

Zhengchun has 10+ years of experience conducting research and development around Data, Artificial Intelligence and High Performance Computing system. Currently, he is on sabbatical leave from Argonne National Laboratory and works as a Senior Machine Learning Scientist at AWS AI Labs. Specifically, he works at the intersection of machine learning and large scale distributed systems towards cloud-based Autonomous Data Warehouse.

## RESEARCH & ENGINEERING EXPERIENCE

### Amazon Web Service (AWS), AI Labs Aug. 2022 — present

Senior Applied Scientist (Feb. 2023), Machine Learning Scientist II (Aug. 2022)

- Tech Lead of Machine Learning for AI-driven Autonomous Data Warehouse (Redshift Serverless)
- Machine Learning in Database Engine for Workload Management, AI for Systems.

### Argonne National Laboratory, Data Science and Learning division Aug. 2019 — present

on Sabbatical leave (Aug. 2019), Computer Scientist (Tenured, May 2022), Assistant Computer Scientist (Sep. 2022)

- Applied Artificial Intelligence for Science.
- HPC/Systems for Artificial Intelligence applications.
- Data and Machine Learning for HPC System(characterize, predict and optimize).

### University of Chicago, Computation Institute Mar. 2018 — Aug. 2019

Research Scientist

- Scalable cyber-infrastructure for smart/autonomous science ecosystems.
- Performance modeling and characterization of High Performance Computing system.

### Argonne National Laboratory, Mathematics and Computer Science division Sep. 2016 — Mar. 2018

Postdoctoral Researcher

- High Performance File Transfer over Wide-Area Science Network.
- Modeling, Simulation and Optimization for scientific workflows over distributed infrastructures.

### Software Engineer (Part-time) May 2010 — Jun. 2013

Xi'an FengLiTong Electronic, China

- Board Support Package development for  $\mu$ C/OS-II real-time operating system.
- Developed a backend communication service for million-level vehicle-data-recorders (IoT).

### Founder Sep. 2010 — Jul. 2013

Embedded System Technology Consulting & Outsourcing LLC, China

- 10+ cases, three prototypes went into mass production.

## SELECTED AWARDS, GRANTS & HONORS

- Best Paper award at XLOOP'21, FGCS'21, MLN'19, MLN'18, and TRIDENTCOM'18  $\times 5$  2021, 2019, 2018
- Impact Argonne award for notable achievement in Innovation  $\times 2$  May 2020, July 2022
- Top Winner of the Technology Challenge at SC'19 Nov. 2019
- Pacesetter award by Argonne National Laboratory Jan. 2019
- Extraordinary Doctorate Award by Autonomous University of Barcelona Jun. 2018

## EDUCATION

- **PhD., Computer Science**, Autonomous University of Barcelona, Spain Jul. 2016
- **MSc., Guidance, Navigation and Control**, Northwestern Polytechnical University, China Apr. 2013
- **BSc., Aircraft Manufacturing Engineering**, Northwestern Polytechnical University, China Jun. 2010

## ACTIVITIES

- Professional Membership: Association for Computing Machinery (ACM).
- Editorship: Journal of Future Generation Computer Systems (FGCS), 2020-2023, Impact Factor: 7.2.
- Workshop Co-Chair: SRMPDS 2017, 2018, 2019, 2020; AI-Science'19.
- Technical Program Committee: ICDS'19; DAAC'17-19; DLS'19; ICDCS'20; SC'20; HPCC'20; HiPC'22; SC'23; IPDPS'23,24.
- Journal Reviewer: MDPI Sensors; Elsevier FGCS, JOCS; IEEE Access, TPDS.

