Hongyi Zhang

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Education

Washington University in St. Louis (WashU) *Aug 2024 – May 2026*
Master of Science in Data Analytics and Statistics, GPA 3.94/4.00 *USA*

- **Honors:** The Outstanding Master's Research Award; Master's Honors Program; Student Marshal
- **Research Assistant:** WashU Medicine, Medical AI Lab, Advised by Prof. Shinjini Kundu
- **Teaching Assistant:** Probability and Stochastic Processes, Lead TA; Optimization, Lead TA; Introduction to Machine Learning and Pattern Classification, Grader

Southern University of Science and Technology (SUSTech) *Aug 2019 – July 2023*
Bachelor of Science in Mathematics and Applied Mathematics, GPA 3.38/4.00 *China*

- **Honors:** SUSTech Outstanding Undergraduate Scholarship
- **Research Assistant:** SUSTech, Advised by Prof. Jiaqiang Wen
- **Teaching Assistant:** Introduction to MATLAB, TA
- **Exchange Program:** North Carolina State University Data Science Program (Grade A+, 2022)

Publications

1. **Zhang, H. Y.**, Latimer, C. S., Keene, C. D., Benjamini, D., Kundu, S. (2026). Multidimensional MRI Maps Histology-Defined Phosphorylated Tau Burden in Alzheimer's Disease. In preparation for submission to Brain.
2. **Zhang, H. Y.** (2026). Multidimensional MRI Maps Histology-Defined Phosphorylated Tau Burden in Alzheimer's Disease. McKelvey School of Engineering Theses & Dissertations. https://openscholarship.wustl.edu/eng_etds/1356.
3. **Zhang, H. Y.** (2024). Real-time face recognition method based on MTCNN-Inception-ResNet-v2-SVM model. Applied and Computational Engineering, 45, 179–189. https://doi.org/10.54254/2755-2721/45/20241677.
4. Wang, Y. M., Lei, S., **Zhang, H. Y.** (2023). Numerical simulation analysis of coal silos surrounding rock stability under different coal storage conditions. China Energy and Environmental Protection, 45(08), 6–10. https://doi.org/10.19389/j.cnki.1003-0506.2023.08.002.

Research Experience

Mapping Phosphorylated Tau Using MD-MRI in Alzheimer's Disease *Jan 2025 - Now*
Research Assistant, WashU, Advised by Prof. Shinjini Kundu *St. Louis*

- Developed a multidimensional MRI (MD-MRI) framework integrated with supervised machine learning to non-invasively estimate phosphorylated tau (pTau) concentration and spatial distribution in Alzheimer's Disease, providing a safer and more accessible alternative to cerebrospinal fluid analysis and tau-PET imaging.
- Engineered geometry-aware features leveraging Transport-Based Morphometry (TBM) and PCA, transforming complex high-dimensional diffusion-relaxation distributions (voxelwise T1-MD and T2-MD joint probability distributions) into low-dimensional representations for downstream modeling.
- Optimized Random Forest models via nested cross-validation and Bayesian optimization, achieving 92.6% binary accuracy, 89.3% ternary accuracy, and a regression R^2 of 0.883 for continuous pTau estimation, while demonstrating robust generalizability across independent external datasets.
- Reconstructed predictive maps demonstrating strong concordance with histology-derived ground truth for the precise localization of tau pathology.

Surrogate Modeling of High-Frequency Bitcoin Using Deep Neural Networks *Sep 2024 - Jan 2025*
Research Assistant, USC, Advised by Prof. Weixuan Xia *Remote*

- Modeled high-frequency Bitcoin log returns using a regulating stochastic clocks framework to capture asymmetric and heavy-tailed dynamics; generated synthetic data from the theoretically intractable density of a regulated mixed process of of Bitcoin log returns.
- Developed a MLP surrogate model to approximate the theoretically intractable probability density function of Bitcoin log returns, achieving high accuracy with an R^2 of 0.96 and an RMSE of 0.03 while effectively capturing

complex distributional structures, significantly accelerating the inference process for real-time analysis.

