Haowen Wang

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🌐 whw-alex.github.io/ ● ⌨ https://github.com/whw-alex

Education

Tsinghua University   **Sep. 2021 - Present**

Undergraduate at School of Software

○ Overall GPA: **3.91** / **4.00**

○ Core Courses: Software analysis and verification(A^+), Computer Organization Principle(A^+), Computer Networks(A^+), Introduction to Complex Analysis(A^+), Students Research Training(A^+), Introduction to Mobile Application Development(A), Principles of Database Systems(A), Principles of Assembly and Compilation(A), Modern Operating System(A), Probability and Statistics(A), Programming Methodology(A)

University of California, San Diego   **Jun. 2024 - Sep. 2024**

Visiting student at Department of Cognitive Science

Publications

(* indicates equal contribution)

[1] **Haowen Wang***, Guowei Zhang*, Xiang Zhang, Zeyuan Chen, Haiyang Xu, Dou Hoon Kwark, Zhuowen Tu.
Mousterian: Exploring the Equivalence of Generative and Real Data Augmentation in Classification
Under Review

[2] Hang Zhou*, Yuezhou Ma*, Haixu Wu*, **Haowen Wang**, Jianmin Wang, Mingsheng Long.
Unisolver: PDE-Conditional Transformers Are Universal PDE Solvers
Under Review

[3] Haixu Wu, Huakun Luo, **Haowen Wang**, Jianmin Wang, Mingsheng Long.
Transolver: A Fast Transformer Solver for PDEs on General Geometries
International Conference on Machine Learning (ICML), 2024 [PDF][Code][Slides] (**Spotlight Paper**)
✰ **Integrated into NVIDIA Modulus as the Latest Neural PDE Solver**

[4] Bingjun Luo, **Haowen Wang**, Jinpeng Wang, Junjie Zhu, Xibin Zhao, Yue Gao.
Hypergraph-Guided Disentangled Spectrum Transformer Networks for Near-Infrared Facial Expression Recognition
AAAI Conference on Artificial Intelligence (AAAI), 2024 [PDF]

Research Experience

Effectiveness of Generative Data Augmentation   **Jun. 2024 - Oct. 2024**

Advisor: Zhuowen Tu, Professor, University of California, San Diego

○ With the increasing representation power and photo-realism of generative modeling, exploring the effectiveness of generative data augmentation is vital for the future advancement of image classification.

○ Investigated the impact of generative data augmentation concerning the generative models' quality and the baseline training set's size on ImageNet and CIFAR-10.

○ Provided a **quantitative equivalence** for synthetic dataset augmentation to achieve comparable improvements to traditional real data augmentation.

○ Submitted to ICLR, 2025.

PDE-Conditional Transformers for Universal PDE   Mar. 2024 - Oct. 2024
Advisor: Mingsheng Long, Associate Professor, Tsinghua University

- Proposed **Unisolver**, a conditional Transformer architecture that leverages embedded partial differential equations (PDEs) to enhance PDE generalizability and performance.
- Inspired by the mathematical structure of PDEs, defined a complete set of PDE components and flexibly embedded them as domain-wise and point-wise conditions for Transformer PDE solvers.
- Achieved an average improvement of **27.4%** in in-distribution test settings and **43.9%** in zero-shot generalization settings on real-world benchmarks across various tasks.
- Submitted to ICLR, 2025.

Fast Transformer Solver for PDEs on General Geometries   Sep. 2023 - Jan. 2024
Advisor: Mingsheng Long, Associate Professor, Tsinghua University

- Designed **Transolver**, a physics-informed model to solve partial differential equations (PDEs), to learn intrinsic physical states for better performance.
- Proposed a new Physics-Attention mechanism that adaptively divides the discretized domain into learnable slices based on similar physical states.
- Achieved consistent state-of-the-art with **22%** relative gain across six standard benchmarks and also excelled in large-scale industrial simulations, including car and airfoil designs.
- Accepted as **Spotlight** by ICML, 2024.

Near-Infrared Facial Expression Recognition   Aug. 2022 - Aug. 2023
Advisor: Yue Gao & Xibin Zhao, Associate Professor, Tsinghua University

- Proposed **NFER-Former** for facial expression recognition on near-infrared images, with a Self-Attention Orthogonal Decomposition modules to learn the modality-invariant features from heterogeneous samples.
- Created a new dataset called Large-HFE, featuring **4.5** times more subjects than the previous dataset, to tackle the challenge of insufficient near-infrared training data.
- Achieved state-of-the-art results on all the existing datasets with an average improvement of **2.92%**.
- Accepted by AAAI, 2024.

Selected Honors and Awards

- Comprehensive Excellence Scholarship (**Top 1%**), Tsinghua University   **3 times** in 2022, 2023, 2024
- Software Innovation Competition (4th place), Tsinghua University   2023

Skills

- **Programming Languages**: Python, C/C++, Java, Javascript, HTML+CSS, RISC-V, Verilog

- **Professional Software**: PyTorch, Git, NumPy, Pandas, LATEX

- **Language Skills**:
  Chinese: native
  English: TOEFL 108 (R30/L29/S24/W25), GRE 332 (V164/Q168)+AW 3.5