Guangji Bai

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Research Statement

I am a fifth-year Ph.D. student at CS Department, Emory University working with Prof. Liang Zhao. I am generally interested in designing **efficient** and **generalizable** machine learning algorithms. Specifically, my current research topics include but are not limited to **1.** Domain/knowledge transfer, such as multi-task learning, domain adaptation, and domain generalization. **2.** Efficient machine learning for large-scale problems, such as model compression and acceleration of Large Language Models (LLMs), distributed training algorithms of deep neural networks. **3.** Memory-efficient continual/lifelong learning with experience replay and neuroscience inspiration.

Education

Emory University	**Atlanta, GA**
Ph.D. in Computer Science (GPA 3.95/4)	2020.8-Present
The George Washington University	**Washington D.C.**
M.S. in Statistics	2018.9-2020.5
Fudan University	**Shanghai, China**
B.S. in Mathematics	2014.9-2018.6

Internship

Argonne National Laboratory	**Lemont, IL.**
Mathematics and Computer Science Division	2024.5-2024.8

- I worked on how to integrate model pruning of LLMs under the privacy-preserved federated learning setting. The key challenges I addressed in this project include how to conduct model pruning of LLMs in a distributed manner and how to avoid communication overhead due to the massive size of LLMs.
- I proposed an adaptive LLM pruning algorithm with personalization, tailored for the federated learning setting. The deliverable paper has been submitted to NAACL 2025 and is currently under review.

NEC Laboratory America	**Princeton, NJ.**
Data Science and System Security Team	2023.5-2023.8

- I worked on developing machine learning algorithms for domain adaptation on time series data.
- We generalized the prompt tuning techniques from NLP to time series domain and leveraged the prompts to learn domain- specific and domain-invariant representation. Our work has been accepted by KDD 2024.

Publications *(* denotes equal contribution.)*

- **Guangji Bai**, Yijiang Li, Chen Ling, Kibaek Kim, Liang Zhao. "*SparseLLM*: Towards Global Pruning for Pre-trained Language Models." *(NeurIPS 2024)*
- **Guangji Bai***, Junxiang Wang*, Wei Cheng, Zhengzhang Chen, Liang Zhao, Haifeng Chen. "Prompt-based Domain Discrimination for Multi-source Time Series Domain Adaptation." *(KDD 2024)*
- Zekun Cai, **Guangji Bai**, Renhe Jiang, Xuan Song, Liang Zhao. "Continuous Temporal Domain Generalization". *(NeurIPS 2024)*
- Yifei Zhang, Siyi Gu, Bo Pan, **Guangji Bai**, Xiaofeng Yang, Liang Zhao. "Visual Attention-Prompted Prediction and Learning." (*IJCAI 2024*)
- Chen Ling, Xujiang Zhao, Xuchao Zhang, Wei Cheng, Yanchi Liu, Yiyou Sun, Mika Oishi, Takao Osaki, Katsushi Matsuda, Jie Ji, **Guangji Bai**, Liang Zhao, Haifeng Chen. "Uncertainty Quantification for In-Context Learning of Large Language Models." *(NAACL 2024)*
- **Guangji Bai***, Chen Ling*, Liang Zhao. "Temporal Domain Generalization with Drift-Aware Dynamic Neural Networks". *(ICLR 2023, **Oral, top 1% among all papers**).*
- **Guangji Bai,** Chen Ling, Yuyang Gao, Liang Zhao. "Saliency-Augmented Memory Completion for Continual Learning." *SIAM International Conference on Data Mining (SDM 2023)*
- **Guangji Bai,** Johnny Torres, Junxiang Wang, Liang Zhao, Cristina Abad, Carmen Vaca. "Sign-Regularized Multi-task Learning." *SIAM International Conference on Data Mining (SDM 2023)*
- Zishan Gu, Ke Zhang, **Guangji Bai**, Liang Chen, Liang Zhao, Carl Yang. "Dynamic Activation of Clients and Parameters for Federated Learning over Heterogeneous Graphs". *(ICDE 2023)*
- **Guangji Bai**, Qilong Zhao, Xiaoyang Jiang, Yifei Zhang, Liang Zhao. "Saliency-Guided Hidden Associative Replay for Continual Learning". *(AMHN@NeurIPS 2023)*