Papers on **Machine Learning and Systems**

1. Zhengchun Liu, Rajkumar Kettimuthu, Michael E. Papka, Ian Foster. *FreeTrain: A Framework to Utilize Unused Supercomputer Nodes for Training Neural Networks*. IEEE/ACM International Symposium in Cluster, Cloud, and Grid Computing (CCGrid'23).
2. Ahsan Ali\*, Hemant Sharma, Rajkumar Kettimuthu, Peter Kenesei, Dennis Trujillo, Antonino Miceli, Ian Foster, Ryan Coffee, Jana Thayer, Zhengchun Liu. *fairDMS: Rapid Model Training by Data and Model Reuse*. 2022 IEEE International Conference on Cluster Computing. [arXiv:2204.09805](#)
3. Tirthak Patel, Devesh Tiwari, Raj Kettimuthu, William Allcock, Paul Rich and Zhengchun Liu. *What does Inter-Cluster Job Submission and Execution Behavior Reveal to Us?*. 2022 IEEE International Conference on Cluster Computing.
4. Jakob R. Elias, Ryan Chard, Maksim Levental, Zhengchun Liu, Ian Foster, Santanu Chaudhuri. *Real-Time Streaming and Event-driven Control of Scientific Experiments*. [arXiv:2205.01476](#)
5. Rafael Vescovi, Ryan Chard, Nickolaus Saint, Ben Blaiszik, Jim Pruyne, Tekin Bicer, Alex Lavens, Zhengchun Liu, Michael E. Papka, Suresh Narayanan, Nicholas Schwarz, Kyle Chard, Ian Foster. *Linking Scientific Instruments and HPC: Patterns, Technologies, Experiences*. Patterns(2022). [arXiv:2204.05128](#)
6. Joaquin Chung, Wojciech Zacherek, AJ Wisniewski, Zhengchun Liu, Tekin Bicer, Rajkumar Kettimuthu and Ian Foster. *SciStream: Architecture and Toolkit for Data Streaming between Federated Science Instruments*. ACM HPDC'2022.
7. Zhengchun Liu, Ahsan Ali\*, Peter Kenesei, Antonino Miceli, Hemant Sharma, Nicholas Schwarz, Dennis Trujillo, Hyunseung Yoo, Ryan Coffee, Ryan Herbst, Jana Thayer, Chun Hong Yoon, Ian Foster. *Bridge Data Center AI Systems with Edge Computing for Actionable Information Retrieval*. XLOOP@SC'21. **Best Paper Awarded**.
8. Zhengchun Liu, Rajkumar Kettimuthu, Joaquin Chung, Rachana Ananthakrishnan, Michael Link, Ian Foster. *Design and Evaluation of a Simple Data Interface for Efficient Data Transfer Across Diverse Storage*. ACM Transactions on Modeling and Performance Evaluation of Computing Systems, 2021 Vol. 6, No.1.
9. Papadimitriou, George, Cong Wang, Karan Vahi, Rafael Ferreir da Silva, Anirban Mandal, Zhengchun Liu, Rajiv Mayania, Mats Rynge, Mariam Kiran, Vickie E. Lynch, Rajkumar Kettimuthu, Ewa Deelman, Jeffrey S. Vetter, Ian Foster. *End-to-End Online Performance Data Capture and Analysis for Scientific Workflows*. Future Generation Computer Systems, Vol. 117, 2021, Pages 387-400, **2021 Best Paper Award**.
