XIANG FEI

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EDUCATION

Carnegie Mellon University, USA   Aug. 2024 - Aug. 2026
Master of Science, Robotics, Robotics Institute at School of Computer Science
GPA: 4.08/4.00

The Chinese University of Hong Kong (Shenzhen), China   Sept. 2020 - May 2024
Bachelor of Engineering, Computer Science and Engineering, School of Data Science
Major GPA: 3.873/4.000 (Top 5%)

Honors & Awards
2020-2023 Dean's List Honor of School of Data Science, Sept. 2021 - 2023
2021-2022 Academic Performance Scholarship of The Chinese University of Hong Kong, Shenzhen, Dec. 2022
Undergraduate Research Award of The Chinese University of Hong Kong, Shenzhen, Nov. 2022
2020-2021 Master's List Award of Muse College, Nov. 2021
Bowen Scholarship of The Chinese University of Hong Kong, Shenzhen, Sept. 2020

University of California, Berkeley, USA   Jan. - May 2023
Visiting student
Cumulative GPA: 4.000/4.000
Core Courses: (CS182) Designing, Visualizing and Understanding Deep Neural Networks; (EECS C106B) Robotic Manipulation and Interaction; (CS170) Efficient Algorithms and Intractable Problems

PUBLICATIONS (INCLUDING WORKING PAPERS)

X. Fei, T. Tian, H. Choset, L. Li. *Bag of Word Groups (BoWG): A Robust and Efficient Loop Closure Detection Method Under Perceptual Aliasing.* IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) 2025. [Code]

X. Fei, H. Zhao, X. Zhou, J. Zhao, T. Shu, F. Wen. *Power System Fault Diagnosis with Quantum Computing and Efficient Gate Decomposition.* Scientific Reports. [Paper]

Y. Cao, X. Zhou, **X. Fei**, H. Zhao, W. Liu, J. Zhao. *Linear-Layer-Enhanced Quantum Long Short-Term Memory for Carbon Price Forecasting.* Quantum Machine Intelligence. [Paper, Code, Dataset]

X. Zhou, H. Zhao, Y. Cao, **X. Fei**, G. Liang, J. Zhao. *Carbon Market Risk Estimation Using Quantum Conditional Generative Adversarial Network and Amplitude Estimation.* Energy Conversion and Economics. [Paper]

X. Zhou, X. Wang, **X. Fei**, W. Liu, B. Xie, J. Zhao. *Carbon Disclosure Effect, Corporate Fundamentals, and Net-zero Emission Target: Evidence from China.* Submitted to Journal of Cleaner Production. [Abstract]

Data Analysis Team: **X. Fei**, H. Bi, S. Dai, Y. Xu, C. Tao. *Carbon Rating Report of China's 100 Overseas Listed Companies.* (REPORT) 2022 Global Forum on Sustainable Development. [PDF]

RESEARCH CONCENTRATION 1: Robotics Systems, and Simultaneous Localization and Mapping

Robust Loop Closure Module Development for In-pipe SLAM, *Researcher*   Jun. - Aug. 2023
Biorobotics Lab, Robotics Institute, Carnegie Mellon University (Mentor: Prof. Howie Choset)
- A definition of word groups exploiting the co-occurrence and proximity of visual words. This representation enriches the discriminative information of images with similar appearance
- An online word group database is designed and implemented, providing context-specific representation. Through the integration of direct and inverse index tables, our system achieves efficient loop closure detection suitable for large-scale applications
- Temporal consistency and feature distribution information are incorporated directly into the similarity score calculation, complemented by dedicated temporal and geometrical post-verification modules. These additions further improve the system's precision and recall
- First-authored the paper "Bag of Word Groups (BoWG): A Robust and Efficient Loop Closure Detection Method Under Perceptual Aliasing"

SLAM for Vision-based Navigation, *Researcher*   Mar. - May 2023

Berkeley AI Research Lab, University of California, Berkeley (Mentors: Dr. Chih-Yuan Chiu, Prof. Somil Bansal)

