Rethinking Compilers in the Rise of Machine Learning and AI (Keynote)

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Abstract
Recent years have witnessed some influential progresses in Machine Learning (ML) and Artificial Intelligence (AI). The progresses may lead to some significant changes to future programming. Many programs, for instance, may be not code written in some specially designed programming languages, but high-level user intentions expressed in natural languages. Deep Learning-based software, despite the difficulties in interpreting their results, may continue its rapid growth in the software market and its influence in people’s everyday life. This talk will first examine the implications of these changes to compiler research, and then discuss the potential opportunities that ML and AI could bring to possibly transform the field of compiler research.

Specifically, the talk will focus on the possibilities for ML and AI to help reveal the high-level semantics and attributes of software components that traditional compiler technology cannot do, and hence, open important opportunities for high-level large-scoped code reasoning and optimizations—a direction that has some tremendous potential but has been beyond the reach of traditional compiler technology. The talk will discuss how ML and AI may help break the "abstraction wall"—barriers formed by layers of abstractions in modern software—for program analysis and optimizations, and how ML and AI may transform the way in which high-level user intentions get translated into low-level code implementations. The talk will conclude with a list of grand challenges and possible research directions for future compiler constructions.

CCS Concepts • Software and its engineering → Compilers;

Keywords Compilers; Machine Learning; AI; NLP; High-Level Program Optimizations

ACM Reference Format:

Biography
Xipeng Shen is an Associate Professor in the Computer Science Department at North Carolina State University in USA. He has received a number of recognitions, including Early Career Research Award from the US Department of Energy, CAREER Award from US NSF, Google Faculty Research Award, IBM Center for Advanced Studies Faculty Fellow Award, ACM Distinguished Speaker, and so on. His primary research work lies in the field of compiler and programming systems, but features an emphasis on inter-disciplinary problems and approaches. His research has produced influential results in multcore memory performance enhancements, GPU program compilations, high-level code optimizations, and other topics in programming systems. A number of the results have been incorporated into commercial compilers (e.g., IBM XL compilers) and other products. Meanwhile, his research has led to a number of progresses in machine learning and artificial intelligence, exemplified with a set of new machine learning algorithms (e.g., Yinyang K-Means, Multi-label Scene Classification) published at major ML or AI venues (e.g., ICML, ICDE, ICDM, Pattern Recognition) and adopted by Microsoft and other industry companies. He has served on numerous Technical Program Committees of major conferences as well as the technical advisory boards of some industry companies. Prior to joining NC State in 2014 as a Chancellor’s Faculty Excellence Program cluster hire in Data-Driven Science, Shen was the Adina Allen Term Distinguished Associate Professor in the Computer Science Department at The College of William and Mary. He spent his sabbatical at MIT, Microsoft Research, and Intel Labs between 2012 and 2013. He was an assistant professor at The College of William and Mary from 2006 to 2012. He received his Ph.D. in Computer Science from University of Rochester in 2006.