10. Tirthak Patel, Zhengchun Liu, Rajkumar Kettimuthu, Paul Rich, Bill Allcock, Devesh Tiwari. *Job Characteristics on Large-Scale Systems: Long-Term Analysis, Quantification, and Implications*. The International Conference for High Performance Computing, Networking, Storage, and Analysis (SC'20).
11. Zhengchun Liu, Ryan Lewis\*, Rajkumar Kettimuthu, Kevin Harms, Philip Carns, Nageswara Rao, Ian Foster and Michael Papka. *Characterization and Identification of HPC Applications at Leadership Computing Facility*. International Conference on Supercomputing (ICS'20).
12. Yuanlai Liu\*, Zhengchun Liu, Rajkumar Kettimuthu, Nageswara Rao, Zizhong Chen and Ian Foster. *Data transfer between scientific facilities - bottleneck analysis, insights and optimizations*. IEEE/ACM International Symposium in Cluster, Cloud, and Grid Computing (CCGrid'19).
13. Zhengchun Liu, Rajkumar Kettimuthu, Prasanna Balaprakash, Nageswara S. V. Rao and Ian Foster. *Building a Wide-Area Data Transfer Performance Predictor: An Empirical Study*. International Conference on Machine Learning for Networking (MLN'18).
14. Zhengchun Liu, Rajkumar Kettimuthu, Ian Foster, Peter H. Beckman. *Towards a Smart Data Transfer Node*. Future Generation Computer Systems, 2018(89), Pages 10–18.
15. Rajkumar Kettimuthu, Zhengchun Liu, David Wheeler, Ian Foster, Katrin Heitmann, Franck Cappello. *Transferring a Petabyte in a Day*. Future Generation Computer Systems, 2018(88).
16. Zhengchun Liu, Rajkumar Kettimuthu, Ian Foster and Yuanlai Liu. *A comprehensive study of wide area data movement at a scientific computing facility*. IEEE 38th International Conference on Distributed Computing Systems (SNTA@ICDCS'18).
17. Rajkumar Kettimuthu, Zhengchun Liu, Ian Foster, Peter H. Beckman, Alex Sim, John Wu, Wei-keng Liao, Qiao Kang, Ankit Agrawal, and Alok Choudhary. 2018. *Toward Autonomic Science Infrastructure: Architecture, Limitations, and Open Issues*. The 1st Autonomous Infrastructure for Science workshop (AI-Science@HPDC'18).
18. Zhengchun Liu, Rajkumar Kettimuthu, Ian Foster and Nageswara S.V. Rao. *Cross-geography Scientific Data Transfer Trends and User Behavior Patterns*. International Symposium on High-Performance Parallel and Distributed Computing (HPDC'18).
19. Zhengchun Liu, Rajkumar Kettimuthu, Sven Leyffer, Prashant Palkar and Ian Foster. *A mathematical programming and simulation based framework to evaluate cyberinfrastructure design choices*. IEEE International Conference on eScience.
20. Zhengchun Liu, Prasanna Balaprakash, Rajkumar Kettimuthu and Ian Foster. *Explaining Wide Area Data Transfer Performance*. International Symposium on High-Performance Parallel and Distributed Computing (HPDC'17), 167-178.

