Tzu-Heng (Brian) Huang

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Education

- **University of Wisconsin, Madison (UW-Madison)** — Madison, Wisconsin
  Ph.D. in Computer Science (with a four-year guaranteed scholarship). — *Aug. 2021 – Present*
  - [**Teaching**]: TA of Data Science Programming (CS 220) and Intro. to AI (CS 540).
- **National Chengchi University (NCCU)** — Taipei, Taiwan
  *B.S. in Computer Science, Major GPA: **3.96**, Overall GPA: **3.89**.* — *Sep. 2016 – Jul. 2020*
  - [**Teaching**]: TA of Data Mining, Database Management System, Algorithms, and Social Computing.

Research Interests

My research currently focuses on building efficient and effective learning frameworks for multiple agents to transfer knowledge in competitive games or in cooperative games. Especially, I like to perform research to pursue **Pareto frontier, Nash equilibrium and discover provable performance guarantees**. My past research interests lay in optimizing data quality in low-cost sensor networks and developing deep learning models with **spatio-temporal data** to forecast, detect anomalies, and model sensor correlation.

Research Experience

- **Department of Computer Science, UW-Madison** — Madison, Wisconsin
  Independent Study at Sala Lab — *Feb. 2022 - Present*
  - **Bargaining Games for Trading Parameters**:
    - Proposed novel trading mechanisms for multiple agents to transfer knowledge and optimize agents' utilities.
    - Developed effective trading policies to evaluate the value of transferred knowledge in **game theory** settings.
  - **AutoWS-Bench-101: Benchmarking Automated Weak Supervision with 100 Labels [3]**:
    - Contributed a new benchmark to evaluate automated WS techniques with diverse application domains.
  - **Automatic Label Function Design in Weak Supervision**:
    - Studied on prompt-based **Foundation Models** for language generation and summarization.
  - Advised by Prof. Frederic Sala.
- **Argonne National Laboratory** — Lemont, Illinois
  Research Intern at Mathematics and Computer Science Division — *Jun. 2019 - Sep. 2019*
  - **Pattern Identification Based Calibration Model on Time Series for Radiative Error Reduction**:
    - Developed ensemble learning with **DNN** to calibrate temperature sensor for radiative error reduction.
    - Proposed **pattern identification** on time series to improve the performance of calibration model by **25%.**
    - Established RESTful API to transfer sensor data between two large scale air monitoring network platforms.
  - Advised by Dr. Charles Edward Catlett and Dr. Rajesh Sankaran.
- **Department of Computer Science, NCCU** — Taipei, Taiwan
  Research Assistant at Data Mining and Multimedia Lab — *Sep. 2018 - Aug. 2021*
  - **Early Prediction of Affected Sensors by Local Events Detected over Social Media**:
    - Developed **spatial-temporal GNN** models to detect anomalies in time series for affected sensor labeling.
    - Built attention-based **BiGRU/BiLSTM/TCN** models to **early predict** affected sensors with F-score of **80%.**
  - **Efficient and Effective Quality Audit Frameworks for Large Scale Sensor Networks [1, 2]**:
    - Proposed a novel **quality audit framework** to inspect sensor performance with sensor data correlation modeling.
    - Developed effective approximation algorithms with **CPLEX MIP solver** to optimize facility location theory.
  - **Missing Value Estimation of Large Scale Air Monitoring Sensor Network**:
    - Developed spatial-temporal **correlation models** for missing value imputation with error rate less than **10%.**
    - Improved correlation models through time series segmentation with **sequential clustering algorithm** by **17%**.
  - Advised by Prof. Man-Kwan Shan.

