CONGHUI HE

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STATEMENT OF RESEARCH HIGHLIGHTS

Both my academic training and industrial experience focus on the theme of handling large-scale computational problems with large-volume datasets by means of systematic tuning methods and software tools:

- My PhD focused on large-scale seismic modeling and imaging. My thesis work enabled an unprecedented scale of earthquake simulation using **the 10 million cores of Sunway TaihuLight**, the fastest supercomputer in the world at that time. While supporting scientists in performing earthquake simulations at a significantly improved resolution, the work was recognized by **the ACM Gordon Bell Prize**, the most prestigious award in the domain of supercomputing applications.
- In my first industrial position at WeChat, I initiated Project Plato, which efficiently reduced the time to **process billions of nodes** in WeChat's vast social graph from days to minutes, securing the **2019 Tencent Technology Breakthrough Gold Award**.
- In my current joint appointment at SenseTime and Shanghai AI Lab, I have had the opportunity to lead the team in building the infrastructure that prepares and organizes multi-modal datasets, empowering a number of cutting-edge foundational models. I am also the architect of **OpenDataLab**, a leading dataset platform for the AI community, **providing 40 million data retrieval services to over 40,000 developers**.

EDUCATION

Tsinghua University, PhD, Computer Science & Technology 2013 - 2018

- Advisor: Haohuan Fu, High Performance Geo-Computing group
- Thesis: Parallelizing and Optimizing Seismic Simulations on the Sunway TaihuLight Supercomputer
- Scaled earthquake simulations on the 10-million-core Sunway TaihuLight supercomputer **(ACM Gordon Bell Prize)**
- Awarded the National PhD Scholarship and the Outstanding Graduate PhD Student Award

Imperial College London, Visiting PhD Scholar 2016 - 2017

- Advisor: Wayne Luk, Department of Computing
- Investigated a fully-pipelined hardware design for Gaussian mixture models
- Derived optimized hardware designs for low-latency financial trading

Stanford University, Visiting PhD Scholar 2016

- Advisor: Robert Clapp, Stanford Earth Imaging Project (SEP) group
- Developed an algorithm to approximate Q-factor propagation in elastic seismic modeling
- Parallelized and optimized the seismic imaging algorithm for CPU-GPU hybrid clusters

Sun Yat-Sen University, Bachelor, Software Engineering 2009 - 2013

- Graduated with a major GPA of 91.50/100, ranking 2nd among 108 students
- Awarded the National Scholarship, the First Prize Scholarship, and Second Prize in the National Embedded Contest
- Led the Microsoft Technical Student Club (MSTC), one of the most popular student clubs at Sun Yat-Sen University

WORK EXPERIENCE

SenseTime Group Limited, Senior Director, Leading a Group of 70+ Engineers 2019 - Present

- Developed a data-driven R&D system to address critical issues of scale, quality, and diversity in training corpora for Large Language Models (LLMs). This system brought forth pioneering solutions for standardizing data representation and purification across a variety of sources, languages, and formats. It also implemented parallel processing strategies for the enhancement and deduplication of data on a massive scale. These strategies were applied to trillions of tokens derived from over 10PB of raw data, significantly enriching the textual quality, density of information, and the breadth of knowledge contained within the datasets, thus propelling SenseTime's large-scale models to a leading position in the international AI industries.
- Built an AI data platform to streamline large-scale training data preparation, significantly cutting down the turnaround time and costs. The platform supports aggregation, annotation, and analysis of huge volumes of

datasets, and contributes to the creation of 70,000 models with 100,000+ datasets and billions of images, saving up to 50 million RMB. Additionally, we developed 20+ intelligent annotation tools for 200+ scenarios, improving efficiency by 30%-400%, directly supporting 100+ research papers from SenseTime and its collaborators.

