

Jiayang Ren

Portfolio: jiayang.site

Linkedin: [linkedin.com/jiayang-ren](https://www.linkedin.com/in/jiayang-ren)

Email: rjy12307@mail.ubc.ca

EDUCATION

- **University of British Columbia** Vancouver, Canada
Ph.D. in Chemical Engineering, Advisor: Dr. Yankai Cao, GPA:98.0/100 Sep 2021 - Current
- **Zhejiang University** Hangzhou, China
M.S. in Control Engineering, Advisor: Dr. Dong Ni, GPA: 88.9/100 Sep 2018 – June 2021
- **Zhejiang University** Hangzhou, China
B.A. in Automation, GPA: 3.80/4.0 Sep 2014 – June 2018

RESEARCH INTERESTS

- Intersection of Large-Scale Global Optimization, Machine Learning and Control

CONFERENCE PROCEEDINGS

- [**NeurIPS 2022**]: **Ren, J.**, Hua, K. and Cao, Y. (2022). Global Optimal K-Medoids Clustering of One Million Samples. Advances in Neural Information Processing Systems. Accepted.
- [**NeurIPS 2022**]: Hua, K., **Ren, J.** and Cao, Y. (2022). A Scalable Deterministic Global Optimization Algorithm for Training Optimal Decision Tree. Advances in Neural Information Processing Systems. Accepted.
- [**ICML 2022**]: Shi, M., Hua, K., **Ren, J.**, and Cao, Y. (2022). Global Optimization of K-Center Clustering. International Conference on Machine Learning. pp. 19956-19966.
- [**FOCAPO/CPC 2023**]: Okamoto, M., **Ren, J.**, and Cao, Y. (2023). Approximation of Nonlinear Model Predictive Control Using Mixture Density Networks. Foundations of Computer Aided Process Operations / Chemical Process Control 2023. Accepted.
- [**IFAC 2023**]: Okamoto, M., **Ren, J.**, and Cao, Y. (2023). Approximation of Model Predictive Control for Scheduling Using Bernoulli Mixture Networks. IFAC World Congress 2023. Under Review.
- [**ESCAPE-33**]: **Ren, J.**, Hua, K. and Cao, Y. (2023). Global Optimal Explainable Models for Biorefining. The 33rd European Symposium on Computer-Aided Process Engineering. Accepted.
- [**CAC 2019**]: **Ren, J.**, and Ni, D. (2019) Real-time Fault Detection System for Multiphase Plasma Etching Process using OES, Two-Step Division and Change Stage Alignment Method. 2019 Chinese Automation Congress (CAC). pp. 599-604.

JOURNAL ARTICLES & PATENTS

- [**Operations Research**]: **Ren, J.**, Hua, K. and Cao, Y. (2022). A Parallelization-enabled Global Optimization Algorithm for K-Center Clustering of One Billion Samples. Operations Research. Submitted.
- [**IECR**]: Li, Y., Wang, Y., Chen, Y., Lu, Y., Hua, K., **Ren, J.**, ... and Cao, Y. (2022) Deep-Learning-Based Predictive Control of Battery Management for Frequency Regulation. Industrial Engineering Chemistry Research. 61(24): 8432-8442
- [**IEEE TSM**]: **Ren, J.**, and Ni, D. (2021) A Real-Time Monitoring Framework for Wafer Fabrication Processes With Run-to-Run Variations. IEEE Transactions on Semiconductor Manufacturing, 34(4): 483-492.
- [**CHERD**]: **Ren, J.**, and Ni, D. (2020) A batch-wise LSTM-encoder decoder network for batch process monitoring. Chemical Engineering Research and Design. 164. 102-112
- [**Patent**]: Ni, D., Zhu, F. and **Ren, J.** (2018) Plasma components spatial distribution method for real-time measurement and its device based on light spectrum image-forming.

RESEARCH EXPERIENCE

- **Global Optimization Algorithms for Large-Scale Machine Learning** Vancouver, Canada
Research Assistant, Advisor: Dr. Yankai Cao Sep 2021 - Current
 - Explore the **global optimal solutions of large scale machine learning problems** (e.g. ten million or one billion samples, typically 100 times SOTA), including K-Means, K-Medoids, K-Center, and Decision Tree.
 - Tailor the **reduced-space spatial branch and bound strategy** for clustering and decision tree training.
 - Develop efficient **lower bounding methods using scenario relaxation techniques**, such as scenario linear relaxation, scenario Lagrange decomposition and so on.
 - Investigate the structures of problems to design corresponding **bound tightening** and **sample reduction** methods to reduce the search space.
 - GPU and CPU enabled Parallel Computing for accelerating the solving process.

