Yudong Hu

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Yudong (Shawn) Hu | abdn-hyd

Education

- **South China Normal University (Dual-Degree Program)** *Sep. 2021 - Jun. 2025*
  - *Bachelor of Engineering*
  - Major: Artificial Intelligence
  - GPA: 88.0/100.0
- **University of Aberdeen** *Sep. 2021 - Jun. 2025*
  - *Bachelor of Science (First-Class Honours)*
  - Major: Artificial Intelligence
  - GPA: 20.06/22.00

Research Interests

- **Efficient LLMs:** Model compression (pruning & quantization), complexity optimization (linear attention).
- **Foundational Computer Vision:** Interpretable architecture for recognition, diffusion.
- **Trustworthy AI:** Privacy protection in federated learning, analysis of bias and fairness in NLP.

Publications

C=Conference, J=Journal, S=In Submission

[C.1] **Yudong Hu**, Yueju Han, Rui Sun and Jinke Ren. (2025). MSPCaps: A Multi-Scale Patchify Capsule Network with Cross-Agreement Routing for Visual Recognition. ***AAAI 2026***.

[J.1] Huijun Xing, Rui Sun, Jinke Ren, Jun Wei, Chun-Mei Feng, Xuan Ding, Zilu Guo, Yu Wang, **Yudong Hu**, Wei Wei, Xiaohua Ban, Chuanlong Xie, Yu Tan, Xian Liu, Shuguang Cui, Xiaohui Duan and Zhen Li. (2025). FlexFair: Achieving Flexible Fairness Metrics in Federated Learning for Medical Image Analysis. ***Nature Communications***, vol. 16, pp. 3342. DOI: https://doi.org/10.1038/s41467-025-58549-0.

Research Experiences & Projects

- **Hessian-Aware Sparse & Low-Rank Quantization for LLMs** *Sep. 2025 - Present*
  Research Assistant; The Chinese University of Hong Kong, Shenzhen
  Supervisor: Prof. Jinke Ren
  - Developed a hybrid framework to factorize LLM weights into sparse and low-rank components, which isolates outliers from structural redundancies.
  - Constructed a Hessian-weighted objective function that incorporates activation statistics to estimate and minimize layer-wise quantization error.
  - Designed an iterative alternating-minimization algorithm to find the optimal parameter allocation between the k-rank and s-sparse components for partial quantization.
- **Multi-Scale Based Patchify Capsule Network for Visual Recognition** *May 2025 - Nov. 2025*
  Research Assistant; The Chinese University of Hong Kong, Shenzhen [GitHub]
  Supervisor: Dr. Rui Sun and Prof. Jinke Ren
  - Developed a novel framework that generates part-whole capsules via uniform patchify operations.
  - Proposed an advanced Cross-Agreement Routing to match optimal part-to-whole pairs for the final voting process.
  - Achieved state-of-the-art performance on multiple public image classification benchmarks, and demonstrated exceptional robustness against adversarial attacks (FGSM & BIM attacks).
  - First-authored a paper accepted by the top-tier conference ***AAAI 2026***.
- **Multimodal Medical Image Prediction & Fairness Analysis** *Dec. 2023 - Apr. 2025*
  Research Assistant; The Chinese University of Hong Kong, Shenzhen [GitHub]
  Supervisor: Dr. Rui Sun, Prof. Jinke Ren and Prof. Xiaohui Duan
  - Standardized irregular 3D MRI data by applying multiple resampling techniques (Lanczos, Bilinear, etc.); processed regions of interest (ROIs) to improve data quality for lesion identification.
  - Designed a dual-stream framework integrating a pre-trained BERT and a 3D Vision Transformer (ViT); utilized contrastive learning and cross-attention mechanisms to align semantic text features with visual representations.
  - Researched the role of federated learning and fairness metrics in protecting data privacy. The research work has been published in ***Nature Communications***.
- **Implementation and Analysis of Denoising Diffusion Probabilistic Models (DDPM)** *May 2025 - Jun. 2025*
  Individual Project [GitHub]
  - Implemented the DDPM framework from scratch; systematically evaluated the performance of various beta schedulers, including linear, quadratic, constant, and warmup schedules.

- Investigated the paradigm shift from predicting the original image to noise; compared the performance of a baseline U-Net against a U-Net enhanced with a spatial attention mechanism.
- Achieved high-quality image generation on both the CIFAR-10 and CelebA datasets.

- **Autonomous Vehicle Navigation Simulation** *Mar. 2024 - Jun. 2024*
  Group Project [GitHub]
  - Developed a comprehensive robotics system in which the vehicle can operate autonomously using sensor data and perform simultaneous localization and mapping (SLAM).
  - Employed Gazebo for environment simulation and RViz for robot and sensor data visualizations.
  - Facilitated robot navigation by implementing a path planning and obstacle avoidance algorithm with LiDAR data.

Academic Services

- **Program Committee:** AAAI Conference on Artificial Intelligence (AAAI 2026)

Industry Experiences

- **Guangzhou Xiaopeng Motors Technology Co., Ltd.[Web]** *Jun. 2024 - Aug. 2024*
  Big Data Analytics Intern Guangzhou, China
  - Fulfilled data collection and image screening duties for an autonomous parking project (AVM-BEV-FSD); established corner cases for parking scenarios to meet daily data quotas.
  - Executed view stitching of parking scenarios using the IPS model; utilized the Redash platform to monitor daily data collection, identify data anomalies, and analyze their root causes.
  - Identified and reported image quality issues such as scene repetition and IPS inconsistencies; monitored various data collection metrics to inform potential risks and adjust volumes for different parking scenarios.

- **Sun Yat-Sen Memorial Hospital, Sun Yat-Sen University[Web]** *Jan. 2024 - Feb. 2024*
  Data Analytics Intern Guangzhou, China
  - Applied custom masks on 2D image slices to extract specific Regions of Interest (ROIs) for analysis.
  - Performed data compression and content extraction on medical imaging data (NIfTI format).

Skills

- **Programming Languages:** Python, MATLAB, JavaScript, Java, C++
- **Data Science & Machine Learning:** PyTorch, Numpy, Scikit-learn, Pandas, OpenCV, Eigen
- **DevOps & Version Control:** Git, Docker, Orbstack, Bash Scripting, MiniConda
- **Other Tools & Technologies:** Neovim, Linux, Latex, Ollama
- **Research Skills:** Literature Review, Experiment Design, Scientific Communication.