Tianrui (Eric) Qi

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Education

Bachelor of Science in Computer Science **Jan 2023 - (May 2025)**
Georgia Institute of Technology, Atlanta, GA GPA: 3.92/4.00
- Minor in Physics

Bachelor of Science in Computer Science; Double Major in Mathematics **Sep 2020 - Dec 2022**
Rensselaer Polytechnic Institute, Troy, NY GPA: 3.73/4.00
- Minor in Economics
- Dean's Honor List (all five semesters)

Experience

Startup Founder **Aug 2024 - Present**
Georgia Institute of Technology, Atlanta, GA
CREATE-X Idea to Prototype, Mentor: Dr. Xuanwen Hua
- Conceptualizing an AR platform that simulate interactions with 2D surfaces in a 3D space, addressing limitations of screens that only support 2D writing and drawing and VR apps that focus solely on fully 3D interactions.
- Exploring Apple's AR platforms and ARKit, assessing the extent of realistic user-environment interactions possible, and gathering user feedback to identify potential applications.
- Developing an iOS app that transforms a 3D indoor space into 2D canvas for creation and projects back to the space for viewing, with plans to expand to more complex environments and additional devices.

Co-op **Jan 2024 - Aug 2024**
Regeneron Genetics Center, Tarrytown, NY
Therapeutic Area Genetics, Manager: Dr. Jing He
- Obtrained a vector representation for each whole exome sequencing (WXS) sample by creating a bio-meaningful space using BERT-based large language models (LLMs) and unsupervised feature selection.
- 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 about 1,000 WXS samples with 100 billion DNA sequences by optimizing parallel computing for high-performance computing (HPC) and enhancing file system efficiency through hashing.

Undergraduate Research Assistant **Apr 2023 - Present**
Georgia Institute of Technology, Atlanta, GA
Jia Laboratory for Systems Biophotonics, Principal Investigator: Dr. Shu Jia
- Engineered a scalable 3D U-Net pipeline based entirely on simulated data for volumetric localization in single-molecule super-resolution microscopy, achieving resolution down to 20 nm.
- Developed a patch-based prediction pipeline that flexibly adapts to various input volume size 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.

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.

Undergraduate Research Assistant **Nov 2021 - Dec 2022**
Rensselaer Polytechnic Institute, Troy, NY
AI-based X-ray Imaging System Lab, Principal Investigator: 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 rivals conventional neural networks with hundreds of neurons in classifying simulated and real-world Gaussian mixture data.

Publications

Keyi Han†, Xuanwen Hua†, **Tianrui Qi**†, 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).

† *denotes co-first authors*

Projects

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 violation at each outer iteration for the testing datasets.

Windows of Susceptibility Analysis for Brain Diseases **Jan 2022 - Mar 2022**
Rensselaer Polytechnic Institute, Troy, NY
Data Mathematics, Instructor: Dr. Kristin Bennett

- Performed the windows of susceptibility analysis based on mouse data from a similar brain-in-a-dish model for mice using R with k-means clustering and principal component analysis (PCA).
- Analyzed the same sets of microcephaly-associated genes and Zika-associated genes and detected similar windows of susceptibility for Microcephaly and Zika-induced microcephaly in mice as in humans.

MIPS Processor in C **Sep 2021 - Dec 2021**
Rensselaer Polytechnic Institute, Troy, NY
Computer Organization, Instructor: Dr. Konstantin Kuzmin

- Designed a datapath for a reduced MIPS instruction set architectures (ISA) that support I-type instructions including `lw`, `sw`, `beq`, `addi`, R-type including `and`, `or`, `add`, `sub`, `slt`, `jr`, and J-type including `j`, `jal`.
- Implemented the datapath through a full gate-level circuit in C, including components of the processor like memory, control, arithmetic logic unit (ALU), decoder, adder, multiplexor, etc.

Skills

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 Plantforms: 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 (Proficient), Mandarin (Native).