

# Qinglei Cao

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## 📖 RESEARCH INTERESTS

High performance computing (HPC) and Artificial Intelligence (AI), including Task-based runtime systems, Linear algebra algorithms, and Large-scale machine learning & deep learning

## 🎓 EDUCATION

**The University of Tennessee, Knoxville (UTK)**, Computer Science Aug. 2016 - July 2022  
PhD, High Performance Computing

Advisor: Dr. Jack Dongarra (**Turing Award, 2021**), Dr. George Bosilca

**Ocean University of China (OUC)**, Computer Application Technology Sept. 2013 - June 2016  
MS, Image Processing & Parallel Computing

Advisors: Dr. Yuntao Qian (Zhejiang University), Dr. Zhiqiang Wei (OUC)

**Hunan University (HNU)**, Information and Computational Science Sept. 2005 - June 2009  
BS, Mathematics

## 👛 PROFESSIONAL EXPERIENCE

**Department of Computer Science, Saint Louis University (SLU)** St. Louis, MO  
Assistant Professor Aug. 2023 - Present

**Innovative Computer Laboratory (ICL), UTK** Knoxville, TN  
Post-Doctoral Research Associate, Distributed Computing Group Mar. 2023 - July 2023

**Cerebras Systems, Inc.** Sunnyvale, CA  
Member of Technical Staff for HPC and Machine Learning Aug. 2022 - Feb. 2023

**Innovative Computer Laboratory (ICL), UTK** Knoxville, TN  
Graduate Research Assistant, Distributed Computing Group Aug. 2017 - July 2022

**Cerebras Systems, Inc.** Sunnyvale, CA  
HPC and Machine Learning Research Intern May 2021 - Aug. 2021

**Cadence Design Systems, Inc.** Austin, TX  
HPC Research Intern May 2020 - July 2020

**National University of Defense Technology (NUDT)** Changsha, China  
HPC Software Developer & Research Scientist May 2010 - July 2013

## 🏆 HONORS & AWARDS

◇ 3,000,000 Node Hours on Shaheen II Supercomputer (rank #104), KAUST, Saudi Arabia 2019 - 2023

◇ **ACM Gordon Bell Prize Finalist** 2022

◇ 4,000,000 Node Hours on Fugaku Supercomputer (rank #2), RIKEN, Japan 2022

◇ SIAM Student Travel Award 2021

◇ 40,000 Node Hours on Summit Supercomputer (rank #5), Oak Ridge National Laboratory, US 2021

◇ **Best Paper Award, CLUSTER** 2020

◇ Graduate Student Senate (GSS) Travel Awards, UTK 2020

◇ Honor of Outstanding Graduates, OUC 2014

◇ Graduate Student Scholarship, OUC 2014

◇ Honor of Annual Advanced Worker, NUDT 2010, 2011

◇ Honor of Bronze Medal of TH-1A, NUDT	2010
◇ Outstanding Scholarship, HNU	2006, 2007
◇ Honor of Excellent Student Cadre, HNU	2006

