Hua Zheng

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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-preesent, Boston, WA*
PhD in Industrial Engineering | GPA: 3.89
Honor: John and Katharine Cipolla PhD Merit Award

University of Washington, Department of Statistics *2014-2016, Seattle, WA*
M.S. in Statistics (Statistical Learning track) | GPA: 3.6

Shandong University, Department of Mathematics *2010-2014, Jinan, China*
*B.S. in Mathematics | Overall GPA: 91.75 | Rank **1st** over 38 (in class) and **2nd** over 188(in department)*

- Honor: President Scholarship (top 0.07% over 40,000), National Scholarship (top 1% over 200)
- Dissertation: Equity Market: Dynamical System in Macroeconomics Based on Keen's model.

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:** Bayesian inference, method for messing data, advanced regressions, learning theory.

WORK EXPERIENCE

MIE Northeastern University. *Nov. 2019-Present, Boston, MA US*
Research Assistant, PhD candidate

- Created a deep reinforcement learning algorithm to control ventilators (FiO2 & PEEP) to reduce the in-hospital mortality rate of COVID-19 patients by 7%; *collaborated with NYU Langone Health*.
- Innovated a sample efficient model-based reinforcement algorithm (BN-MDP) with theoretical guarantee of local convergence. Empirical study showed the policy learned by BN-MDP achieved human level control of Yeast fermentation with 15 episodes while DDPG used 3000 episodes to achieve the same performance; *collaborated with BioSEL Lab at UML.*
- Developed a deep Q network algorithm for personalized multimorbidity management for patients with type 2 diabetes based on electronic health records; *collaborated with NYU Langone Health.*
- Developed a novel experience reply method based on likelihood ratios for RL and tested it in chromatography control problem, which shows significant acceleration of convergence. (Published)

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, Lowe's and Macys's. (SDE) Backend data pipeline maintenance and ML solution implementation; (ML Scientist) Model prototyping with Apache Spark, Keras and Mathout for information retrieval, search, product recommender system and product location assignment.
- 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 for each mobile location and analyzes users' offline shopping/dwelling behavior.
- Led Macy's Product Location Assignment project. Designed and built a multi-output deep learning architecture. There are two separated input layers: one for product text input followed by a pretrained embedding layer and the other one for high-dimensional categorical input. Then the merged layer is supervised by both department classification loss and x/y distance-based means squared loss.
- Implemented the autocomplete search, map viewport search and search by distance suing Apache Solr and worked their search relevancy improvement.
- Implemented recommender systems including algorithms: item-to-item recommender system, matrix factorization, Stochastic SVD, and Local Causal Discovery. (Apache Spark, Pig, Scala)

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: the equity market, which shows a stabilizing effect due to its function of absorbing more household savings.

DATA SCIENCE RELATED EXPERIENCE

- Participate in Kaggle NLP competition: toxic comment with multi-class learning (**top 3% on the LB**).
- Built a recommendation system using Wikipedia movie documents plus Netflix data (~ 90 million total ratings) via parallel SDG algorithm with GraphLab. Wikipedia information were crawled and represented with bag-of-words model and unified collaborative filtering was trained.
- Conducted more than 10 projects using existing R and python packages such as LMM, GMM, NN, etc.

PUBLICATIONS

- Hua Zheng, Wei Xie, Ben Feng (2020). Green Simulation Assisted Reinforcement Learning with Model Risk for Biomanufacturing Learning and Control. *Proceedings of the 2020 Winter Simulation Conference*. https://informs-sim.org/wsc20papers/028.pdf
- Xie, W., Yi, Y., & Zheng, H. (2020). Global-local Metamodel-assisted Stochastic Programming via Simulation. A*CM Transactions on Modeling and Computer Simulation (TOMACS)*, 31(1), 1-34.
- Zheng, H., Ryzhov, I. O., Xie, W., & Zhong, J. (2021). Personalized Multimorbidity Management for Patients with Type 2 Diabetes Using Reinforcement Learning of Electronic Health Records. *Drugs*, 81(4), 471-482.
- Wei Xie, B. Kris Jaeger-Helton, Jared Auclair, Jinxiang Pei, Hua Zheng (2020). STEM Education and Industry Workforce Life-Long Training Platform Development to Faciliate Smart Biopharmaceutical Manufacturing *Proceedings of the 2020 ASEE Zone 1 conference.*
- Zheng, H., Xie, W., Ryzhov, I. O., & Xie, D. (Preprint). Policy Optimization in Bayesian Network Hybrid Models of Biomanufacturing Processes. *arXiv* preprint arXiv:2105.06543.
- Zheng, H., Zhu, J., Xie, W., & Zhong, J. (Preprint). Reinforcement Learning Assisted Oxygen Therapy for COVID-19 Patients Under Intensive Care. *ArXiv*.

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)