Fangshuo (Jasper) Liao

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RESEARCH INTEREST

Convergence theory for optimization algorithms in deep learning, neural network pruning, nonconvex optimization.

ACADEMIC BACKGROUD

Ph.D. *Computer Science* 2021-now
George R. Brown School of Engineering, Rice University GPA: 4.00
Advisor: Prof. Anastasios Kyrillidis `[website]`

B.S. *Computer Science* 2016-2020
George R. Brown School of Engineering, Rice University GPA: 3.92

B.A. *Mathematics* 2016-2020
Wiess School of Engineering, Rice University GPA: 3.92

Research Experience

Rice University, Computer Science Department Feb.2019-Now
Ph.D. (previously undergraduate) student working with Prof. Anastasios Kyrillidis

- Provable acceleration of momentum method for neural network training.
- Provable distributed learning of neural networks with subnetwork training.
- Theoretical aspects of neural network pruning and the lottery ticket hypothesis.
- Numerical algorithms for machine learning (e.g. linear regression and PCA).
- Solve inverse problems for image compression with deep learning approach.

Baylor College of Medicine Jun.2018-Sept.2018
Undergraduate research assistant working with Prof. Robert Waterland

- Finding genetic sequence blocks with systematic individual variation in epigenetics.

CONFERENCE PAPER

Fangshuo Liao and Anastasios Kyrillidis, *"Accelerated Convergence of Nesterov's Momentum for Deep Neural Networks under Partial Strong Convexity"*, ALT, 2024. `[Link]`

Zichang Liu, Aditya Desai, **Fangshuo Liao**, Weitao Wang, Victor Xie, Zhaozhuo Xu, Anastasios Kyrillidis, Anshumali Shrivastava, *"Scissorhands: Exploiting the Persistence of Importance Hypothesis for LLM KV Cache Compression at Test Time"*, NeurIPS, 2023. `[Link]`

Zheyang Xiong*, **Fangshuo Liao*** and Anastasios Kyrillidis, *"Strong Lottery Ticket Hypothesis with ε–perturbation"*, AISTATS, 2023. `[Link]`

Qihan Wang*, Chen Dun*, **Fangshuo Liao*** and Anastasios Kyrillidis, *"LOFT: Finding Lottery Tickets through Filter-wise Training"*, AISTATS, 2023. `[Link]`

*Equal Contribution

JOURNAL PAPER

Fangshuo Liao and Anastasios Kyrillidis, *"On the Convergence of Shallow Neural Network Training with Randomly Masked Neurons"*, Transactions on Machine Learning Research (TMLR), 2022. [Link]

Cameron R Wolfe*, Jingkang Yang*, **Fangshuo Liao***, Arindam Chowdhury, Chen Dun, Artun Bayer, Santiago Segarra, Anastasios Kyrillidis, *"GIST: Distributed Training for Large-Scale Graph Convolutional Networks"*, Journal of Applied and Computational Topology, 2023. [Link]

PREPRINT

Fangshuo Liao, Junhyung Lyle Kim, Cruz Barnum, and Anastasios Kyrillidis, *"On the Error-Propagation of Inexact Deflation for Principal Component Analysis"*, arXiv preprint arXiv:2310.04283, 2023. [Link]

Cameron R Wolfe*, Fangshuo Liao*, Qihan Wang, Junhyung Lyle Kim, Anastasios Kyrillidis, *"How Much Pre-training Is Enough to Discover a Good Subnetwork?"*, arXiv preprint arXiv:2108.00259, 2023. [Link]

ONGOING PROJECTS

Deep Learning Theory

- Convergence of gradient-based training via subspace strong convexity.
- Edge-of-Stability under adaptive step size.

Optimization

- Block coordinate adaptive step size.
- Efficient distributed linear regression via feature subsampling.

TEACHING ASSISTANT

COMP 540 – Statistical Machine Learning

- *Spring 2022, 2021, 2020*
- Designing course projects, improving and grading homework, giving multiple recitation lectures, and holding office hours.

COMP 440/557 – Artificial Intelligence

- *Fall 2021, 2019*
- Improving and grading homework, giving recitation lectures, holding office hours.

MENTORSHIP

With Prof. Anastasios Kyrillidis

- **Aaron Duong & Albert Zhu** (Rice University) May.2023-Now
  Efficient Distributed Linear Regression via Feature Subsampling.
- **Isabel Cevallos** (Villanova University) May.2023-Aug.2023
  Distributed Principal Component Analysis with Deflation Method.
- **Zheyang (Eddie) Xiong** (Rice University) Aug.2021-May.2023
  Strong Lottery Ticket Hypothesis with ε-Perturbation.
- **Yuan Gao** (Purdue University) May.2022-Aug.2022
  Federated Learning using Graph Independent Subnet Training.
- **Kaichun Luo** (Rice University) May.2020-Aug.2021
  Sparse Simplex Projection for Multi-label Classification and Neural Architecture Search.

INVITED TALKS & WORKSHOPS

Strong Lottery Ticket Hypothesis with ε–perturbation NeurIPS OPT-ML Workshop (Oral). December, 2022.

LoFT: Finding Lottery Tickets through Filter-wise Training. NeurIPS HITY Workshop (Poster). December, 2022.

GIST: Distributed Training for Large-Scale Graph Convolutional Networks. NeurIPS GLFrontier Workshop (Poster). December, 2022.

LoFT: Finding Lottery Tickets through Filter-wise Training. Intel's MLWiNS Annual Workshop. October, 2023.

LoFT: Finding Lottery Tickets through Filter-wise Training. Intel's MLWiNS Annual Workshop. October, 2022.

Provable distributed Learning of Deep Neural Networks using Independent Subnet Training. Intel's MLWiNS Mid-Year Workshop. April, 2022.

On the Convergence of Shallow Neural Network Training with Randomly Masked Neurons. Google's Federated Learning and Analytics Workshop. November, 2021.

SERVICE

Reviewer:

- AISTATS 2023; ICML 2023; ICLR 2024

Workshop:

- TL;DR 2023: Co-organizer for "Texas Colloquium on Distributed Learning" `[Website]`