Yu (Demi) Qin

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EDUCATION

Tulane University, *New Orleans, LA*
Ph.D. in Computer Science — *Sep. 2018 – July. 2024*
Dissertation Topic: *Metric Learning on Topological Descriptors*
Advisors: Prof. Brian Summa and Prof. Carola Wenk — GPA: 3.8/4.0

Chongqing University, *Chongqing, China*
Bachelor of Science in Computer Science — *Aug. 2014 – Jun. 2018*
Graduated top of the class in B.S. Computer Science (1/145) — GPA: 3.8/4.0

PROFESSIONAL EXPERIENCE

Hitachi America, Ltd.

Advisors: Dr. Frank Kloster and Dr. Chi Heem Wong — *Jul. 2023 – Present.*
Research Science Intern at IoT Edge Lab

- Partnered with Stanford University's Dr. Jure Leskovec's lab, co-developing advanced models for supply chains using **Graph Neural Networks (GNN)** capable of temporal graph analysis and prediction.
- Developed the first temporal hyper-heterogeneous graph network in collaboration with the Stanford team. This innovative **GNN** framework models complex supply chain networks, forecasting future transactions between firms, predicting inventory levels, and estimating the Bill of Materials (BoM). The model serves as a strategic tool for inventory management, risk assessment for product shortages, and demand forecasting [Slide].
- Introduced an interpretable sequence prediction model utilizing a custom **Recurrent Neural Network (RNN)** enhanced with an attention mechanism. This model precisely forecasts product consumption and uncovers underlying patterns in inventory data, enhancing BoM estimations with improved accuracy.

National Renewable Energy Laboratory (NREL)

Advisors: Graham Johnson, Dr. Kristi Potter — *Jun. 2022 – Present.*
Graduate Intern at Data, Analysis, and Visualization Group

- Enhanced the detection of extreme climate events by applying **Topological Data Analysis (TDA)** to time-series wind data (i.e. wind speed in various heights) based on global climate models. Achieved a significant computational speed-up, reducing the detection time from quadratic to linear complexity, translating to a minimum 10-fold increase in efficiency. Work published in the EnergyVis 2023 [Slide] [Video].
- Transformed complex datasets from simulated power systems experiencing various outage scenarios into a computationally efficient topological framework. Developed a topology-enhanced **GNN** model that effectively predicts power outages, with a case study focused on the Texas power grid.

Tulane University

Advisors: Prof. Brian Summa, Prof. Carola Wenk — *Sep. 2018 – Present.*
Research Assistant

- Led the development and deployment of advanced machine learning models that enrich **Topological Data Analysis (TDA)** with representation learning, using **generative models (GAN), and Graph Neural Networks (GNN)**. Proposed customized machine learning models for the TDA field, effectively tackling scalability challenges. This innovation significantly improves the extraction and encapsulation of complex structures in large datasets, increasing both efficiency and accuracy. Applied across various domains, such as medical imaging, scalar field analysis, simulation data, graph structures, and 3D shape analysis [Slide].

SELECTED RESEARCH PROJECTS

Visualizing Topological Importance: A Class-Driven Approach

Paper, *Slide* — *Jan. 2022 – Mar. 2023*

- Innovated a method that combines deep metric learning with explainable machine learning techniques to illuminate the role of topological features in data classification. This approach delivers high-accuracy results and transcends traditional classification limits. It particularly excels in graph predictions for protein datasets and showcases enhanced performance and interpretability in medical imaging and 3D shape analysis.

Scalable, Content-Based, Domain-Agnostic Search of Scientific Data through Concise Topological Representations

Website, *Paper* *Aug. 2021 – Sep. 2023*

- Initiated and successfully developed an unprecedented approach for generating binary topological representations using **GAN**, complete with domain-independent training protocols. This advanced strategy significantly condensed the time required for topological descriptor comparisons, from lengthy hours to swift milliseconds, while maintaining the representational quality essential for effective clustering tasks.