## Papers on AI/HPC for Science

1. Anakha V Babu, Tao Zhou, Saugat Kandel, Tekin Bicer, **Zhengchun Liu**, William Judge, Daniel J Ching, Yi Jiang, Sinisa Veseli, Steven Henke, Ryan Chard, Yudong Yao, Ekaterina Sirazitdinova, Geetika Gupta, Martin V Holt, Ian T Foster, Antonino Miceli and Mathew J Cherukara. **Deep Learning at the Edge Enables Real-time Streaming Ptychographic Imaging**. Nature Communications 14, 7059 (2023).
2. Lipeng Wan, Jieyang Chen, Xin Liang, Ana Gainaru, Qian Gong, Qing Liu, Ben Whitney, Joy Arulraj, **Zhengchun Liu**, Ian Foster, Scott Klasky. **RAPIDS: Reconciling Availability, Accuracy, and Performance in Managing Geo-Distributed Scientific Data**. International Symposium on High-Performance Parallel and Distributed Computing (HPDC'23).
3. Petro Junior Milan, Hongqian Rong, Craig Michaud, Naoufal Layad, **Zhengchun Liu**, Ryan Coffee. **Enabling real-time adaptation of machine learning models at x-ray Free Electron Laser facilities with high-speed training optimized computational hardware**. Frontiers in Physics, Volume 10 - 2022.
4. Mike Kraus, Naoufal Layad, **Zhengchun Liu**, Ryan Coffee. **EdgeAI: Machine learning via direct attached accelerator for streaming data processing at high shot rate x-ray free-electron lasers**. Frontiers in Physics, Volume 10 - 2022.
5. **Zhengchun Liu**, Rajkumar Kettimuthu, Ian Foster. **Masked Sinogram Model with Transformer for ill-Posed Computed Tomography Reconstruction: a Preliminary Study**. [arXiv:2209.01356](https://arxiv.org/abs/2209.01356)
6. **Zhengchun Liu**, Hemant Sharma, Jun-Sang Park, Peter Kenesei, Antonino Miceli, Jonathan Almer, Rajkumar Kettimuthu and Ian Foster. **BraggNN: Fast X-ray Bragg Peak Analysis Using Deep Learning**. IUCrJ, Vol. 9, No. 1, 2022.
7. Aniket Tekawade, **Zhengchun Liu**, Peter Kenesei, Tekin Bicer, Francesco De Carlo, Rajkumar Kettimuthu, Ian Foster. **3D Autoencoders For Feature Extraction In X-ray Tomography**. 2021 IEEE International Conference on Image Processing.
8. Jiali Wang, **Zhengchun Liu**, Ian Foster, Won Chang, Rajkumar Kettimuthu, Rao Kotamarthi. **Fast and accurate learned multiresolution dynamical downscaling for precipitation**. journal of Geoscientific Model Development.
9. Selin Aslan, **Zhengchun Liu**, Viktor Nikitin, Tekin Bicer, Sven Leyffer, Doga Gursoy. **Joint Ptycho-Tomography with Deep Generative Priors**. Machine Learning Science and Technology, 2021, Vol. 2, No.4
10. Ziling Wu\*, Tekin Bicer, **Zhengchun Liu**, Vincent De Andrade, Yunhui Zhu, Ian T. Foster. **Deep Learning-based Low-dose Tomography Reconstruction with Hybrid-dose Measurements**. AI4S@SC'20.
11. **Zhengchun Liu**, Tekin Bicer, Rajkumar Kettimuthu, Doga Gursoy, Francesco De Carlo and Ian Foster. **TomoGAN: Low-Dose Synchrotron X-Ray Tomography with Generative Adversarial Networks**. Optical Society of America A, 2020, Vol. 37, No. 2.
12. Vibhatha Abeykoon\*, **Zhengchun Liu**, Tekin Bicer, Rajkumar Kettimuthu, Geoffrey Fox and Ian Foster. **Scientific Image Restoration Anywhere**. XLOOP @SC'19.
13. **Zhengchun Liu**, Tekin Bicer, Rajkumar Kettimuthu and Ian Foster. **Deep Learning Accelerated Light Source Experiments**. IEEE/ACM Deep Learning on Supercomputers DLS@SC'19.
14. **Zhengchun Liu**, Dolores Rexachs, Francisco Epelde, and Emilio Luque. **A simulation and optimization based method for calibrating agent-based emergency department models under data scarcity**. Computers & Industrial Engineering, 2017.
15. Xueping Zhu, **Zhengchun Liu** and Jun Yang. **Model of Collaborative UAV Swarm Toward Coordination and Control Mechanisms Study**. 2015 International Conference on Computational Science (ICCS'15), Vol 51, 493-502.
16. **Zhengchun Liu**, Eduardo Cabrera, Manel Taboada, Francisco Epelde, Dolores Rexachs and Emilio Luque. **Quantitative Evaluation of Decision Effects in the Management of Emergency Department Problems**. International Conference on Computational Science (ICCS'15), Vol 51, Pages 433-442.
17. **Zhengchun Liu**, Eduardo Cabrera, Dolores Rexachs and Emilio Luque. **A Generalized Agent-Based Model to Simulate Emergency Departments**. The 6th International Conference on Advances in System Simulation (SIMUL'14).

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