



IN-PLACE DATA SLIDING ALGORITHMS FOR MANY-CORE ARCHITECTURES

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2015年9月7日 星期一 10:00am

理科五号楼410会议室



ABSTRACT: In-place data manipulation is very desirable in many-core architectures with limited on-board memory. This talk deals with the in-place implementation of a class of primitives that perform data movements in one direction. We call these primitives Data Sliding (DS) algorithms. Notable among them are relational algebra primitives (such as select and unique), padding to insert empty elements in a data structure, and stream compaction to reduce memory requirements. Their in-place implementation in a bulk synchronous parallel model, such as GPUs, is specially challenging due to the difficulties in synchronizing threads executing on different compute units. Using a novel adjacent work-group synchronization technique, we propose two algorithmic schemes for regular and irregular DS algorithms. With a set of 5 benchmarks, we validate our approaches and compare them to the state-of-the-art implementations of these benchmarks. Our regular DS algorithms demonstrate up to $9.11\times$ and $73.25\times$ on NVIDIA and AMD GPUs, respectively, the throughput of their competitors. Our irregular DS algorithms outperform NVIDIA Thrust library by up to $3.24\times$ on the three most recent generations of NVIDIA GPUs.

BIOGRAPHY: Juan Gómez-Luna received the BS and MS degrees in Telecommunication Engineering from the University of Sevilla, Spain, in 2001, and the PhD degree in Computer Science from the University of Córdoba, Spain, in 2012. Since 2005, he has been a lecturer at the University of Córdoba. His research interests focus on the parallelization and optimization of applications, such as image and video processing, on GPUs and heterogeneous systems. He has published research papers in top conferences (PPoPP, Euro-Par, ICPP...) and international journals (IJHPCA, IEEE TPDS, IEEE TC...). He has an active collaboration with research groups from the University of Illinois at Urbana-Champaign (USA), the Technical University of Eindhoven (The Netherlands), the Technical University of Munich (Germany), and the University of Málaga (Spain). He leads the University of Córdoba GPU Education Center supported by NVIDIA.