


Jiachen Yao

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EDUCATION

Bachelor of Science in Information and Computing Science* September 2020 - (July 2024)

Zhili College, Tsinghua University; CGPA: 3.89/4.0; GPA from second year onwards: **3.95/4.0**

Highlight Courses: Advanced Linear Algebra, Real Analysis, Artificial Neural Networks, Software Engineering.

Highlight Achievements: **National Scholarship** (highest undergrad honor in China), many first-class scholarships, selected for Spark Program, funded by the **UGVR** program to conduct summer research at **Stanford**.

* My academic program combines Math and CS with **math training** on par with Mathematics majors.

AREAS OF RESEARCH INTEREST

My vision for the future of research in machine learning is twofold:

- **Bridging the gap between machine-generated insights and human understanding:** I aim to leverage AI to unravel the complexities of the real world and discover novel scientific principles. Recognizing the limitations of purely data-driven approaches, I plan to foster a bi-directional flow of representation and knowledge to improve capability and robustness in **scientific machine learning and machine learning as a whole**.
- **Making machine learning more accessible and human-centered:** I aim to contribute to the field of **technical Human-Computer Interaction** by developing novel solutions that address human challenges. My focus is on bridging the gap between technical innovation and real-world application, **facilitating interaction through AI and with AI in an advanced and socially responsible manner**.

RESEARCH PROJECTS

MultiAdam: Parameter-wise Scale-invariant Optimizer for Multiscale Training of Physics-informed Neural Network May 2022 - Jan 2023

first-author, published in ICML 2023.

- Under the guidance of Professors Hang Su and Jun Zhu.
- Proposed the **functional relationship between weighting and domain scaling** through mathematical analysis, explaining the reason why PINN is sensitive to domain scaling.
- Designed MultiAdam, an adaptive multi-objective optimizer invariant to domain scale by re-weighting, improve the predictive accuracy **by 1-2 orders of magnitude compared with strong baselines**.

WhisperBuds: Whispered Speech Input with Earbuds July 2023 - September 2023

first-author, submitted to IMWUT 2024.*

- Under the guidance of Professors Monica S. Lam and James A. Landay.
- Developed WhisperBuds, **the first general-purpose, socially acceptable voice input method**.
- Designed a unique neural network that enhances speech capture with multichannel audio, effectively separating whispered speech from background noise and significantly **improving accuracy from 75% to 87%**.
- Demonstrated that WhisperBuds achieve 88.5% of the input speed and 97% of the accuracy of traditional normal voice speech input while maintaining lower noise levels than most keyboards.

PINNacle: A Comprehensive Benchmark of PINNs for Solving PDEs February 2023 - June 2023

February 2023 - June 2023

- Under the guidance of Professors Hang Su and Jun Zhu.
- **Led a team to implement and test 11 PINN methods across 22 PDE systems**, providing an in-depth comparison based on accuracy, cost, and sensitivity.
- Offered insights into future research in domain decomposition and robust optimization techniques.
- Provided a toolbox for systematic evaluation, fulfilling the need for a uniform standard in PINNs.

Preconditioning for Physics-Informed Neural Networks

March 2023 - September 2023

*second-author**, submitted to *ICML 2024*.

- Under the guidance of Professors Hang Su and Jun Zhu.
- **Proposed using the condition number as a novel metric** for diagnosing and rectifying training pathologies.
- Developed an algorithm that leverages preconditioning to address the issue of training instability, showcasing **state-of-the-art performance across 16 PDE problems**.

Dynamic Compression Algorithms for Large-Scale Pre-trained Models

October 2021 - May 2022

- Under the guidance of Professor Jianfei Chen.
- Proposed a novel post-training quantization method based on gradient-aware group-wise quantization, with a dynamic programming algorithm to find the optimal group structure under the size constraint.
- Pushed the limit of BERT quantization from 8 bits to 4 bits at 1% loss and 3.5 bits at 5% loss.

Selecting Real-World Objects via User-Perspective Phone Occlusion

January 2021 - August 2021

fourth-author, published in *CHI 2023*.

