Title:
An Analytical Model-based Auto-tuning Framework for Locality-aware Loop Scheduling

Abstract:
HPC developers aim to deliver the very best performance. To do so they constantly think about memory bandwidth, memory hierarchy, locality, floating point performance, power/energy constraints and so on. On the other hand application scientists aim to write performance portable code while exploiting the rich feature set of the hardware. By providing adequate hints to the compilers in the form of directives appropriate executable code is generated. There are tremendous benefits from using directive-based programming however applications are also becoming more and more complex and we need sophisticated tools such as auto-tuning to better explore the optimization space. In applications, loops typically form a major and time-consuming portion of the code. Scheduling these loops involves mapping from the loop iteration space to the underlying platform - for example GPU threads. The user tries different scheduling techniques until the best one is identified. However this process can be quite tedious and time consuming especially when it is a relatively large application as the user needs to record performance of every schedule's run. This paper aims to offer a better solution by proposing an auto-tuning framework that adopts an analytical model guiding the compiler and the runtime to choose an appropriate schedule for the loops, automatically and determining the launch configuration for each of the loop schedules. Our experiments show that the predicted loop schedule by our framework achieves reasonable speedup against the default loop schedule chosen by the compiler.

Bio:
Rengan Xu is a PhD candidate in the department of Computer Science at University of Houston. His research mainly focuses on programming models for multi-core systems and accelerators (OpenMP and OpenACC), compiler and runtime support for programming models and application optimizations with High Performance Computing. He received his Bachelor degree in Hefei University of Technology in 2009.