## PUBLICATIONS

- 1 **Qinglei Cao**, Sameh Abdulah, Hatem Ltaief, Marc G Genton, David E Keyes, and George Bosilca. Reducing Data Motion and Energy Consumption of Geospatial Modeling Applications Using Automated Precision Conversion. IEEE International Conference on Cluster Computing (**CLUSTER**), 2023
- 2 **Qinglei Cao**, Sameh Abdulah, Rabab Alomairy, Yu Pei, Pratik Nag, George Bosilca, Jack Dongarra, Marc G Genton, David E Keyes, Hatem Ltaief, and Ying Sun. Reshaping geostatistical modeling and prediction for extreme-scale environmental applications. International Conference for High Performance Computing, Networking, Storage and Analysis (**SC, ACM Gordon Bell Prize Finalist**), 2022
- 3 **Qinglei Cao**, Rabab Alomairy, Yu Pei, George Bosilca, Hatem Ltaief, David Keyes, and Jack Dongarra. A framework to exploit data sparsity in tile low-rank Cholesky factorization. IEEE International Parallel & Distributed Processing Symposium (**IPDPS**), 2022
- 4 **Qinglei Cao**, George Bosilca, Nuria Losada, Wei Wu, Dong Zhong, and Jack Dongarra. Evaluating data redistribution in parsec. IEEE Transactions on Parallel and Distributed Systems (**TPDS**), 2022
- 5 Sameh Abdulah, **Qinglei Cao (main contributor)**, Yu Pei, George Bosilca, Jack Dongarra, Marc G. Genton, David E. Keyes, Hatem Ltaief, and Ying Sun. Accelerating geostatistical modeling and prediction with mixed-precision computations: A high-productivity approach with parsec. IEEE Transactions on Parallel and Distributed Systems (**TPDS**), 2022
- 6 **Qinglei Cao**, Yu Pei, Kadir Akbudak, George Bosilca, Hatem Ltaief, David Keyes, and Jack Dongarra. Leveraging parsec runtime support to tackle challenging 3d data-sparse matrix problems. IEEE International Parallel and Distributed Processing Symposium (**IPDPS**), 2021
- 7 **Qinglei Cao**, George Bosilca, Wei Wu, Dong Zhong, Aurelien Bouteiller, and Jack Dongarra. Flexible data redistribution in a task-based runtime system. IEEE International Conference on Cluster Computing (**CLUSTER**), 2020
- 8 **Qinglei Cao**, Yu Pei, Kadir Akbudak, Aleksandr Mikhalev, George Bosilca, Hatem Ltaief, David Keyes, and Jack Dongarra. Extreme-Scale Tile Low-Rank Cholesky Factorization Using the PaRSEC Task-Based Runtime. ACM Platform for Advanced Scientific Computing Conference (**PASC**), 2020
- 9 **Qinglei Cao**, Yu Pei, Kadir Akbudak, Aleksandr Mikhalev, George Bosilca, Hatem Ltaief, David Keyes, and Jack Dongarra. Extreme-scale task-based Cholesky factorization toward climate and weather prediction applications. ACM Platform for Advanced Scientific Computing Conference (PASC Poster), 2020
- 10 **Qinglei Cao**, Yu Pei, Thomas Herault, Kadir Akbudak, Aleksandr Mikhalev, George Bosilca, Hatem Ltaief, David Keyes, and Jack Dongarra. Performance analysis of tile low-rank Cholesky factorization using parsec instrumentation tools. IEEE/ACM International Workshop on Programming and Performance Visualization Tools (ProTools at SC), 2019
- 11 Dong Zhong, **Qinglei Cao**, George Bosilca, and Jack Dongarra. Using long vector extensions for MPI reductions. Parallel Computing (**PARCO**), 2021
- 12 Yunhe Feng, Dong Zhong, Peng Sun, Weijian Zheng, **Qinglei Cao**, Xi Luo, and Zheng Lu. Micromobility in smart cities: A closer look at shared dockless e-scooters via big social data. IEEE International Conference on Communications (ICC), 2021
- 13 Elliott Slaughter, Wei Wu, Yuankun Fu, Legend Brandenburg, Nicolai Garcia, Wilhem Kautz, Emily Marx, Kaleb S. Morris, **Qinglei Cao**, George Bosilca, Seema Mirchandaney, Wonchan Lee, Sean Treichler, Patrick McCormick, and Alex Aiken. Task bench: a parameterized benchmark for evaluating parallel runtime performance. IEEE/ACM International Conference for High Performance Computing, Networking, Storage and Analysis (**SC**), 2020

- 14 Xi Luo, Wei Wu, George Bosilca, Yu Pei, **Qinglei Cao**, Thananon Patinyasakdikul, Dong Zhong, and Jack Dongarra. Han: a hierarchical autotuned collective communication framework. IEEE International Conference on Cluster Computing (**CLUSTER, Best paper**), 2020
- 15 Dong Zhong, **Qinglei Cao**, George Bosilca, and Jack Dongarra. Using advanced vector extensions AVX-512 for MPI reductions. ACM European MPI Users' Group Meeting (EuroMPI), 2020
- 16 Dong Zhong, Pavel Shams, **Qinglei Cao**, George Bosilca, Shinji Sumimoto, Kenichi Miura, and Jack Dongarra. Using ARM scalable vector extension to optimize OpenMPI. IEEE/ACM International Symposium on Cluster, Cloud and Internet Computing (CCGRID), 2020
- 17 Yu Pei, **Qinglei Cao**, George Bosilca, Piotr Luszczek, Victor Eijkhout, and Jack Dongarra. Communication avoiding 2d stencil implementations over PaRSEC task-based runtime. IEEE International Parallel and Distributed Processing Symposium Workshops (IPDPSW), 2020
- 18 Yan Yan, Jie Nie, Lei Huang, Zhen Li, **Qinglei Cao**, and Zhiqiang Wei. Exploring relationship between face and trustworthy impression using mid-level facial features. International Conference on Multimedia Modeling (MMM), 2016
- 19 Yan Yan, Jie Nie, Lei Huang, Zhen Li, **Qinglei Cao**, and Zhiqiang Wei. Is your first impression reliable? trustworthy analysis using facial traits in portraits. International Conference on Multimedia Modeling (MMM), 2015

