Introduction to Workshop

Today’s modern applications are producing too large volumes of data to be stored, processed, or transferred efficiently. Data reduction is becoming an indispensable technique in many domains because it can offer a great capability to reduce the data size by one or even two orders of magnitude, significantly saving the memory/storage space, mitigating the I/O burden, reducing communication time, and improving the energy/power efficiency in various parallel and distributed environments, such as high-performance computing (HPC), cloud computing, edge computing, and Internet-of-Things (IoT). An HPC system, for instance, is expected to have a computational capability of $10^{18}$ floating-point operations per second, and large-scale HPC scientific applications may generate vast volumes of data (several orders of magnitude larger than the available storage space) for post-analysis. Moreover, runtime memory footprint and communication could be non-negligible bottlenecks of current HPC systems.

Tackling the big data reduction research requires expertise from computer science, mathematics, and application domains to study the problem holistically, and develop solutions and harden software tools that can be used by production applications. Specifically, the big-data computing community needs to understand a clear yet complex relationship between application design, data analysis and reduction methods, programming models, system software, hardware, and other elements of a next-generation large-scale computing infrastructure, especially given constraints on applicability, fidelity, performance portability, and energy efficiency. New data reduction techniques also need to be explored and developed continuously to suit emerging applications and diverse use cases.

There are at least three significant research topics that the community is striving to answer: (1) whether several orders of magnitude of data reduction is possible for extreme-scale sciences; (2) understanding the trade-off between the performance and accuracy of data reduction; and (3) solutions to effectively reduce data size while preserving the information inside the big datasets.

The goal of this workshop is to provide a focused venue for researchers in all aspects of data reduction in all related communities to present their research results, exchange ideas, identify new research directions, and foster new collaborations within the community.

Research Topics Covered in Workshop

The research topics covered by this workshop include but are not limited to:

- Data reduction techniques for big data issues in high-performance computing (HPC), cloud computing, Internet-of-Things (IoT), edge computing, machine learning and deep learning, and other big data areas:
  - Lossy and lossless compression methods
  - Approximate computation methods
  - Compressive/compressed sensing methods
  - Tensor decomposition methods
  - Data deduplication methods
  - Domain/motif-specific methods, such as structured and unstructured meshes, particles, tensors
  - Accuracy-guarantee data reduction methods
  - Optimal design of data reduction methods

- Metrics and infrastructures to evaluate reduction methods and assess quality/fidelity of reduced data
- Benchmark applications and datasets for big data reduction
- Data analysis and visualization techniques leveraging reduced data
- Characterizing the impact of data reduction techniques on applications
- Hardware-software co-design of data reduction
- Trade-offs between accuracy and performance on emerging computing hardware and platforms
- Software, tools, and programming models for managing reduced data
- Runtime systems and supports for data reduction
- Data reduction challenges and solutions in observational and experimental environments
Important Dates

- Oct. 9, 2020: Due date for full workshop papers submission
- Nov. 6, 2020: Notification of paper acceptance to authors
- Nov. 16, 2020: Camera-ready of accepted papers
- Dec. 10–13, 2020: Workshops

Program Chairs

- Co-chair: Dingwen Tao, Washington State University (WSU), USA
- Co-chair: Sheng Di, Argonne National Laboratory (ANL), USA

Program Committee Members

- Peter Lindstrom, Lawrence Livermore National Laboratory (LLNL), USA
- Allison Baker, National Center for Atmospheric Research (NCAR), USA
- Franck Cappello, Argonne National Laboratory (ANL), USA
- Martin Burtscher, Texas State University (TSU), USA
- Guoqi Han, Argonne National Laboratory (ANL), USA
- Jon Calhoun, Clemson University, USA
- Jieyang Chen, Oak Ridge National Laboratory (ORNL), USA
- Shaomeng Li, National Center for Atmospheric Research (NCAR), USA
- Xin Liang, Oak Ridge National Laboratory (ORNL), USA
- Wen Xia, Harbin Institute of Technology, Shenzhen, China

Organization Expertise

The organization members are well qualified to organize the proposed big data reduction workshop.

