Yu (Demi) Qin

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SUMMARY

Machine Learning and Visualization researcher specializing in **Machine Learning (ML)**, **Visualization (VIS)**, and **Topological Data Analysis (TDA)**. Recognized for developing efficient and scalable ML methods with real-world impact, demonstrated through multiple first-author publications in top-tier venues (AAAI, NeurIPS, IEEE VIS), including a **Best Paper Award at IEEE VIS 2024**. Adept at interdisciplinary collaboration and experienced in leading innovative research projects in medical imaging, climate modeling, and supply chain analytics.

EDUCATION

Tulane University, *New Orleans, LA*
Ph.D. in Computer Science *2018 – 2025*
Dissertation Topic: *Metric Learning on Topological Descriptors*
Advisors: Prof. Brian Summa, Prof. Carola Wenk GPA: 3.8/4.0

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

PROFESSIONAL EXPERIENCE

Research Assistant, Tulane Visualization and Graphics Group *Sep 2018 – Present*
Tulane University, New Orleans, LA

- Developed large data analysis and visualization techniques integrating machine learning (**ML**), visualization (**VIS**), and topological data analysis (**TDA**).
- Achieved **100x speed-up** in similarity search in medical imaging and climate modeling pipelines. Published 5 first-author papers in top-tier venues (AAAI, NeurIPS, IEEE VIS), including a Best Paper Award at IEEE VIS 2024 (top 1% of submissions).
- Applied advanced ML (**CNNs, GANs, GNNs**) to enhance complex data analysis across medical imaging, climate modeling, large graphs, and 3D shapes, supporting scalable and precise data analysis and visualization.

Research Intern, IoT Edge Lab *Jul 2023 – Feb 2024*
Hitachi America Ltd., Santa Clara, CA

- Developed dynamic production model using graph neural networks **GNNs** to learn supply chain networks in collaboration with Stanford University. This is the first GNN model capable of jointly learning internal production functions and forecasting transactions in supply chain networks.
- Achieved a **6-50%** improvement in production function inference and an **11-62%** enhancement in transaction forecasting on real and synthetic data. Published and presented at AAAI 2025 (top 5% of submissions) and the Stanford Graph Learning Workshop 2023 (invited talk).
- Designed an interpretable sequence prediction model using a custom **Recurrent Neural Network (RNN)** with an attention mechanism. Enhanced BoM estimations by improving accuracy and efficiency in product consumption forecasting.

Graduate Intern, Data, Analysis, and Visualization Group *Jun 2022 – Aug 2024*
National Renewable Energy Laboratory (NREL), Golden, CO

- Developed efficient methods for detecting extreme climate events using TDA on **temporal-spatial** climate data. Reduced detection time from quadratic to linear complexity, resulting in a **10x speed-up** in computational efficiency. Presented and published findings at EnergyVis 2023 [Slide] [Video].
- Designed a node lifting approach to represent higher-order interactions inherent in complex networks. Expanded **topological deep learning** by transforming a graph into a hypergraph, where hyperedges are formed by grouping nodes that share the same attribute.

SELECTED TECHNICAL PROJECTS

Machine Learning Assisted Gigantic-Image Cancer Margin Scanner (Media Cover)
Website *Oct 2024 – Present*

- Developed an ML pipeline for pseudo H&E image generation, replacing the multi-step Beer-Lambert law based algorithm with a **Pix2Pix GAN** model, enabling automated, high-fidelity histopathology visualization with real-time inference on large whole-slide images.
- Designed a **neural style transfer** (**NST**) framework to adapt SIM images into realistic H&E-stained slides, improving staining accuracy for emerging H&E foundation models by refining reference image selection and optimizing VGG19 feature extraction.
- Led the development of an advanced image annotation platform for medical imaging. Integrated **DEACT** web UI framework and **Girder** data management platform. Developed a custom shape analysis plug-in, advancing the ability to annotate and analyze complex morphological data in cancer research.

Rapid and Precise Topological Comparison with Merge Tree Neural Networks
Website, *Paper* *Jun 2023 – Mar 2024*

- Developed the first neural network model for merge tree comparison (MTNN) by integrating **GNNs** with a novel topological attention mechanism.
- Achieved a **100x speed-up** over the previous state-of-the-art on benchmark datasets with an error rate below 0.1%, significantly advancing large-scale data analysis and visualization techniques. Published and awarded Best Paper at IEEE VIS 2024.

Scalable, Content-Based, Domain-Agnostic Search of Scientific Data
Website, *Paper* *Aug 2021 – Sep 2023*

- Initiated the first machine learning model for generating binary topological representations using **GANs** with domain-oblivious training. Reduced clustering time from hours to milliseconds and enabled rapid, interactive queries across diverse scientific data domains. Published at IEEE VIS 2021.

PUBLICATIONS (Full List)

[1] **Yu Qin**, Brittany Terese Fasy, Carola Wenk, and Brian Summa. "Rapid and Precise Topological Comparison with Merge Tree Neural Networks," *IEEE Transactions on Visualization and Computer Graphics* (*IEEE VIS 2024*). Best Paper Award

[2] Serina Chang, Zhiyin Lin, Benjamin Yan, Swapnil Bembde, Qi Xiu, Chi Heem Wong, **Yu Qin**, Frank Kloster, Xi Luo, Raj Palleti, and Jure Leskovec. "Learning production functions for supply chains with graph neural networks," *AAAI 2025 (oral)*.

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

[4] **Yu Qin**, Graham Johnson, and Brian Summa. "Topological Guided Detection of Extreme Wind Phenomena: Implications for Wind Energy." *EnergyVis*, IEEE, 2023.

[5] **Yu Qin**, 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*).

[6] **Yu Qin**, Brittany Terese Fasy, Brian Summa, and Carola Wenk. "Comparing distance metrics on vectorized persistence summaries." *Topological Data Analysis & Beyond, NeurIPS 2020*.

SKILLS

Programming: Python (Pandas, NumPy, sklearn), C++ (OpenGL, OpenCV), R, Java, JavaScript
Machine Learning: PyTorch, TensorFlow, PyG (PyTorch Geometric)
Visualization Tools: D3.js, React, Matplotlib, R Shiny, ParaView, ggplot
Databases: MongoDB, MySQL, Amazon Redshift
Parallel Computing: OpenMP, MPI
Platforms: Git, Docker, AWS, Anaconda