- Developed a novel autonomous navigation pipeline that utilizes both learning-based perception (LB-WayPtNav) and SLAM by establishing a switching mechanism based on the robot's states and the external environment
- Utilized reachability analysis to identify the scenarios (tight corners, narrow hallways) where LB-WayPtNav may fail to navigate
- Built experiment scenes and showed that the particle filtering SLAM-based navigation method effectively handles failure cases

EEG-driven Auditory Attention, *Researcher*   Sept. 2022 - Feb. 2023

Human Language Technology Laboratory, Shenzhen Research Institute of Big Data (Mentor: Prof. Haizhou Li)

- Conducted a comprehensive literature review to learn the foundations of EEG-based detection of the locus of auditory attention
- Collected tester-specific EEG data by using head-mounted EEG devices in a noise-free laboratory
- Implemented a CNN-based method with MATLAB to identify the locus of auditory attention without relying on knowledge of speech envelops, achieving an average accuracy of 88.5% in a decoding time of 1-2 seconds
- Joined the review team for ICASSP2023 and evaluated a paper on the combination of CNN and ViT for automatic sleep scoring

RESEARCH CONCENTRATION 2: Quantum Science and Engineering

Quantum Computing Algorithm for Power System Fault Diagnosis, *Researcher*   Aug. 2022 - May 2023

Energy Internet Lab, CUHKSZ (Mentor: Prof. Junhua Zhao)

- Developed a novel framework to tackle power system fault diagnosis using the quantum approximate optimization algorithm
- Derived the Hamiltonian for the power system fault diagnosis problem by utilizing the Ising model
- Proposed the symmetric equivalent decomposition of the multi-qubit rotation gate, which enhances problem-solving efficiency
- Incorporated the unique characteristic of small probability events in power system faults into the developed quantum algorithm
- Gained simulation results indicating that the proposed method achieves accurate optimal outcomes at a faster speed compared to the classical higher-order solver provided by D-wave
- First-authored the paper "Power System Fault Diagnosis with Quantum Computing and Efficient Gate Decomposition"

Quantum Machine Learning for Carbon Price Forecasting, *Researcher*   Apr. - Sept. 2022

Energy Internet Lab, CUHKSZ (Mentor: Prof. Junhua Zhao)

- Proposed and implemented a hybrid quantum computing-based carbon price forecasting framework called Linear-Layer-Enhanced Quantum Long Short-Term Memory (L-QLSTM)
- Implemented parameter sharing between linear and variational layers, reducing parameters and enhancing learning performance
- Results show that the proposed L-QLSTM method greatly improves the learning accuracy compared to the QLSTM method
- Co-authored the paper "Linear-layer-enhanced quantum long short-term memory for carbon price forecasting"

Carbon Market Risk Estimation Using Quantum GAN and Amplitude Estimation, *Researcher*   May - Oct. 2023

Shenzhen Institute of Artificial Intelligence and Robotics for Society (AIRS) (Mentor: Prof. Junhua Zhao)

- Proposed a quantum computing-based carbon market risk estimation framework that utilizes quantum conditional generative adversarial networks-quantum amplitude estimation (QCGAN-QAE) to enhance the estimation accuracy and efficiency
- Improved the circuit structure of the quantum generator in QCGAN by reordering the data entanglement layer and data rotation layer, while introducing the quantum fully connected layer before rotation operations
- Incorporated the binary search approach into QAE to bolster the computational efficiency
- Simulation results manifested that the proposed framework markedly enhances the efficiency and precision of Value-at-Risk (VaR) and Conditional Value-at-Risk (CVaR) compared to the original methods
- Authored a paper "Carbon Market Risk Estimation Using Quantum Generative Adversarial Network and Amplitude Estimation"

RESEARCH CONCENTRATION 3: Energy, Carbon Market, and Sustainability

The Impact of Carbon Disclosure on Company Financial Performance, *Researcher*   Jan. 2022 - Dec. 2022

Energy Internet Lab, CUHKSZ (Mentor: Prof. Junhua Zhao)

