

# Tianrui Qi

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## EDUCATION

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### Bachelor of Science in Computer Science

Jan 2023 - May 2025

*Georgia Institute of Technology, Atlanta, GA*

- GPA: 3.92/4.00
- Honors & Awards: President's Undergraduate Research Awards

### Bachelor of Science in Computer Science; Double Major in Mathematics

Sep 2020 - Dec 2022

*Rensselaer Polytechnic Institute, Troy, NY*

- GPA: 3.73/4.00
- Honors & Awards: Dean's Honor List (every semester)
- Minor: Economics

## EXPERIENCE

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### Undergraduate Research Assistant

Apr 2023 - Present

*Georgia Institute of Technology, Atlanta, GA*

*Jia Laboratory for Systems Biophotonics, PI: Dr. Shu Jia*

- Engineered a scalable 3D U-Net pipeline based entirely on simulated data for volumetric localization in single-molecule super-resolution microscopy, resolving sub-cellular structure down to 60 nm.
- Developed a patch-based prediction pipeline that flexibly adapts to various input volume sizes and achieves a 100x speedup over conventional deterministic localization methods.
- Integrated the redundant cross-correlation algorithm for drift correction with the deep learning-based prediction pipeline.

### Co-op

Jan 2024 - Aug 2024

*Regeneron Genetics Center, Tarrytown, NY*

*Therapeutic Area Genetics, Manager: Dr. Jing He*

- Utilized BERT-based large language models (LLMs) and unsupervised feature selection to obtain a vector representation in a bio-meaningful space for each whole exome sequencing (WXS) sample.
- Demonstrated that the representations capture sample-wise differences by predicting immune system indicators of The Cancer Genome Atlas Program (TCGA) skin cancer samples.
- Scaled up the pipeline to handle hundreds WXS samples with billion DNA sequences by optimizing parallel computing for high-performance computing (HPC) and enhancing file system efficiency through hashing.

### Undergraduate Research Assistant

Nov 2021 - Dec 2022

*Rensselaer Polytechnic Institute, Troy, NY*

*AI-based X-ray Imaging System Lab, PI: Dr. Ge Wang*

- Derived backward propagation formulation for quadratic neural networks and compared forward and backward propagation between quadratic and conventional neural networks mathematically.
- Implemented forward propagation, backward propagation, and training process of quadratic and conventional neural networks explicitly using NumPy in Python.
- Demonstrated that single-layer quadratic neural networks rival conventional neural networks with hundreds of neurons in classifying simulated and real-world Gaussian mixture data.

### Undergraduate Teaching Assistant

Sep 2022 - Dec 2022

*Rensselaer Polytechnic Institute, Troy, NY*

*Foundations of Computer Science, Instructor: Dr. David Goldschmidt*

- Led weekly recitation sessions to help students understand course material.
- Assisted students' understanding of weekly lab exercises and graded assignments and exams.

## PUBLICATIONS

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Keyi Han<sup>†</sup>, Xuanwen Hua<sup>†</sup>, **Tianrui Qi**<sup>†</sup>, Zijun Gao, Xiaopeng Wang, Shu Jia, “Volumetric Reconstruction and Localization Networks for 3D Single-molecule Localization Microscopy,” *manuscript in preparation* (expected 2024).

**Tianrui Qi**, Ge Wang, “Superiority of quadratic over conventional neural networks for classification of gaussian mixture data,” *Visual Computing for Industry, Biomedicine, and Art* (2022).

<sup>†</sup> denotes co-first authors

## PROJECTS

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**Datapath and Control for a Turing Complete ISA with Interrupt Handling**    **Aug 2023 - Dec 2023**  
*Georgia Institute of Technology, Atlanta, GA*

*Introduction to Systems and Networking, Instructor: Daniel Forsyth*

- Designed a single-bus datapath and an efficient four-ROM microcontroller for a Turing complete instruction set architecture (ISA), supporting arithmetic, logical, memory access, and control flow instructions.
- Handled basic and input device interrupts by additional hardware including new instructions, interrupt registers, signals, and I/O bus, along with software supports such as interrupt vector tables.

**Alternating Direction Method of Multipliers for Support Vector Machine**    **Jan 2022 - May 2022**  
*Rensselaer Polytechnic Institute, Troy, NY*

*Computational Optimization, Instructor: Dr. Yangyang Xu*

- Formulated the primal and augmented dual optimization problems for support vector machine (SVM) objective and developed alternating direction method of multipliers (ADMM) solver.
- Implemented the ADMM solver in MATLAB and reported the primal and dual feasibility violations at each outer iteration for the testing datasets.

## SKILLS

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**Programming Languages:** Python (PyTorch, NumPy, pandas), MATLAB, Java, C, C++, R, Swift (ARKit), Bash, MIPS.

**Development Tools:** Git, Conda, VSCode, JetBrains (PyCharm, IntelliJ, CLion, Android Studio), RStudio, Xcode.

**Computing Platforms:** Linux (Ubuntu), AWS (EC2, S3), HPC (Slurm).

**Software:** LaTeX, ImageJ, Adobe Illustrator.

**Laboratory:** optics and laser alignment, fluorescence imaging, fluorescence labeling, cell culture maintenance.

**Communication:** English (Professional), Mandarin (Native).