Dr. Dingwen Tao is an assistant professor at WSU. He is the core developer of an error-bounded lossy compressor SZ [1] and a lossy compression assessment tool Z-checker [2]. He has published more than 30 peer-reviewed high-quality papers in prestigious HPC and Big Data conferences and journals, such as ICS, HPDC, PPoPP, SC, BigData, CLUSTER, IPDPS, MSST, TPDS, IJHPCA, including two best paper awards.

Dr. Sheng Di is a computer scientist at ANL. He is the initial co-founder and one of the key developers of the state-of-the-art lossy compressor - SZ [3], and also a key developer of the lossy compression assessment library - Z-checker [2]. During the recent three years, Dr. Di published over 30 publications in prestigious conferences/journals such as BigData, SC, HPDC, PPoPP, IPDPS, MSST, Cluster (two best papers) and TPDS.

Dr. Peter Lindstrom is a senior computer scientist at LLNL. He is the core developer of two state-of-the-art lossy compressors - ZFP [4] and FPZIP [5]. He is also an expert on scientific visualization.

Dr. Allison Baker is a scientist at NCAR. She is an expert on the compression quality assessment of HPC climate simulations, with 20+ high-quality papers published, one of which received the best presentation award in ACM HPDC 2014 [6].

Dr. Martin Burtscher is a full professor at TSU. He is an expert on lossless compression for floating-point datasets. He is the key developer of the well-known floating-point lossless compression library - FPC [7].

Dr. Hanqi Guo is an assistant computer scientist at ANL. He is an expert on visualization and feature preservation related to data reduction techniques. He has published about 40 high-quality papers.

Dr. Jon Calhoun is an assistant professor at Clemson University. He has received an NSF CAREER award in 2020 for dynamic management of compressed arrays for HPC applications.

Dr. Jieyang Chen is a postdoctoral researcher ORNL. He is the core developer of a multilevel technique for compression of floating-point data - MGARD [8].

Dr. Shaomeng Li is a project scientist at NCAR. He is an expert on wavelet lossy compression. He is the key developer of the NCAR visualization and analysis software VAPOR [9] for oceanic and atmospheric research.
Dr. Xin Liang is an assistant computer scientist at ORNL. He is the core developer of the latest version (2.0) of SZ. He is also the key contributor for several key functions in SZ, including random access support, OpenMP version, performance optimization, and so on.

Dr. Wen Xia is an associate professor at Harbin Institute of Technology. He is an expert on performance optimization of point-wise relative error bounded lossy compression based on SZ compression model [11].

Organization Plan

- We will build an official website to maintain all the information related to the workshop, such as submission guideline, important dates, registration guideline and the program.
- We will post the call-for-paper messages in different CFP websites such as wikiCFP and HPC community, to receive as many paper submissions as possible.
- We will create a paper submission system on easychair to manage the paper submission, paper bidding, paper assignment, paper review, and notifications.

Invited Keynote Speakers

Dr. Franck Cappello (Fellow, IEEE) is currently a program manager and a senior computer scientist with Argonne National Laboratory. From 2009, he held a joint position at INRIA and the University of Illinois at Urbana-Champaign, where he initiated and codirected the INRIA-Illinois Joint Laboratory on Petascale Computing. Until 2008, he led a team at INRIA, where he initiated the XtremWeb (Desktop Grid) and MPICH-V (fault-tolerant MPI) projects. From 2003 to 2008, he initiated and directed the Grid5000 project, a nationwide computer science platform for research in large-scale distributed systems. Dr. Cappello is currently leading two Exascale Computing Project software projects related to resilience and lossy compression of scientific data that will help Exascale applications to run efficiently on Exascale systems. He has authored more than 200 papers in the domains of fault tolerance, high-performance computing, desktop Grids, and Grids and contributed to more than 70 program committees. He is an editorial board member of the International Journal on Grid Computing, Journal of Grid and Utility Computing, and Journal of Cluster Computing. He is the recipient of the 2018 IEEE TCPP Outstanding Service Award.

References