

# Yu (Demi) Qin

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Website

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## EDUCATION

**Tulane University**, *New Orleans, LA*

*Ph.D. in Computer Science*

*Sep. 2018 – Aug. 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

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## PROFESSIONAL EXPERIENCE

**Hitachi America, Ltd.**

*Advisors: Dr. Frank Kloster, Dr. Chi Heem Wong*

*Jul. 2023 – Feb. 2024*

Research Intern at IoT Edge Lab

- Developed the first dynamic production graphs to model complex supply chain network using **Graph Neural Networks (GNN)** in collaboration with Stanford University's Dr. Jure Leskovec's lab. This framework forecasts future business transactions, predicts inventory levels, and estimates the Bill of Materials (BoM) - [[Paper](#)].
- Achieved 6-50% improvement in inferring production functions over baselines and an 11-62% enhancement in forecasting future transactions on real and synthetic data. Work presented at the [Stanford Graph Learning Workshop 2023](#) (invited talk); Stanford Causal Science Conference 2023 (oral), and submitted to AAI 2024.
- Developed an interpretable sequence prediction model utilizing a custom **Recurrent Neural Network (RNN)** enhanced with an attention mechanism. This method 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

- Developed an innovative and efficient method for detecting extreme climate events using **Topological Data Analysis (TDA)** applied to time-series wind data from global climate simulations. Achieved significant computational speed-up, reducing detection time from quadratic to linear complexity, resulting in a 10-fold increase in efficiency. Work presented and published at EnergyVis 2023 workshop - [[Slide](#)] [[Video](#)].
- Accelerated the analysis of large-scale power systems by transforming 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 **large data analysis and visualization** systems integrating machine learning and TDA. Focused on scalable models for fast interactive queries, clustering, and classification across complex data types. Peer-mentored graduate-level Intro to Computer Graphics course. Published multiple first-author papers in top visualization and machine learning venues (VIS, NeurIPS), including the Best Paper Award at VIS.
  - Proposed and implemented advanced machine learning models (**GAN, CNN, and GNN**) in TDA, enhancing the extraction and representation of shapes and geometry in large datasets. Improved efficiency and accuracy for applications in medical imaging, scalar fields, simulation data, graph structures, and 3D shapes - [[Slide](#)].
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## SELECTED RESEARCH PROJECTS

**Visualizing Topological Importance: A Class-Driven Approach**

*Paper, Slide*

*Jan. 2022 – Mar. 2023*

- Innovated a novel method to uncover important topological and shape features in classification using deep metric learning, explainable machine learning techniques, and TDA. Outperforms classical and existing topological classification approaches especially in graph classification with enhanced interpretability. Work presented and published at TopoInVis 2023.

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

Website, Paper

Aug. 2021 – Sep. 2023

- Initiated and developed the first approach for generating binary topological representations using **GAN** with domain-oblivious training. This method reduced topological clustering time from hours to milliseconds while maintaining high quality. This binary representation enables rapid interactive queries across various data domains, particularly for unstructured data. It offers high speed and lower memory usage while maintaining high comparison quality. Work presented and published at IEEE VIS 2021.

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

Website, Paper

Sep. 2018 – Feb. 2023

- Developed classical machine learning models and **Convolutional Models (ResNet)** for prostate cancer medical image classification. Improved 10% in the accuracy of prostate cancer severity. Utilized innovative topological descriptors on whole-slide pathology images, enabling the quantitative detection of previously undetected structural characteristics in cancerous cells.
- Led the development and maintenance of an advanced laboratory annotation system [[Link](#)] for medical imaging using web UI framework **DEACT** and web-based data management platform **Girder**. Developed a custom shape analysis plug-in, significantly enhancing the system's capabilities for detailed image annotation and providing researchers with advanced tools for comprehensive morphological analyses.

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## PUBLICATIONS

- [1] **Qin, Yu**, Brittany Terese Fasy, Carola Wenk, and Brian Summa. "Rapid and Precise Topological Comparison with Merge Tree Neural Networks," Accepted by IEEE VIS 2024. - **Best Paper Award**
- [2] Chang, Serina, Zhiyin Lin, Benjamin Yan, Swapnil Bembde, Qi Xiu, Chi Heem Wong, **Yu Qin**, Frank Kloster, Alex Luo, Raj Palleti, and Jure Leskovec, "Learning production functions for supply chains with graph neural networks," Under review.
- [3] **Qin, Yu**, Brittany Terese Fasy, Carola Wenk, and Brian Summa. "Visualizing Topological Importance: A Class-Driven Approach." In Topological Data Analysis and Visualization (TopoInVis), pp. 93-103. IEEE, 2023.
- [4] **Qin, Yu**, Graham Johnson, and Brian Summa. "Topological Guided Detection of Extreme Wind Phenomena: Implications for Wind Energy." In Workshop on Energy Data Visualization (EnergyVis), pp. 16-20. 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.

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## SKILLS

**Programming Languages:** Python (Pandas, NumPy, sklearn), C++ (OpenGL, OpenCV), Java, Julia, R, JavaScript

**Machine Learning:** PyTorch, TensorFlow, PyG

**Data Visualization:** D3.js, React, Matplotlib, R Shiny, ParaView, ggplot, Power BI

**Databases:** MongoDB, MySQL, Redshift

**Parallel Computing:** OpenMP, MPI

**Development Tools:** Anaconda, Git, Docker, AWS

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## SERVICES and AWARDS

- **IEEE Visualization Conference (VIS) 2024** - Best Paper Award (Top 1% of Accepted Papers)
- **Symmetry and Geometry in Neural Representations (NeurReps)** at NeurIPS 2023 - Program Committee
- **Grace Hopper Celebration (GHC) 2023** - GHC Scholar
- **IEEE Visualization Conference (VIS) 2021 & 2022 & 2023** - Student Volunteer with Travel Fund
- **Neural Information Processing Systems (NeurIPS) 2022** - Student Volunteer with Travel Fund
- **Women in Machine Learning (WiML) 2022 & 2023** - Mentor in the PhD Mentoring Program
- **National Scholarship (China) 2017** - Top 0.2% Nationwide