Quantifying Morphologic Phenotypes in Prostate Cancer-Developing Topological Descriptors for Machine Learning

Website, *Paper* *Sep. 2018 – Feb. 2023*

- Realized a notable 10% enhancement in the precision of prostate cancer severity by engineering a state-of-the-art, scalable, and structure-informed machine learning framework. This advancement was catalyzed by the utilization of innovative topological descriptors applied to whole-slide pathology images, facilitating the quantitative discernment of previously undetected structural characteristics inherent in cancerous cells.
- Led the development and maintenance of an advanced laboratory annotation system [Link] for medical imaging, which was augmented with a custom shape analysis plug-in. This enhancement significantly improved the system's capabilities for detailed image annotation, equipping researchers with sophisticated tools for comprehensive morphological analyses.

PUBLICATIONS

[1] **Qin, Yu**, Brittany Terese Fasy, Carola Wenk, and Brian Summa. *"Rapid and Precise Topological Comparison with Merge Tree Neural Networks,"* Under review at IEEE VIS 2024.

[2] Chang, Serina, ChiHeem Wong, **Yu Qin**, Zhiyin Lin, Frank Kloster, Qi Xiu, and Jure Leskovec, *"Modeling Supply Chain Networks with Production Function,"* Under review, 2024.

[3] **Qin, Yu**, Graham Johnson, and Brian Summa. *"Topological Guided Detection of Extreme Wind Phenomena: Implications for Wind Energy."* In 2023 Workshop on Energy Data Visualization (EnergyVis), pp. 16-20. IEEE, 2023.

[4] **Qin, Yu**, Brittany Terese Fasy, Carola Wenk, and Brian Summa. *"Visualizing Topological Importance: A Class-Driven Approach."* In 2023 Topological Data Analysis and Visualization (TopoInVis), pp. 93-103. IEEE, 2023.

[5] **Qin, Yu**, Brittany Terese Fasy, Carola Wenk, and Brian Summa. *"A domain-oblivious approach for learning concise representations of filtered topological spaces for clustering."* IEEE Transactions on Visualization and Computer Graphics (IEEE VIS 2021) 28, no. 1 (2021): 302-312.

[6] **Qin, Yu**, Fasy, Brittany Terese, Brian Summa, and Carola Wenk. *"Comparing distance metrics on vectorized persistence summaries."* In Topological Data Analysis and Beyond Workshop at the 34th Conference on Neural Information Processing Systems (NeurIPS 2020). 2020.

[7] Liu, Yanjun, Junjian Huang, **Yu Qin**, and Xinbo Yang. *"Finite-time synchronization of complex-valued neural networks with finite-time distributed delays."* Neurocomputing 416 (2020): 152-157.

[8] Liu, Yanjun, **Yu Qin**, Junjian Huang, Tingwen Huang, and Xinbo Yang. *"Finite-time synchronization of complex-valued neural networks with multiple time-varying delays and infinite distributed delays."* Neural Processing Letters 50 (2019): 1773-1787.

SKILLS

Programming Languages: Python (Pandas, NumPy, Scikit-learn), C++, Java, Julia, R, JavaScript
Machine Learning: PyTorch, PyG, TensorFlow
Data Visualization: D3.js, React, Matplotlib, R Shiny, ParaView
Databases: MongoDB, MySQL
Parallel Computing: OpenMP, MPI
Development Tools: Anaconda, Git, Docker, AWS

SERVICES and AWARDS

- **Grace Hopper Celebration (GHC)** 2023 - GHC Scholar
- **Neural Information Processing Systems (NeurIPS)** 2022 -Student Volunteer with Travel Fund
- **IEEE Visualization Conference (VIS)** 2021 & 2022 & 2023 - Student Volunteer with the Travel Fund
- **Women in Machine Learning (WiML)** 2022 & 2023 - Mentor in the PhD Mentoring Program
- **Symmetry and Geometry in Neural Representations (NeurReps)** at NeurIPS 2023 - Program Committee