Shanghai Artificial Intelligence Laboratory, Young Scientist (Joint Appointment) 2021 - Present

- Served as the architect of the large model open dataset platform **OpenDataLab** from scratch. The platform has released **over 6600 datasets, covering 60 data modalities, 1700+ tasks, and 100+ scenarios, providing nearly 20 million data retrieval services to 40,000 community developers**. OpenDataLab, recognized as one of the highest-impact open data platforms in China, was designated as the official open-source data platform by the China Large Model Corpus Alliance.
- Led the team (with over 30 researchers & engineers) that curated the training data for the large model **InternLM**, focusing on data collection, cleaning, standardization, and balancing. We released the **Wanjuan** dataset, the largest and highest-quality Chinese-English multi-modal dataset for large models, featuring diverse content including text, images, and videos across sectors such as tech, literature, and law. With rigorous cleansing and deduplication, Wanjuan has improved the model's knowledge, reasoning, and generalization capabilities, becoming China's most downloaded open-source large model dataset with **over 140,000 downloads**.

Tencent Technology, WeChat Group, Senior Researcher 2018 - 2019

- To manage the complexity of WeChat's vast social graph, I initiated **Plato**, a distributed graph framework that can efficiently process billions of nodes and hundreds of billions of edges. Plato outperformed the then-popular Spark GraphX by an order of magnitude, slashing memory use by 70%-90%.
- Deployed across WeChat services like Moments, Public Accounts, and Advertising, Plato cut processing times for hundred-billion-scale graph data from days to minutes, earning the **2019 Tencent Technology Breakthrough Gold Award**.

National Supercomputing Center in Wuxi, Research Intern 2015 - 2017

- Designed and implemented a suite of extensive optimizations addressing the memory bandwidth limitations of the TaihuLight supercomputer, introducing a just-in-time compression technique that not only doubled the capacity for problem-solving but also enhanced performance by 24%.
- Succeeded in harnessing 15% of the TaihuLight's peak performance, coordinating 160,000 MPI processes across 10,000,000+ cores, which facilitated the earthquake simulation at 18-Hz frequency and 8-meter spatial resolution (2017 ACM Gordon Bell Prize award).

SELECTED AWARDS

- 2023, SenseTime Award (company's highest award)
- 2021, Outstanding Team Award at SenseTime
- 2019, Tencent Technology Breakthrough Award - Gold Prize (highest technical award)
- 2018, Outstanding Graduate PhD Student Award
- 2017, ACM Gordon Bell Prize (the highest award in the field of high-performance computing applications)
- 2017, National PhD Scholarship
- 2013, Global Champion of the IEEE-IBM Smarter Planet Challenge (Team Leader)
- 2010, National Scholarship

INVITED TALKS

- "An Introduction to OpenDataLab", Tutorial, IEEE/CVF International Conference on Computer Vision, France, October 2023
- "OpenDataLab: The Next-Generation Open Dataset Platform", Tutorial, IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), Vancouver, June 2023
- "Exploring the Potential of Reconfigurable Platforms for Order Book Update", Oral Presentation, IEEE International Conference on Field-Programmable Logic and Applications (FPL), Ghent, September 2017
- "Approximating Q Propagations for Elastic Modeling on GPUs", Oral Presentation, 79th EAGE Conference and Exhibition, France, June 2017
- "A Nanosecond-level Hybrid Table Design for Financial Market Data Generators", Oral Presentation, 25th IEEE International Symposium on Field-Programmable Custom Computing Machines, Napa, May 2017

- "Ensemble Full Wave Inversion with Source Encoding", Oral Presentation, 77th EAGE Conference and Exhibition, Spain, June 2015

PUBLICATIONS

Names with * denotes the corresponding authors. For a full list, please refer to my Google Scholar.

