Transforming Computation and Communication Patterns for High-Performance

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1:30 pm – 2:30 pm
Showcase Room

Abstract:

The emergence of stupendously large matrices in applications such as data mining and large-scale scientific simulations has rendered the classical software frameworks and numerical methods inadequate in many situations. In this talk, I will demonstrate how building domain-specific compilers and reformulating classical mathematical methods significantly improve the performance and scalability of large-scale applications on modern computing platforms.

In the first part of the talk, I will introduce Sympiler, a domain-specific code generator that transforms computation patterns in sparse matrix methods for high-performance. Specifically, I will demonstrate how decoupling symbolic analysis from numerical manipulation will enable automatic optimization of sparse codes with static sparsity patterns. The performance of Sympiler-generated code will be compared to optimized library codes to demonstrate the effectiveness of symbolic decoupling.

In the second part of the talk, I will show that through mathematical reformulation, communication patterns in classical optimization methods can be transformed to reduce communication costs. As a result, the performance of optimization algorithms is inherently improved when executed on distributed platforms leading to significant speedups compared to the classical formulations.

Short Bio:

Maryam Mehri Dehnavi is an Assistant Professor in the Electrical and Computer Engineering Department at Rutgers University. Her research focuses on high-performance computing and domain-specific compiler design. Previously, she was a postdoctoral researcher at MIT and a visiting scholar at UC Berkeley. She received her Ph.D. in Electrical and Computer Engineering from McGill University in 2013. Maryam is the recipient of the NSF CRII, NSERC CGS, NSERC PDF, and the FQRNT awards. Her research has received the grand final prize of the 2017 ACM Student Research Competitions.