

Qincheng (Daisy) Lu

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Highlights

I am a PhD candidate specializing in representation learning for graph and time-series, developing machine learning methods for integer parameter estimation in linear models and combinatorial optimization, with applications in wireless communications, signal processing and GNSS based positioning.

My expertise includes:

- **Graph Neural Network:** graph spectral theory, heterophilic learning
- **Deep Generative Models:** VAE, diffusion models
- **Time-series Representation Learning:** Transformer, SSM, neural ODE

Skills

- **Programming Language:** Python, R, MATLAB, C, C++, Java, SQL
- **Computing Libraries:** NumPy, SciPy, Pandas, Scikit-learn, PyTorch, TensorFlow

Education

- **Ph.D. Computer Science, 4.0/4.0** 09/2020 – Flexible
School of Computer Science, McGill University, Montreal, Canada
Advisor: [Xiao-Wen Chang](#)
- **M.Sc. Statistics, 90.8/100 (A+)** 09/2018 – 08/2020
Dept. of Mathematics and Statistics, University of Victoria, Victoria, Canada
Advisor: [Xuekui Zhang](#)
- **LLB, 3.64/4.0 | Minor in Data Science, School of Computer Science, 3.6/4.0** 09/2014 – 06/2018
Fudan University, Shanghai, China

Professional Experience

- **Co-op Student - BC Ministry of Health** 01/2020 – 05/2020
 - Developed a Shiny application served as a data center for analyzing and reporting.
 - Automated data collection and data quality evaluation using R language.
 - Significantly improved the data analysis efficiency for the team.
- **Developer - Google Summer of Code, R Project for Statistical Computing** 05/2019 – 08/2019
 - Implemented five new optimization methods in C++ and extended test cases in R.
 - Employed the SAGA algorithm with optimal batch/step size and cache locality.
 - Proposed new algorithms for non-convex penalty and not-Lipschitz-continuous derivative.
- **SDE Intern - Dell EMC Shanghai R&D Center** 02/2018 – 09/2018
 - Developed a web application connecting Avamar servers using Django, Paramiko, and SQLite3.
 - Implemented test strategies for installation, upgrade, and hotfix for multiple releases of Avamar.
 - Managed cluster network for DPSearch team, developed and extended tools for internal usage.
- **Mitacs Globalink Research Intern-University of Victoria, Dept. of Economics** 06/2017-09/2017
 - Built an analytics pipeline for text mining and text data pre-processing for research using STATA.

Activities

- Lecturer of Numerical Computing to over 200 students at McGill University Fall 2021, 2023
- Organizer of LoG 2023 Montreal Meetup, presented tutorial for LoG 2024 2023, 2024

Research Experience

- **PhD Research Assistant** - McGill University 09/2020 – Present
 - **Graph Neural Network**
 - Proposed the graph convolution-enhanced expectation propagation network to infer the integer parameters in linear models for MIMO detection. Published at GLOBECOM 2024.
 - Proposed the flexible diffusion with parameterized Laplacian. Published at LoG 2024 (PMLR).
 - Conducted research on the modeling and theoretical analysis for heterophilic-specific Graph Neural Network. Published at NeurIPS 2022, 2023.
 - **Generative AI**
 - Proposed a VAE for parameter estimation in integer least squares problem. Published at ISIT 2023.
 - Conducted research on diffusion models to generate solutions for unconstrained integer linear system to resolve the integer ambiguities in GPS positioning. Ongoing.
 - Developed foundation models for time-series forecasting using generative pre-training on biosignals and longitudinal medical data. Published at MLHC (PMLR), ACM BCB, NeurIPS TSALM, 2024.
- **Master Research Assistant** – University of Victoria 09/2018 – 08/2020
 - Conducted research on a non-parametric approach for detecting differentially expressed genes on scRNAseq data with an abundance of zero and multimodality.

Publications

1. **Q. Lu**, S. Luan, and X.-W. Chang. GCEPNet: Graph Convolution-Enhanced Expectation Propagation for Massive MIMO Detection. To Appear in Proceedings of the 2024 IEEE Global Communications Conference (GLOBECOM).
2. **Q. Lu**, J. Zhu, S. Luan, and X.-W. Chang. Flexible Diffusion Scopes with Parameterized Laplacian for Heterophilic Graph Learning. To Appear in the Proceeding of Machine Learning Research (PMLR) for Learning on Graphs Conference (LoG), 2024.
3. Z. Song, **Q. Lu**, H. Zhu, and Y. Li. Bidirectional Generative Pre-training for Improving Time-series Representation Learning. To Appear in Proceedings of the 9th Machine Learning for Healthcare Conference (MLHC) and the Proceeding of Machine Learning Research (PMLR), 2024.
4. Z. Song, **Q. Lu**, H. Xu, and Y. Li. TimelyGPT: Extrapolatable Transformer Pre-training for Long-term Time-series Forecasting in Healthcare. To Appear in ACM Conference on Bioinformatics, Computational Biology, and Health Informatics (ACM-BCB), 2024.
5. Z. Song, **Q. Lu**, H. Zhu, D. L. Buckeridge, and Y. Li. TrajGPT: Healthcare Time-series Representation Learning for Trajectory Prediction. In NeurIPS Workshop on Time Series in the Age of Large Models, 2024.
6. S. Luan, C. Hua, **Q. Lu**, L. Ma, L. Wu, X. Wang, M. Xu, X.-W. Chang, D. Precup, R. Ying, et al. The Heterophilic Graph Learning Handbook: Benchmarks, Models, Theoretical Analysis, Applications and Challenges. arXiv preprint arXiv:2407.09618, 2024.
7. S. Luan, C. Hua, M. Xu, **Q. Lu**, J. Zhu, X.-W. Chang, J. Fu, J. Leskovec, and D. Precup. When Do Graph Neural Networks Help with Node Classification? Investigating the Homophily Principle on Node Distinguishability. Proceedings of NeurIPS 2023.
8. X.-W. Chang, **Q. Lu**, and Y. Xu. Success Probabilities of L2-norm Regularized Babai Detectors and Maximization. Proceedings of the 2023 IEEE International Symposium on Information Theory (ISIT).
9. X.-W. Chang, **Q. Lu**. A Machine Learning-based Method for Resolving GNSS Integer Ambiguities. 2023 International Congress on Industrial and Applied Mathematics, Talk.
10. S. Luan, C. Hua, **Q. Lu**, J. Zhu, M. Zhao, S. Zhang, X.-W. Chang, and D. Precup. Revisiting Heterophily for Graph Neural Networks. Proceedings of NeurIPS 2022, Spotlight.