Hua Zheng

zheng.hua1@northeastern.edu | hua.zheng0908@gmail.com | (206)565-7698

Personal Website: http://zhenghuazx.github.io/hua.zheng

Github: https://github.com/zhenghuazx | Linkedin: linkedin.com/in/hua-zheng-b064a8b0

PhD in Industrial Engineer and former 3-year ML Engineer. Industrial experience in big data, product search, recommender system; research experience in (deep) reinforcement learning, stochastic optimization and graphic model. Multi-disciplinary skill set including computer engineering (2-year SDE), optimization, machine learning (PhD research) and statistics (MS).

EDUCATION

Northeastern University, Mechanical and Industrial Engineering   *2019-present, Boston, WA*
PhD in Industrial Engineering | Honor: John and Katharine Cipolla PhD Merit Award
University of Washington, Department of Statistics | *M.S. in Statistics*   *2014-2016, Seattle, WA*
Shandong University, **Department of Mathematics** | *B.S. in Mathematics*   *2010-2014, Jinan, China*

SKILLS

- **Programming:** Scala, Python, R, Java; Familiar with Apache Spark, TensorFlow, Hadoop, and Keras;
- **Operations Research:** Computer Simulation, Stochastic Optimization, Discrete-event Simulation, Queueing;
- **Machine Learning:** Reinforcement learning (RL), deep learning, recommender system, Graphical Model and etc;
- **Statistics:** Stochastic model, Bayesian inference, method for messing data, advanced regressions, learning theory.

WORK EXPERIENCE

MIE Northeastern University.   *July. 2019-Present, Boston, MA US*
Research Assistant, PhD candidate | Supervising junior MS/PhD students (July, 2019 - Present)

- **Current Project**: (1) work on three research projects (related to reinforcement learning and stochastic modeling in system biology). (2) lead the NEU team (3 PhD including myself, 1 master and two undergraduate students) in a multi-million-dollar project (NIIMBL PC4.1-206) to build a simulation + AI platform (Python, Julia, service hosted on AWS) of biopharmaceutical manufacturing process.
- Cell therapy optimization: we optimize the decisions during cell culture using Bayesian RL.
- "Let AI remember and smartly learn from the past": We developed a novel variance reduction-based experience replay, a new "experience reply" method that allows policy optimization algorithms (e.g. PPO, TRPO) to intelligently select and reuse the most relevant historical trajectories; see GitHub.
- Created a deep deterministic policy gradient to control the oxygen flow rate to reduce the in-hospital mortality rate of COVID-19 patients from 7.9% to 2.6%; *collaborated with NYU Langone Health*.
- Innovated the dynamic Bayesian model-based reinforcement algorithm (DBN-RL) with the theoretical guarantee of local convergence. The empirical study showed DBN-RL achieved human-level control in a Yeast fermentation example with 15 episodes; see GitHub.
- Developed a deep Q network algorithm for personalized multimorbidity management for patients with type 2 diabetes using electronic health records; *collaborated with NYU Langone Health; see GitHub*.

Amazon Web Services (AWS), Inc.   *June. 2021-Sep. 2021, Seattle, WA US*
Applied Scientist Intern (with 2022 return internship offer)

- Developed a kNN-GBDT algorithm to solve a cold-start demand forecast problem. It models the associations between "nearby" historical time series in various sub-input spaces via k nearest neighbor search (KNN) and makes a forecast based on a gradient boosted decision tree (GBDT).

Point Inside, Inc.   *Nov. 2016-May. 2019, Bellevue, WA US*
ML Scientist, Research (1-year) & Software Engineer, Backend (2-year)

- **Responsibility**: Providing product search, recommendation, customer analytics, in-store map solution to Target, Lowes, and Macys. (<u>SDE</u>) Backend data pipeline and ML solution implementation; (<u>ML Scientist</u>) Model prototyping, recommender system and product location prediction.
- Led research projects, including data collection, modeling, architecture design and engineer projects including map viewport search and search by distance (Solr), Spark-Scala based "data enrichment" backend system to identify shopper visit behavior by processing billions of mobile locations per day.
- Led mobile location data enrichment project, which processes billions of location records per day and estimates probabilities of the visiting tenants/stores and analyzes users' in-store shopping behavior.
- Participated in Macy's Product Location Assignment project (Algorithm/ML solution).

Fields Institute for Research in Mathematics Sciences   *July 2013- Oct. 2013, Toronto, Canada*
Research Assistant, Supervised by Professor Matheus Grasselli

- Built locally stable differential equations system to extend Goodwin-Keen model with stock-flow consistency and adding new economic sectors.

PUBLICATIONS (6 Journals & 3 Conference Proceedings)

1. H. Zheng, W. Xie, and M. B. Feng, "[Variance Reduction based Experience Replay for Policy Optimization](#)". arXiv preprint arXiv:2208.12341, 2022 (under review by JMLR).
2. H. Zheng, W. Xie, I. O. Ryzhov, and D. Xie, "Policy optimization in dynamic Bayesian network hybrid models of biomanufacturing processes," INFORMS Journal on Computing, 2022. doi.org/10.1287/ijoc.2022.1232
3. H. Zheng and W. Xie, "Variance reduction based partial trajectory reuse to accelerate policy gradient optimization," in Proceedings of the 2022 Winter Simulation Conference. IEEE, 2022
4. W. Xie, K. Wang, H. Zheng, and B. Feng, "Sequential importance sampling for hybrid model Bayesian inference to support bioprocess mechanism learning and robust control," in Proceedings of the 2022 Winter Simulation Conference. IEEE, 2022.
5. H. Zheng, I. O. Ryzhov, W. Xie, and J. Zhong, "Personalized multimorbidity management for patients with type 2 diabetes using reinforcement learning of electronic health records," Drugs, vol. 81, no. 4, pp. 471–482, 2
6. H. Zheng, J. Zhu, W. Xie, and J. Zhong, "Reinforcement learning assisted oxygen therapy for covid-19 patients under intensive care," BMC medical informatics and decision making, vol. 21, no. 1, pp. 1–8, 20
7. H. Zheng, W. Xie, K. Wang, and Z. Li, "Opportunities of hybrid model-based reinforcement learning for cell therapy manufacturing process development and control," arXiv preprint arXiv:2201.03116, 2022
8. H. Zheng, W. Xie, and M. B. Feng, "Green simulation assisted reinforcement learning with model risk for biomanufacturing learning and control," in Proceedings of the 2020 WSC. 2020, pp. 337–3
9. W. Xie, Y. Yi, and H. Zheng. "Global-local Metamodel-assisted Stochastic Programming via Simulation." ACM Transactions on Modeling and Computer Simulation (TOMACS) 31.1 (2020): 1-34.

CONFERENCE PRESENTATION & TALKS

INFORMS Annual Meeting (virtual), 10/26/21.

Winter Simulation Conference (virtual), 12/15/20.

SCHOLARSHIPS AND AWARDS

- John and Katharine Cipolla PhD Merit Award (PhD)
- China National Scholarship (Undergraduate)
- Presidential Scholarship of Shandong University (Undergraduate)
- Provincial Level Outstanding Student in Shandong Province (Undergraduate)