## ⌚ PROFESSIONAL ACTIVITIES

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### ◇ Editorial Board

- ✉ American Journal of Computer Science and Technology

### ◇ Technical Program Committee

- ✉ Workshop on HPC on Heterogeneous Hardware 2022, 2023
- ✉ AD/AE, Intl Conference for High Performance Computing, Networking, Storage and Analysis (**SC**) 2021
- ✉ Intl Conference on Advances and Trends in Software Engineering (SOFTENG) 2021, 2022, 2023

### ◇ Conference & Journal External Reviewer

- ✉ IEEE Transactions on Multimedia 2023
- ✉ ACM Transactions on Mathematical Software (TOMS) 2023
- ✉ International Conference on Emerging Information Security and Applications 2022
- ✉ Intl Conference for High Performance Computing, Networking, Storage and Analysis (**SC**) 2020, 2021
- ✉ PeerJ Computer Science 2021
- ✉ International Conference on Cluster Computing (CLUSTER) 2020
- ✉ International Conferences on High Performance Computing and Communications (HPCC) 2020, 2021

## 💎 TEACHING EXPERIENCE

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### ◇ Lecturer

- ✉ CSCI 4620/5620 **Distributed Computing** Fall 2023, SLU

### ◇ Teaching Assistant

- ✉ COSC 594 **Scientific Computing for Engineers** Spring 2018, UTK
- ✉ COSC 361 **Operating Systems** Spring 2017, UTK
- ✉ COSC 361 **Operating Systems** Fall 2016, UTK

### ◇ Guest Lecturer

## PRESENTATION & TALK

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### ◇ Paper Presentation

- ☞ International Parallel and Distributed Processing Symposium (IPDPS) 2021, 2022
- ☞ International Conference on Cluster Computing (CLUSTER) 2020
- ☞ Platform for Advanced Scientific Computing Conference (PASC) 2020
- ☞ International Workshop on Programming and Performance Visualization Tools (ProTools at SC) 2019

### ◇ Talk

- ☞ Innovative Computer Laboratory (ICL) Lunch Talk 2019, 2020, 2021, 2022
- ☞ Joint Laboratory on Extreme Scale Computing Workshop (JLESC) 2021
- ☞ SIAM Conference on Computational Science and Engineering (CSE) 2021
- ☞ SIAM Conference on Parallel Processing for Scientific Computing (PP) 2020

### ◇ Poster

- ☞ Joint Laboratory on Extreme Scale Computing Workshop (JLESC) 2020
- ☞ Platform for Advanced Scientific Computing Conference (PASC) 2020

## ♥ OPEN SOURCE CONTRIBUTIONS

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- ◇ [PaRSEC]: Task-based runtime system, funded by Exascale Computing Project (ECP)
- ◇ [DPLASMA]: Leading implementation of a dense linear algebra package for distributed system
- ◇ [HiCMA]: Low-rank math library of exploiting the data sparsity of the matrix operator
- ◇ [ExaGeostat]: Parallel high performance unified framework for computational geostatistics

## 📰 MEDIA COVERAGE

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- ◇ Gordon Bell Prize Finalists Develop Method for More Efficient Computing[AAAS Eurekalert][HLRS News]
- ◇ KAUST Supercomputing Expertise Shines at SC22[ KUAST News]
- ◇ Inside the Gordon Bell Prize Finalist Projects[ HPCwire]
- ◇ SC22 Unveils ACM Gordon Bell Prize Finalists[ HPCwire]
- ◇ 2022 ACM Gordon Bell Prize Finalists Announced[ Communications of the ACM]
- ◇ What's New in HPC Research: EXA2PRO, DQRA, and HiCMA-PaRSE Frameworks & More[ HPCwire]
- ◇ KAUST Leverages Mixed Precision for Geospatial Data[ HPCwire]
- ◇ Mixing Precision for Model Acceleration[ Tech Xplore]
- ◇ Mixing It Up: Saudi Researchers Accelerate Environmental Models with Mixed Precision[ Nvidia]
- ◇ 「富岳」を用いた3つの研究成果がゴードン・ベル賞ファイナリストに選出されました[ RIKEN News]