Kaixiang Zheng

Phone: +12265810988 | k56zheng@uwaterloo.ca | kaixiang-zheng.github.io | Google Scholar | LinkedIn | GitHub

Education

University of Waterloo **Waterloo, Canada**

Ph.D. in Electrical & Computer Engineering, Department of Electrical & Computer Engineering ***09/2021-12/2027***

- Area: Artificial Intelligence and Machine Learning
- Supervisor: En-Hui Yang (Fellow of IEEE, the Canadian Academy of Engineering, and the Royal Society of Canada)
- Overall GPA: 93.86/100

Tianjin University **Tianjin, China**

B.S. in Automation, School of Automation and Information Engineering ***08/2017-07/2021***

- Overall GPA: 92.42/100, 3.85/4.0, Ranking: 3/180

Research Interests

- I am broadly interested in topics on **efficient** and **trustworthy** AI, including but not limited to:
- Deep Learning, Computer Vision, Information Theory, Model and Image Compression, Knowledge Distillation, Quantization, Generalization, Robustness, Abstention, Large Language Models, and Multimodality.

Selected Publications (* Authors contributed equally.)

- **Kaixiang Zheng** and Jacob H. Seidman, "Post-hoc Selective Classification for Reliable Synthetic Image Detection", The Fortieth Annual Conference on Neural Information Processing Systems (NeurIPS), 2026.
- **Kaixiang Zheng** and En-Hui Yang, "Knowledge Distillation Based on Transformed Teacher Matching", The Twelfth International Conference on Learning Representations (ICLR), 2024.
- Siyu Chen*, **Kaixiang Zheng***, Ahmed H. Salamah*, En-Hui Yang, "Differentiable JPEG-based Input Perturbation for Knowledge Distillation Amplification via Conditional Mutual Information Maximization", The Fourteenth International Conference on Learning Representations (ICLR), 2026.
- Ahmed H. Salamah*, **Kaixiang Zheng***, Yiwen Liu, En-Hui Yang, "JPEG Inspired Deep Learning", The Thirteenth International Conference on Learning Representations (ICLR), 2025.
- **Kaixiang Zheng***, Ahmed H. Salamah*, Linfeng Ye*, En-Hui Yang, "JPEG Compliant Compression for DNN Vision", 2023 IEEE International Conference on Image Processing (ICIP), 2023.
- Ahmed H. Salamah*, **Kaixiang Zheng***, En-Hui Yang, "Generalized Coded Knowledge Distillation via Conditional Mutual Information Maximization", 2026 IEEE International Symposium on Information Theory (ISIT), 2026.
- Ahmed H. Salamah*, **Kaixiang Zheng***, Linfeng Ye*, En-Hui Yang, "JPEG Compliant Compression for DNN Vision", IEEE Journal on Selected Areas in Information Theory, 2024.
- **Kaixiang Zheng** and En-Hui Yang, "Deep Learning Based on Train-Test Discrepancy Minimization", The VII AMMCS International Conference, 2026.

Industry Experience

Reality Defender Inc. **New York, U.S.A**

Computer Vision PhD Intern ***12/2025-04/2026***

- **Project: Post-hoc Selective Classification (SC) for Reliable Synthetic Image Detection**
  - Proposed a simple yet effective SC framework for **Re**liable **S**ynthetic **I**mage **De**tection (ReSIDe).
  - ReSIDe significantly boosts the SC performance of various logit-based confidence score functions (CSFs) under common covariate shifts, achieving up to 69.55% reduction in the area under the risk-coverage curve (AURC).

Research Experience

Multicom Research Group (University of Waterloo) **Waterloo, Canada**

Research Assistant, Advisor: Prof. En-Hui Yang ***09/2021- present***

- **Project: Knowledge Distillation (KD) Based on Transformed Teacher Matching**
  - Proved the equivalence between dropping the temperature on the student side and adding a Rényi entropy regularizer to KD, and then proposed a new distillation method based on this result.
  - The proposed distillation method reaches 72.19% classification accuracy on ImageNet for ResNet-18 distilled from ResNet-34, achieving state-of-the-art performance with almost the same computational complexity as KD.
- **Project: Soft Quantization Activation Functions (SQUAFs) for Deep Learning**
  - Proposed SQUAFs, a novel family of trainable, architecture-agnostic AFs for deep learning, which can approximate any continuous 1D function with arbitrary precision.
  - Evaluated SQUAFs across diverse model architectures (MLPs, KANs, CNNs, ViTs, and LLMs) and tasks (function fitting, image classification, DPO-based LLM finetuning, PDE solving, 2D/3D implicit neural representation), consistently demonstrating performance gains, up to 5000× error reduction in function fitting and 25.27 dB PSNR gain in image fitting.
  - Showed additional benefits of SQUAFs in model compression and inter-device communication cost reduction in model-parallel settings, up to 3.2× model compression ratio and 9.4× communication cost reduction while preserving accuracy gains.
- **Project: Coded Knowledge Distillation via Conditional Mutual Information (CMI) Maximization**
  - Developed input perturbation techniques to maximize teacher's CMI for better distillation performance.
  - The proposed techniques improve distillation performance for various distillers significantly and consistently.
- **Project: JPEG Inspired Deep Learning (JPEG-DL)**
  - Proposed a differentiable JPEG layer to be trained jointly with DNNs for better image classification accuracy.
  - The proposed JPEG-DL framework increases model accuracy by as much as 20.9% on some fine-grained image classification tasks.
- **Project: JPEG Compliant Compression for DNN Vision**
  - Revisited JPEG quantization table design based on DNN's sensitivity to DCT frequencies and end-to-end training equipped with a differentiable JPEG layer.
  - The proposed frameworks and algorithms achieve an increase in accuracy by as much as 11.60% at the same rate, or a reduction of compression rate up to 80.05% at the same accuracy.

Affective Intelligence and Robotics Lab (University of Cambridge) **Cambridge, U.K.**

Undergraduate Research Assistant, Advisor: Prof. Hatice Gunes ***07/2020-07/2021***

- **Project: Adaptive Robotic EQ for Well-being (ARoEQ)**
  - Used OpenFace to extract features, especially action units, from facial images and thoroughly analyzed the output.
  - Trained ResNet-18 on AffectNet Database for faces' arousal/valence prediction on our private dataset. The RMSE of the trained model reaches 0.38 for both valence and arousal, demonstrating state-of-the-art performance.

Tokuda Lab (Harvard University) **Cambridge, U.S.A**

Undergraduate Research Assistant, Advisor: Prof. Junichi Tokuda ***07/2020-10/2020***

- **Project: Building Software Systems for Image-Guided Robot-Assisted Interventions**
  - Simulated a brain surgery with 3D Slicer and ROS.
  - Segmented brain MRIs with 3D Slicer.

Skills

- **Programming Languages:** Python (PyTorch), C++ (OpenCV), Matlab, SQL, Shell.
- **Operating Systems:** Linux, Windows.
- **Software Tools:** GitHub, LaTeX, Visual Studio, PyCharm, SQL Server.

Honors & Awards

- Graduate Student Research Dissemination Award ***2023, 2024, 2025***
- FOE University of Waterloo Graduate Scholarship ***2023***
- David Johnston International Student Entrance scholarship ***2021***
- Outstanding Graduate of Tianjin University ***2021***
- Outstanding Student of Tianjin University (Top 2% of 179 students) ***2017-2020***
- Weichai Power Scholarship (Top 3% of 175 students) ***2018-2019***
- Bingchang Zhuang Special Scholarship (Top 2% of 179 students) ***2017-2018***