- **Guangji Bai**, Liang Zhao. "Saliency-Regularized Deep Multi-Task Learning." *(KDD 2022)*
- Yuyang Gao, Tong Steven Sun, **Guangji Bai**, Siyi Gu, Sungsoo Ray Hong, Zhao Liang. "*Res: A Robust* Framework for Guiding Visual Explanation". (*KDD 2022*)
- Dazhou Yu, **Guangji Bai**, Yun Li, Liang Zhao. "Deep Spatial Domain Generalization." (*ICDM 2022*)

Preprints

- **Guangji Bai**, *et al*. "Beyond Efficiency: A Systematic Survey of Resource-Efficient Large Language Models." *Under review of CSUR* (more than **50** citations since 2024 on Google Scholar)
- **Guangji Bai**, Ziyang Yu, Zheng Chai, Yue Cheng, Liang Zhao. "Staleness-Alleviated Distributed GNN Training via Online Dynamic-Embedding Prediction." (2023)
- **Guangji Bai***, Zheng Chai*, Liang Zhao, Yue Cheng. "Distributed Graph Neural Network Training with Periodic Historical Embedding Synchronization." (2023)
- Xiongxiao Xu, Canyu Chen, Yueqing Liang, Baixiang Huang, **Guangji Bai**, Liang Zhao, Kai Shu. "SST: Multi-Scale Hybrid Mamba-Transformer Experts for Long-Short Range Time Series Forecasting". (2024)

Professional Services, Grants and Awards

- PC member for AISTATS (23'24'), NeurIPS (22'23'24'), ICLR (24'), AAAI (24'), ICML (24'), etc.
- Primary writer for the **NSF NAIRR** 240189 grant ($15k) on parallel and distributed training of LLMs on graphs.
- Travel Awards: KDD 2022, CIKM 2022, ICLR 2023, SDM 2023, NeurIPS 2024.
- 2017 American mathematical modeling competition (H prize).
- Third Prize Scholarship for the 2016-2017 academic year of Fudan University (top 30% among all undergrads).

Skills

- **Programming**: Python, PyTorch, TensorFlow, MATLAB
- **Operation System**: Windows, Mac OS, Linux, Ubuntu
- **Cloud Services**: Oracle Cloud, Amazon Web Service, Google Cloud Platform
- English-Proficiency

Courses

- **Computer Science**: Introduction to Programming (Python, C++), Data Structures and Algorithms, Object-Oriented Programming, Operating Systems, Database Systems, Machine Learning, Deep Learning (with a focus on CNNs, RNNs, LLMs), Natural Language Processing, High-Performance Computing, Neural Networks and Deep Learning.
- **Mathematics**: Calculus I, II, III, Linear Algebra, Numerical Methods, Differential Equations (ODE and PDE), Convex Optimization, Stochastic Processes, Optimization, Multivariate Calculus, Combinatorial Optimization, Game Theory, Mathematical Physics.
- **Statistics**: Probability Theory, Statistical Inference, Bayesian Inference, Statistical Learning Theory, Multivariate Analysis, Statistical Data Mining, Applied Regression Analysis, Longitudinal Data Analysis.

Teaching Experiences

- Teaching Assistant, *Introduction to Statistics* – GWU, Spring 2019
  Assisted in grading, tutorials, and student support for undergraduate statistics.
- Teaching Assistant, *Data Mining* – Emory, Spring 2021
  Supported undergraduates with assignments and data mining concepts.
- Teaching Assistant, *Artificial Intelligence* – Emory, Fall 2021
  Guided graduate students in AI methodologies and project work.
- Teaching Assistant, *System Programming* – Emory, Spring 2022
  Helped undergraduates with programming assignments and debugging.

Mentoring Experiences

- Ziyang Yu (2022-2024)
  Mentored on distributed GNN training and LLMs.
  Now an incoming CS PhD student at Emory.
- Qilong Zhao (2022-2024)
  Guided research on memory-efficient continual learning.
  Now a CS Master's student at Emory.
- Tingwei Shi (2023-2024)
  Guided research on resource-efficient LLMs.
  Now a SDE at Amazon Web Services (AWS).