1. Weijia Li, Zhenghao Hu, Lingxuan Meng, Jinwang Wang, Juepeng Zheng, Runmin Dong, **Conghui He**, Gui-Song Xia, Haohuan Fu, and Dahua Lin. "Weakly-supervised 3D Building Reconstruction from Monocular Remote Sensing Images", in *IEEE Transactions on Geoscience and Remote Sensing*, 2024.
2. Weijia Li, Haote Yang, Zhenghao Hu, Juepeng Zheng, Gui-Song Xia, **Conghui He***, "3D Building Reconstruction from Monocular Remote Sensing Images with Multi-level Supervisions", in *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, 2024.
3. Junyan Ye, Qiyan Luo, Jinhua Yu, Huaping Zhong, Zhimeng Zheng, **Conghui He**, Weijia Li, "SG-BEV: Satellite-Guided BEV Fusion for Cross-View Semantic Segmentation", in *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, 2024.
4. Qidong Huang, Xiaoyi Dong, Pan Zhang, Bin Wang, **Conghui He**, Jiaqi Wang, Dahua Lin, Weiming Zhang, Nenghai Yu, "Opera: Alleviating hallucination in multi-modal large language models via over-trust penalty and retrospection-allocation", in *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, 2024.
5. Bin Wang, Fan Wu, Xiao Han, Jiahui Peng, Huaping Zhong, Pan Zhang, Xiaoyi Dong, Weijia Li, Wei Li, Jiaqi Wang, **Conghui He***, "Vigc: Visual Instruction Generation and Correction", *Proceedings of the AAAI Conference on Artificial Intelligence*, 2024.
6. Yu Sun, Dongzhan Zhou, Chen Lin, **Conghui He**, Wanli Ouyang, Han-Sen Zhong, "LOCR: Location-Guided Transformer for Optical Character Recognition", arXiv preprint *arXiv:2403.02127*, 2024.
7. Jiantao Qiu, Haijun Lv, Zhenjiang Jin, Rui Wang, Wenchang Ning, Jia Yu, ChaoBin Zhang, Pei Chu, Yuan Qu, Runyu Peng, Zhiyuan Zeng, Huanze Tang, Ruiliang Xu, Wei Li, Hang Yan, **Conghui He***, "WanJuan-CC: A Safe and High-Quality Open-sourced English Webtext Dataset", arXiv preprint *arXiv:2402.19282*, 2024.
8. Shuangrui Ding, Zihan Liu, Xiaoyi Dong, Pan Zhang, Rui Qian, **Conghui He**, Dahua Lin, Jiaqi Wang, "SongComposer: A Large Language Model for Lyric and Melody Composition in Song Generation", arXiv preprint *arXiv:2402.17645*.
9. Kai Lv, Xiaoran Liu, Qipeng Guo, Hang Yan, **Conghui He**, Xipeng Qiu, Dahua Lin, "LongWanjuan: Towards Systematic Measurement for Long Text Quality", arXiv preprint *arXiv:2402.13583*.
10. Peng Gao, Renrui Zhang, Chris Liu, Longtian Qiu, Siyuan Huang, Weifeng Lin, Shitian Zhao, Shijie Geng, Ziyi Lin, Peng Jin, Kaipeng Zhang, Wenqi Shao, Chao Xu, **Conghui He**, Junjun He, Hao Shao, Pan Lu, Hongsheng Li, Yu Qiao, "SPHINX-X: Scaling Data and Parameters for a Family of Multi-modal Large Language Models", arXiv preprint *arXiv:2402.05935*, 2024.
11. Dinghao Yang, Bin Wang, Weijia Li, **Conghui He**, "Exploring the User Guidance for More Accurate Building Segmentation from High-Resolution Remote Sensing Images", *International Journal of Applied Earth Observation and Geoinformation*, vol. 126, 2024, page 103609.
12. Xiaoyi Dong, Pan Zhang, Yuhang Zang, Yuhang Cao, Bin Wang, Linke Ouyang, Xilin Wei, Songyang Zhang, Haodong Duan, Maosong Cao, Wenwei Zhang, Yining Li, Hang Yan, Yang Gao, Xinyue Zhang, Wei Li, Jingwen Li, Kai Chen, **Conghui He**, Xingcheng Zhang, Yu Qiao, Dahua Lin, Jiaqi Wang, "InternLM-XComposer2: Mastering Free-form Text-Image Composition and Comprehension in Vision-Language Large Model", arXiv preprint *arXiv:2401.16420*, 2024.
13. Yiqi Lin, **Conghui He***, Alex Jinpeng Wang, Bin Wang, Weijia Li, Mike Zheng Shou, "Parrot Captions Teach CLIP to Spot Text", arXiv preprint *arXiv:2312.14232*, 2023.
14. Zhiyuan Zhao, Bin Wang, Linke Ouyang, Xiaoyi Dong, Jiaqi Wang, **Conghui He***, "Beyond Hallucinations: Enhancing LLMs through Hallucination-Aware Direct Preference Optimization", arXiv preprint *arXiv:2311.16839*, 2023.
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for Advanced Text-Image Comprehension and Composition", arXiv preprint *arXiv:2309.15112*, 2023.