- Proposed an efficient table extraction pipeline incorporating PP-PicoDet (table detection), SLANet (table structure recognition), and PP-OCRv3 (table text extraction) to extract table content from ESG reports
- Utilized web crawlers and the proposed table recognition technology to establish a comprehensive database of emission disclosure information from 4336 Chinese A-share listed companies, covering data from 2017 to 2022
- Developed a difference-in-differences model to examine carbon disclosure behavior's impact on indicators of companies
- Investigated the correlation between company stock market performance, carbon disclosure behavior, and the implementation of

national/regional emission trading systems (ETS) in China
- Authored a paper "Carbon Disclosure Effect on Listed Companies under the Net-zero Emission Target: The Case of China"

Carbon Rating Report of China's 100 Overseas Listed Companies, *Researcher*   Aug. 2021 - Jun. 2022
Shenzhen Institute of Artificial Intelligence and Robotics for Society (AIRS) (Mentor: Prof. Junhua Zhao)
- Contributed to the collaborative effort to design an innovative method for calculating carbon scores
- Selected appropriate metrics capable of accurately measuring corporate carbon scores
- Conducted data collection and analysis, focusing on energy disclosure data from China's 100 overseas listed companies
- Published a comprehensive research report at the 2022 Global Forum on Sustainable Development

INTERNSHIPS

Winning Health Technology Group Co., Ltd., *Algorithm Engineer (Computer Vision)*   Jul. - Sept. 2022
- Took on the role of initiating the monocular endoscope 3D reconstruction project and implemented a sophisticated 3D reconstruction technique for the gastrointestinal tract [Project Report]
- Utilized the sparse reconstruction and camera pose obtained by Structure from Motion with SIFT descriptors as self-supervised signals to train a designed two-branch Siamese network to achieve dense depth estimation and feature descriptors
- Reconstructed a watertight triangle mesh surface of the gastrointestinal tract with high accuracy by using marching cubes method
- Contributed to creating a promotional video for the company's science and technology festival, highlighting creative teamwork

Shenzhen Teabreak Network Technology Co., Ltd., *Leader of the Back-end Development Department*   Dec. 2020 - Mar. 2022
- Played a key role in the development of more than 5 products, contributing to the backend program development, product strategy, requirements gathering, feature prioritization, and successful execution [Code]
- Successfully organized and executed Halloween promotion activities for JD.com, Inc. at CUHK(SZ), effectively engaging the target audience and driving participation and sales during the festive season
- Received recognition as the top-performing entrepreneurial team at the school's incubation base in 2021

EXTRACURRICULAR ACTIVITIES

Teaching Assistant of the Discrete Mathematics Course
- Conducted tutorial courses to assist students in their understanding of complex mathematical concepts and course material
- Developed homework assignments for students and provided timely and constructive feedback through grading
- Offered guidance and clarification to students, addressing their questions and concerns to enhance their learning experience

Peer Advisor of the School of Data Science
- Organized orientation activities to help freshmen acclimate to university life and foster a sense of community
- Facilitated communication between freshmen and professors, ensuring they had access to the necessary support and resources
- Provided advice on study strategies and overall student life, helping freshmen navigate their university experience

Member of the Chinese University of Hong Kong (Shenzhen) Basketball Team
- Participated in the second level of the Chinese University Basketball League
- Engaged in friendly matches against opponents such as Shenzhen Technology University and Shenzhen Sports School

COMPETITION & AWARDS

National University Student Energy Economy Academic Creativity Competition
  · 2023 National Outstanding Award of Graduate Group (National Top 10)   May 2023
  · 2022 National Outstanding Award of Undergraduate Group (National Top 5)   May 2022
2022 CCF "Sinan Cup" Quantum Computing Programming Competition
  ·National Second Prize (National Top 18)   Aug. 2022
2022 Mathematical Contest in Modeling
  ·Meritorious Winner (Global Top 7%)   May 2022

INTERESTS, LANGUAGES, SKILLS

Previous Fields of Research: Robotics Systems; Simultaneous Localization and Mapping (SLAM); Quantum Science and Engineering; Computer Vision; Energy, Carbon Market and Sustainability
Languages: English (TOEFL 103; GRE 325+4), Mandarin (native)
Skills: ROS, Python, Pytorch, C++, C, Matlab, Linux, Git, CUDA, Django, MySQL, Latex, Microsoft Office