- Under the guidance of Professors Chun Yu and Yuanchun Shi.
- Implemented real-time tracking of the 3D positions of the user's eyes based on iris detection.
- Improved the object detection algorithm based on YOLOv4, achieving 95.9% accuracy on a custom dataset.

PUBLICATION

Submitted for Publication

Jackie Yang*, **Jiachen Yao***, Yingtian Shi, Monica Lam, and James Landay. "WhisperBuds: Whispered Speech Input with Earbuds". [link] [video]

Zhongkai Hao*, **Jiachen Yao***, Chang Su*, Hang Su, Ziao Wang, Fanzhi Lu, ..., and Jun Zhu. "PINNacle: A Comprehensive Benchmark of Physics-Informed Neural Networks for Solving PDEs". [link]

Songming Liu, Chang Su*, **Jiachen Yao***, Zhongkai Hao, Hang Su, Youjia Wu, and Jun Zhu. "Preconditioning for Physics-Informed Neural Networks". [link]

Peer-reviewed Publication

Jiachen Yao*, Chang Su*, Zhongkai Hao, Songming Liu, Hang Su, and Jun Zhu. "MultiAdam: Parameter-wise Scale-invariant Optimizer for Multiscale Training of Physics-informed Neural Networks". *Proceedings of the 40th International Conference on Machine Learning*. [link] [poster] July 2023

Yue Qin, Chun Yu, Wentao Yao, **Jiachen Yao**, Chen Liang, Yueting Weng, ..., and Yuanchun Shi. "Selecting Real-World Objects via User-Perspective Phone Occlusion". *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems*. [link] [video] April 2023

* denotes equal contributions.

INTERNSHIP

Department of Computer Science, Stanford University

June 2023 - August 2023

via the Chinese Undergraduate Visiting Research (**UGVR**) Program (**only 20 students** in China each year)

- Fully funded by Tsinghua University and Stanford University.
- Supervised by Professors Monica S. Lam and James A. Landay, working with Jackie (Junrui) Yang.
- Designed the WhisperBuds to integrate voice input into everyday life in a smooth and socially-appropriate way. (See Project #2)

ACHIEVEMENTS

National Scholarship (Highest undergrad honor in China, top 0.2% nationwide)	<i>Autumn 2022</i>
Selected for Tsinghua University's Spark Program (Top 3%, based on outstanding research performance)	<i>2023</i>
Zhili College Dean's List (7/219)	<i>Autumn 2022</i>
GigaDevice Scholarship (Tsinghua University First-class Scholarship)	<i>Autumn 2023</i>
Scholarship of Science and Technology Innovation Excellence (University-level Scholarship)	<i>Autumn 2023</i>
Scholarship of Science and Technology Innovation Excellence (College-level Scholarship)	<i>Autumn 2022</i>
Scholarship of Comprehensive Excellence (Tsinghua University First-class Scholarship)	<i>Autumn 2021</i>
Third prize of Tsinghua's 39th Challenge Cup	<i>Spring 2021</i>
Silver Medal in National Olympiad in Informatics (Top 100 nationwide)	<i>Summer 2019</i>

OPEN-SOURCE PROJECTS

📄 PINNacle: A Comprehensive Benchmark of PINNs for Solving PDEs	June 2023 - Present
· Implemented 11 variants of PINN and created a new challenging dataset consisting of 22 cases to compare them. (See Project #3)	
📄 Utilities for Tsinghua University E-Library	April 2021 - Present
· Written in Python, got 200+ starts on Github and 1000+ users on campus.	
📄 Pomodoro Improved: A Browser Extension to Stay Focused	March 2021 - Present
· Written in JavaScript, reached a peak of 6000+ users on Edge Add-ons.	

PERSONAL INTEREST

Interests	Tennis, Basketball, Running; Blogging, Coding, Movies
Technical Skills	Python, C/C++, JavaScript/TypeScript, MATLAB, Bash, \LaTeX PyTorch, Huggingface, DeepXDE, OpenCV, React, Vue; Git, Docker