- **Institute of Information Science, Academia Sinica** Taipei, Taiwan
  Research Assistant at Network Research Lab *Feb. 2018 - Jul. 2020*
  - **Real-time Air Quality Forecasting with Seq2seq Model for Edge Computing**:
    - Developed accurate **Seq2seq** models to forecast multivariate time series in large scale low-cost sensor networks.
  - **Calibrating Low-cost PM2.5 Sensors in Large Scale IoT Environmental Monitoring Systems**:
    - Proposed adaptive calibration framework with regression-based models to ensure data quality of low-cost sensors.
    - Project was awarded Student Research Scholarship granted by the Ministry of Science and Technology in Taiwan.
  - **Environmental Sensing Hub (PiM25)**:
    - Designed a maker-based sensor hub with **over-the-air** updates to detect various environmental conditions.
    - Deployed an **on-device pretrained audio model** to recognize environmental sounds with F-score of **75%**.
    - This open-source project is released online and was accepted by **HKoscon'19** and **COSCUP'19** to present.
    - PiM25 is cooperated with Raspberry Pi Org. in Taiwan and was the **first** Taiwan's project reported by Magpi.
  - Advised by Prof. Ling-Jyh Chen.
- **College of Commerce, NCCU** Taipei, Taiwan
  Research Assistant at Human Resource Lab *Jul. 2017 - Jul. 2020*
  - **Conditional Indirect Effects in Multi-level Models with Monte Carlo Simulations**:
    - Developed an interactive online tool to estimate effects for multilevel models with **Monte Carlo** simulation.
  - **Predicting Employee Attrition with Machine Learning Models**:
    - Discovered useful knowledge rules and potential factors for Pegatron manufacturing plants to retain employees.
    - Developed ML models **(SVM/XGBoost/LightGBM)** to predict employee turnover with accuracy over **90%**.
  - **Automative Assessment Tool of Employee Personality**:
    - Developed an automative data visualization platform to analyze and generate employee personality assessments.
  - Advised by Prof. Changya Hu.

Teaching Experience

- **Fall 2022 at UW-Madison CS**: TA of Introduction to Artificial Intelligence (CS 540).
- **Spring 2022 at UW-Madison CS**: TA of Data Science Programming (CS 220).
- **Fall 2021 at UW-Madison CS**: TA of Data Science Programming (CS 220).
- **Spring 2021 at NCCU CS**: TA of Algorithms (Undergraduate Course).
- **Fall 2020 at NCCU CS**: TA of Data Mining (Graduate Course).
- **Fall 2020 at NCCU CS**: TA of Social Computing (Graduate Course).
- **Spring 2020 at NCCU CS**: TA of Database Management System (Graduate Course).
- **Spring 2020 at NCCU CS**: TA of Data Mining (Graduate Course).

Publications

[1] Tzu-Heng Huang, Cheng-Hsien Tsai, Man-Kwan Shan, "Key Sensor Discovery for Quality Audit of Air Sensor Networks", MobiSys'20.
[2] Tzu-Heng Huang and Man-Kwan Shan, "An Effective and Efficient Quality Audit Framework for Large Scale Sensor Networks".
[3] 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", NeurIPS'22.

Invited Talks and Academic Services

- **Student Association of Taiwna (SAT), UW-Madison**: President, Jun. 2022 - May. 2023.
- **Student Association of Taiwan (SAT), UW-Madison**: Vice President, Jun. 2021 - May. 2022.
- **IEEE Global Communications Conference (IEEE GLOBECOM'20)**: Paper Reviewer, Jul. 2020.
- **IoT Tutorial for High School Students**: Lecturer, invited by Nangang High School, Dec. 2019.
- **International Internship Sharing - Research Project**: Speaker, invited by NCCU, Sep. 2019.
- **LASS Conference International Session - Research Project**: Speaker, invited by Academia Sinica, Jul. 2019.
- **Techbang Magazine Sharing - PiM25 Project**: Speaker, invited by Techbang Magazine, Mar. 2019.
- **Raspberry Pi Jam - PiM25 Project**: Speaker, invited by Raspberry Pi Org. (TW), Mar. 2019.
- **The 24th of Raspberry Pi Meetup - PiM25 Project**: Speaker, invited by Raspberry Pi Org. (TW), Jan. 2019.

Honors and Awards

- **First-year CS Departmental Scholarship**: granted by Department of Computer Science, UW-Madison.
- **International Research Intern Scholarship**: granted by National Chengchi University (NCCU), Taiwan.
- **Undergraduate Research Scholarship**: granted by the Ministry of Science and Technology (MOST), Taiwan.

Programming Skills

- **Programming Languages**: Python, R, C++, C, SQL, LaTeX, Shell Programming, GAMS, and VBA.
- **Technologies**: **Pytorch, Tensorflow, Keras**, ShinyApp, Linux, Flask, Dash, Git, and Vim.
- **Database Management Systems**: PostgreSQL, MySQL, and SQLite.