Practical Reliability of Systems

Abstract:

Recent years have seen the emergence of new kinds of software including deep learning,  
programmable computer networks, and blockchains. Unfortunately, these systems have  
been shown to suffer from critical safety and security errors, affecting their wider adoption.  
The goal of my research is to develop new automated program verification and synthesis  
techniques which ensure safety and reliability of these systems.

In this talk, I will start by introducing AI2, the first automated verifier for neural networks  
able to certify large convolutional models. The key idea behind AI2 is to bridge abstract  
interpretation and neural networks, enabling a sound over-approximation of a network’s  
behavior in a scalable manner. I will then briefly discuss DL2, a system which enables clean  
interaction with deep learning models by allowing users to pose queries in a declarative  
manner. Finally, I will demonstrate how automated program analysis and synthesis can  
address key security and reliability challenges in domains such as computer networks and  
blockchains, preventing severe outages and financial losses.

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