [LINK: https://www.nsf.gov/awardsearch/showAward?AWD_ID=2237229&HistoricalAwards=false] .

Throughout this project, Bak will work to develop formal verification methods for cyber-physical systems (CPS) that include artificial intelligence (AI) components. Although recent advances in AI have impacted in many fields, there have been fewer applications of AI techniques in CPS, where computer systems directly interface with the physical world. These systems are often safety-critical since incorrect decisions can manifest in the real world. Most AI components like large neural networks, however, are opaque and difficult to reason about. Errors or unexpected behaviors cannot be tolerated, and so the research will develop fundamental methods in order to enable formal and trustworthy deployment of components like large neural networks within the critical behavior and decision-making parts of a safety-critical CPS. The key strategy to be explored in this work will be to replace complex AI components by approximations based on a process called input quantization. The approximations behave similar to the original AI components, but can be formally reasoned about using mathematical techniques and have strong guarantees on their behaviors.

This project strives to instill a justified trust in AI systems. Educational aspects entail tutorials during CPS Week and integration with Bak's coursework. As computer science students are rarely exposed to control theory, Bak hopes to add such aspects to the undergraduate AI class. Through mentorship of high school Simons Summer Research Program students, Bak hopes to expand research in trustworthy AI-based CPS.

Congratulations to our latest CAREER awardee, Stanley Bak!

-Kimberly Xiao