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21. Yi Wang, Yinan He, Yizhuo Li, Kunchang Li, Jiashuo Yu, Xin Ma, Xinhao Li, Guo Chen, Xinyuan Chen, Yaohui Wang, **Conghui He**, Ping Luo, Ziwei Liu, Yali Wang, Limin Wang, Yu Qiao, "Internvid: A Large-Scale Video-Text Dataset for Multimodal Understanding and Generation", arXiv preprint *arXiv:2307.06942*, 2023.
22. Yuan Liu, Haodong Duan, Yuanhan Zhang, Bo Li, Songyang Zhang, Wangbo Zhao, Yike Yuan, Jiaqi Wang, **Conghui He**, Ziwei Liu, Kai Chen, Dahua Lin, "Mmbench: Is Your Multi-modal Model an All-Around Player?", arXiv preprint *arXiv:2307.06281*, 2023.
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25. Peng Gao, Jiaming Han, Renrui Zhang, Ziyi Lin, Shijie Geng, Aojun Zhou, Wei Zhang, Pan Lu, **Conghui He**, Xiangyu Yue, Hongsheng Li, Yu Qiao, "Llama-Adapter V2: Parameter-Efficient Visual Instruction Model", arXiv preprint *arXiv:2304.15010*, 2023.
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on Computer Vision, 2021.

35. Zhuoming Liu, Hao Ding, Huaping Zhong, Weijia Li, Jifeng Dai, **Conghui He**, "Influence Selection for Active Learning", *Proceedings of the IEEE/CVF International Conference on Computer Vision*, 2021.
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38. Weijia Li, **Conghui He**, Haohuan Fu, Juepeng Zheng, Runmin Dong, Maocai Xia, Le Yu, Wayne Luk, "A Real-Time Tree Crown Detection Approach for Large-Scale Remote Sensing Images on FPGAs", *Remote Sensing*, vol. 11, no. 9, 2019, 1025.
39. Weijia Li, **Conghui He**, Jiarui Fang, Juepeng Zheng, Haohuan Fu, Le Yu, "Semantic Segmentation-Based Building Footprint Extraction Using Very High-Resolution Satellite Images and Multi-Source GIS Data", *Remote Sensing*, vol. 11, no. 4, 2019, 403.
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41. Bingwei Chen, Haohuan Fu, Yanwen Wei, **Conghui He**, Wenqiang Zhang, Yuxuan Li, Wubin Wan, Wei Zhang, Lin Gan, Zhenguo Zhang, Guangwen Yang, Xiaofei Chen, "Simulating the Wenchuan Earthquake with Accurate Surface Topography on Sunway TaihuLight", *SC18: International Conference for High Performance Computing, Networking, Storage and Analysis*, IEEE, 2018.
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51. **Conghui He**, Haohuan Fu, Yi Shen, Robert Clapp, Guangwen Yang, "Approximating Q Propagations for Elastic Modeling on GPUs", *In 79th EAGE Conference and Exhibition 2017*.
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Networking, Storage and Analysis, IEEE Press, 2016.

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