Professional Goals and Objectives

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My long-term career goal is develop revolutionary breakthroughs for how we build high-performance, trustworthy systems that reason about knowledge at an unprecedented scale of both complexity and magnitude. I began my career by developing formal methods for security, and became frustrated at the enormous gulf between formal methods theory and practical static analysis systems for large-scale systems. Observing that all industrial-scale program analysis systems were implemented in Datalog, I shifted my focus to the high-performance implementation of Datalog, along with making foundational advancements to Datalog's semantics to enhance its expressivity and suitable for expressing complex structured logical reasoning. In sum, my team currently holds the world record (to our knowledge, backed up by publications at top venues) for the fastest Datalog solvers on servers, clusters, datacenter GPUs, and GPU clusters; in some cases our work outperforms the long-established state of the art by **up to 200×**! This is a significant breakthrough, given the nature of Datalog as a central component in workloads for graph analytics, program analysis, and business analytics.

Going forward, my goal is to leverage my group's state-of-the-art technology to solve the hardest and most important reasoning problems in program analysis, knowledge reasoning, security, medical analytics, neurosymbolic AI, and related areas. I have been collaborating for several years with a government lab where we are working on binary analysis, the challenge of analyzing properties of binary code without source. This area is ripe with potential for my approach, and I am beginning to publish and write grants in this direction. Additionally, I am exploring the foundations connecting programming languages and databases: I have begun to publish more frequently in databases, and have developed strong collaborations with that area as well. Long-term, I plan to leverage my (now quite broad) formal perspective to develop fundamentally new logic programming languages which allow us to express complex analytic reasoning queries while also leveraging the kinds of high-performance implementation approaches developed by my group.

Mentorship is a core aspect of my career, having successfully graduated my first PhD student (Arash Sahebolamri) in 2023; indeed, Arash's influence is felt to this day, with his Ascent crate (which won best paper at OOPSLA '23) being used both in industry and academia. Additionally, during 2020 I filmed my undergraudate course CIS352 and released it on YouTube—these lectures have become hugely popular, with nearly 100k views. Going forward, I strive to continue to mentor PhD and undergraduate students of the highest caliber. However, I also strive to mentor other researchers, both in our department and also in the research area and United States broadly. To this end, I have been active in chairing workshops and participating on the PCs of top conferences. My medium-term goal is to be PC chair of a top conference, with a longer-term consideration being potential governmental service (e.g., NSF) or being chief editor of a prominent journal.