- Real-time Fault Detection and Diagnosis System for Batch Processes** Hangzhou, China
Research Assistant, Advisor: Dr. Dong Ni Sep 2018 – June 2021
 - Deployed **Multivariate Statistical Analysis** methods like PCA and **Time Series Analysis** methods like SARIMA, LSTM in the system to capture the correlations among multiple variances.
 - Proposed a **differential weighted distance based phase aligning** method to solve the uneven phase duration problem in the multi-phase batch process.
 - Proposed a **SARIMA based state drift forecast-compensation framework** for batch process monitoring to solve the batch-to-batch state drifting problem in the continuous batch process, improving the fault detection rate by 50%, reducing the total model numbers for the factory level by 10x.
 - Proposed a **LSTM-Encoder Decoder network and the corresponding monitoring method** to solve the non-linear problem in the batch process, improving the fault detection rate by 100% under the same false alarm rate.
- Dynamic spectral feature extraction for plasma etch process** Hangzhou, China
Research Assistant, Advisor: Dr. Dong Ni Oct 2017 – Jun 2018
 - Employed **PCA** to extract dynamic information, **wavelet composition** to extract spectral peaks.
 - Combined dynamic information and spectral peaks to extract **dynamic spectral feature**.
 - Applied the method to optical emission spectral flow of plasma etch process, effectively obtained ma state in real-time and was proved to be consistent with the reaction mechanism

WORK EXPERIENCE

- Shanghai Huali Microelectronics Corporation** Shanghai, China
Intern Software Engineer, Director: Xiong Shao Dec 2019 – Jun 2020
 - Fault detection system design:** design and validate a real-time fault detection system for industrial-scale semiconductor manufacturing processes.
 - Data acquisition and preprocess:** acquire and denoise data streams from Hadoop databases in a real-time manner
 - Process modeling:** compare performance of different models including state space, PCA, Neural network based model.
 - Algorithm implementation:** implement a PCA based fault detection algorithm with machine adjustments, improve the fault detection rate by 50% and enlarge model suitability from 1 machine to one cluster of machines (~ 10 machines).
- Samsung Semiconductor (China) Research and Development Co.,Ltd** Hangzhou, China
Intern Software Engineer Apr 2017 – Sept 2017
 - Transplanted the **device tree seeking and reading API from Linux kernel** to U-Boot using C language

TEACHING EXPERIENCE

- Teaching Assistant: CHBE366 Chemical Engineering Lab (Data Analysis Lab) - UBC 01/2023 - 05/2023
- Student Mentor: Mitacs Globalink Program - Deep learning-based Control - UBC 05/2023 - 08/2023

HONORS & AWARDS

- NeurIPS 2022 Scholar Award 2022
- 17th Informs Data Mining Workshop - Best Theoretical Paper (Global Optimal Decision Tree) 2022
- University of British Columbia Affiliate Fellowship 2022-2023
- China Scholarship Council Doctoral Scholarship 2021-2025
- Zhejiang University Scholarship for Outstanding Students 2018-2021

PROFESSIONAL SERVICES

- NeurIPS 2022:** Thirty-sixth Conference on Neural Information Processing Systems, Poster Presenter
- CCEC 2022:** Canadian Chemical Engineering Conference 2022, Session Chair, Oral Presenter
- INFORMS 2022:** 2022 CORS/INFORMS International Conference, Oral Presenter
- ICML 2022:** Thirty-ninth International Conference on Machine Learning, Reviewer, Poster Presenter
- IET CSR:** IET Cyber-Systems and Robotics, Blog Writer for the General Audience

SKILLS & INTERESTS

- Knowledge:** Optimization, Machine learning, Control theory and application
- Programming:** Julia, Python, CPLEX, Gurobi, MPI, PyTorch, Scikit, Matlab, C, SQL
- Hobbies:** Photography, Cooking, Aerobic Sports (e.g., jogging, swimming, cycling, etc.)