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Santosh Pande · Vivek Sarkar (Eds.)

Languages and Compilers for Parallel Computing

32nd International Workshop, LCPC 2019
Atlanta, GA, USA, October 22–24, 2019
Revised Selected Papers

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Preface

The **32nd Workshop on Languages and Compilers for Parallel Computing (LCPC)** was held during **October 22–24, 2019 at Georgia Institute of Technology, Atlanta**. LCPC is the longest-running workshop in the intersection of programming systems and parallel computing. Since its inception, LCPC has been a leading venue for disseminating cutting-edge research on all aspects of parallel programming systems – including programming models, languages, compilers, runtime systems, and tools – for a diverse range of application domains and computing platforms. The scope of LCPC 2019 spanned a wide variety of topics related to parallel computing, including current domains and platforms, such as scientific computing, batch/streaming/real-time data analytics, machine learning, cognitive computing, heterogeneous/reconfigurable computing, mobile computing, cloud computing, IoT; as well as forward-looking domains such as analog and quantum computing. Bold new ideas in programming systems are critical for the success of computing platforms in the Moore's Law end-game and post-Moore eras. LCPC 2019 offered a highly interactive forum for the dissemination of innovative research contributions as well as in-depth discussions of novel and emerging ideas. As in past years, LCPC 2019 brought together researchers from academia, national labs, and industry with the aim of creating and strengthening research collaborations. LCPC 2019 also hosted a co-located event on October 21, 2019 – a special workshop on MLIR for HPC organized by Prof. Mary Hall.

We were fortunate to have a diverse set of expert program committee (PC) members, spanning junior and senior researchers, women and under-represented groups, and researchers from different cross sections of the community, including academia, industry, and national labs. The details of the PC can be found at https://lcpc19.cc.gatech.edu/committee. Two types of papers were invited for submission:

- **Full papers** on innovative and original research that describe new research contributions. 15 pages limit.
- **Short papers** on preliminary results, surveys, demonstrations, or vision for future research. 8 pages limit.

The review process was guided by novelty; reviewers were given explicit instructions to look for novel, intriguing ideas in the submissions. The inclusion of papers that propose new ideas – a new problem, a new research topic, radical insight into an existing topic, surprising results, etc. – was one of the key goals in devising the workshop program. Another important consideration was whether the paper could provoke interesting discussions during the workshop. The PC ensured that each paper received at least 4 reviews. Each paper was discussed in an online PC meeting, and the final selection of the papers was based on the degree of novelty and quality. Regardless of acceptance or rejection, authors were provided with detailed feedback. Out of 17 submissions, 8 were accepted as regular papers and 3 were accepted as short papers. As in past LCPC workshops, a two-tier revision process was followed for the accepted

papers: first, the authors were asked to incorporate the reviewers' feedback and prepare a pre-proceedings version of the paper, which was made available at the workshop. Next, the authors were asked to incorporate the feedback received during the workshop and prepare a final camera-ready version, which is included in these proceedings.

Apart from the accepted papers, the workshop program included two exciting keynote talks, one on resource-efficient quantum computing by Prof. Fred Chong, University of Chicago, and another on the role of compilers in supporting modern cryptography-based computations by Dr. Madan Musuvathi from Microsoft Research. The program also included eight invited talks and a panel that covered a variety of frontiers and emerging topics in the field. The full program of the workshop can be found at https://lcpc19.cc.gatech.edu/program. The eight invited talks were:

1. 'HPVM: Performance, Portability, Programmability and Approximation for Heterogeneous Parallel Systems' by Vikram Adve, UIUC
2. 'Optimization in the Sparse Tensor Algebra Compiler' by Fredrik Kjolstad, MIT
3. 'Optimizing Data Movement and Achieving Performance Portability with Brick Data Layouts' by Mary Hall, University of Utah
4. 'DPC++: A Direct Programming Model for Diverse Architectures' by Xinmin Tian, Intel
5. 'Model-driven multi-level tiling for tensor contractions' by P. (Saday) Sadayappan, University of Utah
6. 'A framework for compositional transformations of recursions and loops' by Milind Kulkarni, Purdue University
7. 'A Lightweight Polyhedral Abstraction for MLIR' by Albert Cohen, Google
8. 'Filling in the gaps between applications and OpenMP for in-node programming on exascale systems' by Oscar Hernandez, Oak Ridge National Laboratory

The social part of the workshop included an excursion to Georgia Aquarium, the largest aquarium in the United States and in the Western Hemisphere. It is home to whale sharks, beluga whales, California sea lions, bottlenose dolphins, and manta rays that reside in 10 million gallons of fresh and saltwater (workshop photos are available at: https://lcpc19.cc.gatech.edu/photos).

A total of 48 students, faculty, and researchers participated in LCPC 2019. They contributed to interesting discussions in a close-knit setting during the workshop sessions, breaks, lunches, excursion, and dinner, while enjoying beautiful fall weather in Atlanta.

The LCPC 2019 organizers would like to thank our sponsors, Futurewei and Intel, for their generous support. We are grateful to the keynote and invited speakers, the authors, and all the participants for making LCPC 2019 a great success. We would especially like to thank Sri Raj Paul (Publicity and Web Chair) and Francella Tonge (Administrative Support), without whose hard work the workshop would not have been possible. We would also like to thank all the student volunteers. We thank Georgia Tech and GT Hotel for the use of their conference facilities and Springer-Verlag for providing publication support for the workshop proceedings through their LNCS series. Finally, we would like to thank the LCPC steering committee for providing us the

opportunity to organize LCPC 2019, and for their guidance and support throughout the entire process.

Sincerely,

Santosh Pande
Vivek Sarkar

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