- Estimated jump activity via activity signature function and calibrated remaining parameters using maximum likelihood estimation on real Bitcoin transaction data; demonstrated strong alignment among theoretical, DNN-fitted, and kernel density distributions, establishing a new computational framework for volatility modeling and risk assessment in cryptocurrency markets.

Chinese Institute of Coal Science, State Key Laboratory of Intelligent Mining *Sep 2023 - May 2024*
Research Assistant, Advised by Prof. Qingxin Qi *Beijing*

- Collected coal-rock image data and performed preprocessing tasks such as denoising and data augmentation; gathered data from microseismical monitoring system and applied operations such as imbalance handling.
- Applied various models including ResNet-GRU for microseismical hazard analysis; developed characteristic values using time, location, and energy data from microseismical monitoring; achieved an accuracy rate of 0.83.
- Conducted DEM–FEM coupled numerical simulations to evaluate the mechanical stability of coal silo surrounding rock under different storage conditions; provided insights for optimizing structural design and safety management.
- Analyzed the effectiveness of hydraulic fracturing technology for weakening hard roof strata in coal mining; demonstrated the significant effectiveness of hydraulic fracturing technology in preventing rock bursts by constructing pressure unloading and transmission models based on rock mechanics.

Object Detection and Face Recognition *Sep 2023 - Dec 2023*
Research Assistant, Duke, Advised by Prof. Rabih Younes *Remote*

- Explored and evaluated image processing algorithms and CNN-based models using Python; analyzed their performance in multiple computer vision applications such as lane detection and vehicle detection.
- Architected and implemented an end-to-end real-time face recognition pipeline using MTCNN for detection, Inception-ResNet-v2 for feature extracting, and SVM for classification, achieving 0.988 accuracy.

Cryptocurrency Price Prediction Based on Machine Learning *Jan 2023 - Jun 2023*
Undergraduate Thesis, SUSTech, Advised by Prof. Jiaqiang Wen *Shenzhen*

- Applied wavelet denoising for data preprocessing and employed an autoencoder for nonlinear dimensionality reduction; performed regression using multiple models with time series cross-validation and Bayesian optimization.
- The hybrid model CNN-LSTM achieved the best performance, yielding an R^2 of 0.92 and an 84.1% return rate based on the MACD trading strategy, using high-frequency Bitcoin price data.

Internship Experience

CCTEG Financial Leasing Co., Ltd *Jul 2021 - Aug 2021*
Data Analysis Intern *Beijing*

- Optimized the corporate credit rating system to stratify applicant tiers; implemented forecasting models to predict market trends to visualize analysis results, providing robust data-driven support for strategic decision-making.
- Based on the IoT risk monitoring system for leased assets, applying sensor data, such as load factors, and periodic client feedback to identify operational anomalies and potential default risks of partnered enterprises.

Spect AI Inc. (Nonlinear) *Aug 2025 - Now*
AI Agent Developer *Remote*

- Developed Agentic Workflows for the Architecture, Engineering, and Construction (AEC) industry, automating complex, multi-stage structural analysis and design verification protocols.
- Engineered machine learning models trained on large-scale AEC datasets, integrating LLM-driven reasoning for precise engineering cost estimation and construction strategy evaluation, improving decision-making accuracy.

Competition and Extracurriculars

Mathematical Contest in Modeling, Honorable Mention, Leader *May 2022 Shenzhen*
China Undergraduate Mathematical Contest in Modeling, Excellence Award, Leader *Oct 2021 Shenzhen*
Joint University Investment Game, issued by HKSI, Overall 7th Runner-up *Sep 2020 Hong Kong*
SUSTech Powerlifting Club, *Co-founder and Chief Advisor* *Mar 2020 - Sep 2022*
SUSTech COVID-19 Prevention and Control Team, *Volunteer* *Mar 2022 - Sep 2022*
SUSTech Undergraduate Admission Office, *Volunteer* *Dec 2019 - Jan 2020*