

# Tzu-Heng (Brian) Huang

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## Education

- **University of Wisconsin-Madison** Madison, Wisconsin  
3rd-year Ph.D. student in Computer Science. Minor in Economics. Aug. 2021 — Jun. 2026 (expected)
- **National Chengchi University (NCCU)** Taipei, Taiwan  
B.S. in Computer Science. (Major GPA: 3.96/4.30) Sep. 2016 — Jul. 2020

## Research Summary

I am passionate about advancing potent and efficient techniques for **data-centric AI**, specifically empowering **foundation models** to acquire more knowledge while diminishing reliance on extensive human supervisions. To achieve this objective, I have undertaken several initiatives:

1. Pioneered the first **parameter trading market** to enhance multi-agents' performance while reducing training costs [1].
2. Presented a new adaption method with label information to improve **foundation models** without extra training [2].
3. Proposed a scalable **multimodal data curation framework** via ensembles and object detection to improve CLIPs [3].
4. Built a **zero-cost automated labeling system**, integrating with synthesized labeling sources via Code LLMs [4].
5. Tailored Llama 2 for low-resource domains and built the first **large language model** for traditional Chinese medicine.

## Publications

- [1] **Tzu-Heng Huang**, Harit Vishwakarma, Frederic Sala, "Train 'n Trade: Foundations of Parameter Markets", in *Neural Information Processing Systems (NeurIPS)*, 2023.
- [2] Nicholas Roberts, Xintong Li, Dyah Adila, Sonia Cromp, **Tzu-Heng Huang**, Jitian Zhao, Frederic Sala, "Geometry-Aware Adaptation for Pretrained Models", in *Neural Information Processing Systems (NeurIPS)*, 2023.
- [3] **Tzu-Heng Huang\***, Changho Shin\*, Sui Jiet Tay, Dyah Adila, Frederic Sala, "Multimodal Data Curation via Object Detection and Filter Ensembles", in *ICCV Workshop: Towards the Next Generation of Computer Vision Datasets*, 2023.
- [4] **Tzu-Heng Huang**, Catherine Cao, Spencer Schoenberg, Harit Vishwakarma, Nicholas Roberts, Frederic Sala, "ScriptoriumWS: A Code Generation Assistant for Weak Supervision", in *ICLR Workshop: Deep Learning For Code*, 2023 and in *Midwest Machine Learning Symposium*, 2023.
- [5] Nicholas Roberts, Xintong Li, **Tzu-Heng Huang**, Dyah Adila, Spencer Schoenberg, Cheng-Yu Liu, Lauren Pick, Haotian Ma, Aws Albarghouthi, Frederic Sala, "AutoWS-Bench-101: Benchmarking Automated Weak Supervision with 100 Labels", in *Neural Information Processing Systems (NeurIPS)*, 2022.
- [6] **Tzu-Heng Huang**, Cheng-Hsien Tsai, Man-Kwan Shan, "Key Sensor Discovery for Quality Audit of Air Sensor Networks", in *ACM International Conference on Mobile Systems, Applications, and Services (MobiSys)*, 2020.

## Research Experience

- **Apple Inc.** San Diego, California  
AIML Research Intern, advised by Javier Movellan and Manjot Bilkhu May. 2024 — Sep. 2024
- **Department of Computer Science, UW-Madison** Madison, Wisconsin  
Graduate Research Student, advised by Prof. Frederic Sala Feb. 2022 — Present
  - **Train 'n Trade: Foundations of Parameter Markets** [1]:
    - Designed a new knowledge exchange marketplace for multi-agents to trade parameter sets and to accelerate training process.
    - Applied parameter alignments to merge models and proved efficacy via faster convergence and successful monetization.
  - **Geometry-Aware Adaptation for Pretrained Models** [2]:
    - Proposed a new adaption method by leveraging relational information in label spaces to improve foundation models (CLIP).
    - Validated enhanced foundation models over SimCLR on ImageNet and scaled to extreme classes without additional training.
  - **Multimodal Data Curation via Object Detection and Filter Ensembles** [3]:
    - Built a scalable multimodal data curation framework via filter ensembles and object detection (e.g. DINO) to improve CLIP.
    - **Rank #1** on the small-scale filtering track of ICCV'23 [Datacomp](#) leaderboard.
  - **ScriptoriumWS: A Code Generation Assistant for Weak Supervision** [4]:
    - Applied in-context learning, RAG and Code LLMs to develop zero-cost labeling systems with synthesized labeling sources.
    - Showcased framework efficacy by comparable label correctness but higher coverage on par with human annotation standards.
  - **AutoWS-Bench-101: Benchmarking Automated Weak Supervision with 100 Labels** [5]:
    - Developed a new benchmarking framework to evaluate automated weak supervision techniques on diverse science tasks.

