Alex Qiuyang Wang

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Theoretical/Computational Neuroscience, Video Game Development, Interactive Simulation

EDUCATION

Georgia Institute of Technology — 2023.09-Present
Ph.D. student in Biology & Computational Science and Engineering — Atlanta, GA, U.S.

Columbia University in the City of New York — 2021.09-2022.12
M.S. in Applied Mathematics — New York, NY, U.S.

Wuhan University — 2017.09-2021.06
B.S. (Honors) in Chemistry — Wuhan, Hubei, China

RESEARCH EXPERIENCES

Georgia Insititute of Technology, School of Mathematics — 2023.09-Present
Doctoral Researcher (Advisor: Hannah Choi)
- Investigated the rank dependency of pruning algorithms in Recurrent Neural Networks (RNNs) with analytical results on eigenspaces and validation through large-scale simulations on memory integration tasks.
- Incorporated Dale's law and anatomically informed connectivity into RNN training. Further inferred functional connectivity among distinct neuronal populations by training multi-regional RNNs to reconstruct 2-photon calcium imaging data.
- Utilized One-hot Generalized Linear Model-Hidden Markov Model (GLM-HMM) to investigate the spiking patterns and functional connectives of VNC neurons in hawkmoths during multisensory integration.

Columbia University, Bionet Group — 2022.05-2022.12
Research Assistant (Advisor: Yiyin Zhou, Aurel Lazar)
- Developed a series of reduced photoreceptor models for phototransduction, which captures the luminance adaptation behavior based on the population dynamics of microvilli and molecular cascade.
- Co-developed a gain control model for amacrine cells in Drosophila with spatio-temporal Volterra feedback and divisive normalization.
- Accelerated the simulation speed of the Drosophila retina by implementing the reduced model on GPUs via CUDA, achieving a 15x speed increase.

Wuhan University, School of Mathematics and Statistics — 2020.09-2021.05
Research Assistant (Advisor: Jiwei Zhang)
- Explored and modeled the kinetic PDE governing Integrate-and-Fire neural network dynamics, emphasizing numerical solutions through moments closure and the maximum entropy principle.
- Simulated the CaMKII pathway and the CREB pathway in synaptic plasticity based on biochemical reactions to characterize their On/Off properties.

Wuhan University, College of Chemistry and Molecular Sciences — 2018.06-2019.06
Research Assistant (Advisor: Xianzheng Zhang)
- Developed a novel anti-bacterial method combining photodynamic therapy with chimeric peptides.

GAME PROJECTS

Neural Fireworks — 2025.06-Present

Puzzle game prototype where players wire excitatory and inhibitory neurons to spark chains of spikes to reactive memory cells in a dying brain, blending neuroscience rules with playful design and story about scientists (ongoing project).

Botting Alive (Team Lead in VGDev at Georgia Tech) — 2025.01-Present

Narrative game where players interact with voice bots through a broken Apple Watch while trapped in a coffin, blending puzzle mechanics with immersive storytelling (demo).

Publications

1. **Alex Q. Wang**, Soon Ho Kim, Hannah Choi[*] *Rank Dependency of Rescaled Pruning in Recurrent Neural Networks*, Working Paper (2025).

2. Aishwarya H. Balwani, **Alex Q. Wang**, Farzaneh Najafi, Hannah Choi[*] *Constructing Biologically Constrained RNNs via Dale'S Backprop and Topologically-Informed Pruning*, Under Revision at Science Advances (2024).

3. Ai-Nv Zhang[1], Wei Wu[1], Chi Zhang, **Qiu-yang Wang**, Ze-Nan Zhuang, Han Cheng, Xian-Zheng Zhang[*] *A Versatile Bacterial Membrane-Binding Chimeric Peptide with Enhanced Photodynamic Antimicrobial Activity*, Journal of Materials Chemistry B (2019).

Conferences

1. **Alex Q. Wang**, Vidit Tripathi, Hannah Choi[*] *Unraveling the Effects of Different Pruning Methods on Recurrent Neural Networks*, Georgia Tech Frontiers in Science Conference and Symposium (2025).

2. Vidit Tripathi, **Alex Q. Wang**, Hannah Choi[*] *Unraveling the Effects of Different Pruning Rules on Network Dynamics*, Computational and Systems Neuroscience (2025).

Teaching & Mentoring

Teaching/Lecture Assistant in Georgia Tech
    MATH 3670 Probability and Statistics (2025 Spring)
    MATH 1553 Intro to Linear Algebra (2024 Fall)
    BIOS 4401 Experimental Design & Statistical Methods for Biology (2024 Spring)
    APPH 1040/1050/1060 The Science of Physical Activity and Health (2023 Fall, 2024 Summer, 2025 Summer)
Mentor of Directed Reading Program at Georgia Tech Math (Mentee: Neil Dave, Graham Joonsar)
Reviewer of Undergraduate Research Symposium at Georgia Tech 2024, 2025

Social Activities and Volunteer

Team Lead at Georgia Tech Video Game Development club (VGDev)	2025.01-Present
Volunteer at Georgia Tech Undergraduate Research Symposium	2024.04, 2025.04
Advocator of Quantitative Biology Graduate Program at Georgia Tech	2024.03
Columbia University Multi-Faith Fellowship	2022.9-2023.2
Volunteer General Care & Support at Animal Haven, New York	2022.8-2023.4

Honors

Outstanding Scholarship for Visiting Student, Wuhan University	2020
Merit Scholarship for Hongyi Honor College, Wuhan University	2018, 2019
2nd Prize for Drama Competition in Division of Sciences, Wuhan University	2018

Skills

Programming: Python, C#, C, MATLAB, Julia
Libraries/Platforms: PyTorch, CUDA, PyCUDA, LaTeX, Networkx
Video Games: Unity, Godot, Aseprite, Blender
Experimental skills: Surgery & Anatomy on Rodents, Confocal Laser-Scanning Microscopy, Fluorescence Imaging