Yuji Cao

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Education

The Chinese University of Hong Kong, Shenzhen — Shenzhen, China
M.Sc., Bioinformatics, cumulative GPA: 3.44/4.00 — *Sep 2022 – Dec 2023 (expected)*

- **Relevant coursework:** Deep Learning, Statistics, Machine Learning

The Chinese University of Hong Kong, Shenzhen — Shenzhen, China
B.Eng., Computer Science and Engineering, cumulative GPA: 2.89/4.00, major GPA: 3.19/4.00 — *Sep 2017 – Jul 2021*

- **Relevant coursework:** Optimization, Mathematical Analysis, Probability and Statistics, Machine Learning

Publications

1. **Y. Cao**, H. Zhao, G. Liang, J. Zhao, H. Liao, and C. Yang, "Fast and explainable warm-start point learning for AC Optimal Power Flow using decision tree," International Journal of Electrical Power & Energy Systems, vol. 153, p. 109369, 2023. (***JCR Q1***)

2. **Y. Cao**, X. Zhou, X. Fei, H. Zhao, W. Liu, and J. Zhao, "Linear-layer-enhanced quantum long short-term memory for carbon price forecasting," Quantum Machine Intelligence, vol. 5, no. 2, pp. 1–12, 2023.

3. J. Ruan, Y. Zhou, **Y. Cao**, S. Lei, G. Liang, J. Qiu, J. Zhao, Z. Xu, "Privacy-preserving bi-level optimization of internet data centers for electricity-carbon collaborative demand response," IEEE Transactions on Sustainable Energy (under review)

4. S. Wang, H. Zhao, **Y. Cao**, Z. Pan, J. Zhao, "Deep reinforcement learning-based bi-level active power control for wind storage integrated system with physics-informed neural network," IEEE Transactions on Smart Grid (under review)

5. X. Zhou, H. Zhao, **Y. Cao**, J. Zhao, "Carbon market risk estimation using quantum generative adversarial network and amplitude estimation," Information Science (under review)

Research Experience

Quantum model-based reinforcement learning for stochastic optimization — *Jul 2023 – Present*
Advisors: Dr. Huan Zhao, Prof. Junhua Zhao

- Proposed a quantum model-based reinforcement learning framework for where the environment optimization model is replaced by a quantum circuit.
- Constructed the environment system quantum circuit based on the Ising formulation of the original quadratic unconstrained binary optimization (QUBO) problem.
- The Hamiltonian in environment quantum circuit incorporated the distribution of uncertainty and thus the distribution of solution can be directly obtained by measuring the results for sufficient times.

Strategic bidding in joint carbon-electricity market with deep RL — *Nov 2022 - March 2023*
Advisors: Dr. Huan Zhao, Prof. Junhua Zhao

- Proposed a Markov decision process(MDP) for strategic bidding of generation companies participating in the joint carbon-electricity market.
- Developed deep reinforcement learning method to address the strategic bidding problem.
- Used dynamic carbon emission factors for different generators to accurately estimate the carbon footprint.

Linear-layer-enhanced quantum LSTM for carbon price forecasting — *Jul 2022 – Nov 2022*
Advisors: Dr. Huan Zhao, Prof. Junhua Zhao

- Designed a hybrid quantum computing framework with a quantum machine learning model for carbon price forecasting.
- Proposed L-QLSTM by employing linear layers before and after the variational quantum circuit(VQC) to extract feature representations, reduce the number of qubits and increase the learning ability of VQCs.
- Replaced the original VQC with a strongly entangled controlled-Z quantum circuit and quantum gates and connections between different quantum bits are optimized for stronger quantum entanglement and better expressibility.

Fast and explainable warm-start point learning for AC-OPF by decision tree *Jan 2022 – Jul 2022*
Advisors: Dr. Huan Zhao, Prof. Gaoqi Liang, Prof. Junhua Zhao

- Proposed a multi-target binary decision tree-based model to provide warm-start points for the AC-OPF problem. The warm-start point methods accelerate the AC-OPF solving process significantly and the model inference time is extremely short (on the microsecond timescale).
- Adopted post-pruning method to fit different power system scenarios fairly and alleviate the overfitting problem.
- Extracted a set of decision rules from the trained models to explain the power system considerations behind the calculated warm-start points and also identify important loads.

Expandable multi-agent reinforcement learning for real-time AC-OPF *Jul 2021 – Dec 2021*
Advisors: Dr. Huan Zhao, Prof. Junhua Zhao

- Proposed expandable multi-agent reinforcement learning framework to solve the real-time AC-OPF problem in distributed power systems with scalability and feasibility.
- Designed a communication-efficient consensus methodology that decomposes the power system into areas with each governed by an agent and allows individual agents to learn a group control policy using local rewards.

Low-carbon data center spatio-temporal scheduling *Jun 2020 – Dec 2020*
Advisors: Prof. Gaoqi Liang, Dr. Guolong Liu, Dr. Jiaqi Ruan, Prof. Junhua Zhao

- Proposed a bi-level data center optimization framework considering distributed PV and BESS for low-carbon demand response by shifting computational tasks spatially across different geographical locations.
- Incorporated distributed PV and BESS into the model, which, based on spatial scheduling, enhances the temporal utilization efficiency of energy, thereby achieving spatio-temporal demand response for data centers.

Academic Services

Reviewer for Energy Conversion and Economics

Teaching Experience

Statistical Genetics and Genomics (Spring 2023) Shenzhen, China
Teaching Assistant, Instructor: Prof. Jin Liu *Jan 2023 – May 2023*

- Prepared tutorial slides of statistical knowledge for undergraduate students.
- Designed Linux lab tutorials and instructed students to perform computational tasks on servers.

Reading For Excellence in Economics and Finance (Fall 2018, Spring 2019) Shenzhen, China
Teaching Assistant, Instructor: Prof. Chak Wong *Sep 2018 – Aug 2019*

- Cultivated students' ability of critical thinking by organizing discussion seminars and writing non-fiction book reviews.

Awards & Achievements

National Second Prize in CCF "Pilot Cup" Quantum Computing Competition in Jun 2022

Honorable Mention, The Mathematical Contest in Modeling in March 2020

Skills

Programming languages: MATLAB, Python, C/C++, R, Bash

Tools and Frameworks: PyTorch, TensorFlow, MATPOWER, Git, Linux, LaTeX, Prophet

Specialized Skills: Reinforcement Learning, Power System Modeling, Quantum Computing