- **Awan.AI LLC** San Jose, California  
May. 2023 — Apr. 2024  
*Founder, collaborated with TechTCM*
  - **Large Language Models for Traditional Chinese Medicine:**
    - Tailored generative AI solutions via Llama 2 and LangChain and built the first LLM for traditional Chinese medicine.
    - Curated customized and synthesized datasets for LLM continue pretraining and fine-tuning with LoRA and Flash Attention.
  - **Tongue Syndrome Diagnosis in Traditional Chinese Medicine:**
    - Built on CLIP with crowdsourcing tongue images and medical diagnosis to answer extreme multi-label syndromes.
- **Argonne National Laboratory** Lemont, Illinois  
Jun. 2019 — Sep. 2019  
*Research Intern, advised by Dr. Charles Catlett*
  - **Radiative Error Reduction for Low-cost Temperature Sensors:**
    - Researched pattern identification on time series and ensemble learning to improve calibration model performance by **25%**.
- **Department of Computer Science, NCCU** Taipei, Taiwan  
Sep. 2018 — Aug. 2021  
*Research Assistant at Data Mining Lab, advised by Prof. Man-Kwan Shan*
  - **Key Sensor Discovery for Quality Audit of Air Sensor Networks [6]:**
    - Proposed a new quality audit framework to monitor low-cost sensor performance while reducing human effort on inspections.
    - Developed sensor correlation model and built diverse relational graphs to discover key sensors via graph traversal algorithms.
  - **Early Prediction of Affected Sensors by Local Events Detected over Social Media:**
    - Applied spatial-temporal GNNs to detect anomalies in multivariate time series and to label diffusion among regions.
    - Developed an early prediction framework with Seq2seq models for affected region prediction with F1-score of **80%**.
  - **Missing Value Estimation of Large Scale Air Monitoring Sensor Network:**
    - Developed spatial-temporal correlation models via geo-context for missing value imputation with error rate less than **10%**.
    - Enhanced correlation models with diverse time series segmentation methodologies by **17%**.
- **Institute of Information Science, Academia Sinica** Taipei, Taiwan  
Feb. 2018 — Jul. 2020  
*Research Intern at Network Research Lab, advised by Dr. Ling-Jyh Chen*
  - **Calibrating Low-cost PM2.5 Sensors in Large Scale IoT Environmental Monitoring Systems:**
    - Proposed an adaptive calibration framework with regression models to ensure data quality of large-scale low-cost air sensors.
    - Project was awarded Undergrad Student Research Scholarship granted by Ministry of Science and Technology in Taiwan.
  - **PiM25 — Environmental Sensing Hub:**
    - Designed maker-based sensor hub with OTA updates to detect environmental conditions, e.g., air, temperature, and sounds.
    - PiM25 was accepted by HKoscon'19 and COSCUP'19 to demonstrate and was the first TW's project reported by Magpi.

## Awards

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- **Conference Scholar Award:** granted by NeurIPS'23.
- **ICCV'23 Datacomp Competition: rank #1** in the small-scale filtering track.
- **First-year Departmental Scholarship:** granted by Department of Computer Science, UW-Madison.
- **International Research Intern Scholarship:** granted by National Chengchi University (NCCU).
- **Undergrad Student Research Scholarship:** granted by Ministry of Science and Technology (MOST), Taiwan.

## Invited Talks

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- **IoT Instantiation: Air Sensor Deployment:** invited by Nangang High School (Taiwan), Dec. 2019.
- **Internship Abroad Scholarship Sharing:** invited by National Chengchi University, Sep. 2019.
- **LASS Conference International Session:** invited by Institute of Information Science, Academia Sinica, Jul. 2019.
- **Techbang Magazine Sharing: PiM25 Project:** invited by Techbang Magazine, Mar. 2019.
- **Raspberry Pi Jam: PiM25 Project:** invited by Raspberry Pi Foundation (Taiwan), Mar. 2019.
- **The 24th of Raspberry Pi Meetup: PiM25 Project:** invited by Raspberry Pi Foundation (Taiwan), Jan. 2019.

## Academic Services

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- **Co-organizer:** AutoML Cup in AutoML'23.
- **Paper Reviewer:** GLOBECOM'20, NeurIPS'23, ICLR'24, CoLLAs'24, ICML'24, DMLR.
- **Student Association of Taiwan (SAT), UW-Madison:** President, Jun. 2022 — May. 2023.
- **Student Association of Taiwan (SAT), UW-Madison:** Vice President, Jun. 2021 — May. 2022.

## Programming Skills

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- **Programming Languages:** Python, R, C++, SQL, LaTeX, and Shell Programming.
- **Technologies:** PyTorch, Tensorflow, Keras, ShinyApp, PostgreSQL, Linux, Flask, Dash Visualization, Git, and Vim.