Yuhong Liu

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Education

June 2025 (expected) **Dr. rer. nat.**, Faculty of Mathematics and Natural Sciences — University of Bonn
Advised by Prof. Tatjana Tchumatchenko

June 2021 **M.S.**, Department of Applied Mathematics — University of Washington
Advised by Prof. Douglas Martin

May 2019 **B.S.**, Department of Mathematics — Baruch College, CUNY

Research Interest

I am broadly interested in studying neural dynamics to understand how brains work and uncovering the governing laws that generate such dynamics. My research is driven by questions in three areas: **1)** how does the brain function on various levels such as molecular, synaptic, and network levels **2)** how does the brain process information, **3)** how does the brain evolve under its intrinsic mechanism (as in **1)**) and the influence of information processed (as in **2)**). Specifically, I am interested in:

1. **Multi-scale models that link cellular processes to network dynamics** incorporating known biological and chemical characteristics of proteins of interest into dynamical system framework and generating testable hypotheses for further experiments.
2. **Geometric analysis of population dynamics of neurons:** to better understand symmetry and latent space embedded in population activity
3. **Bayesian models for state estimation:** to construct models that properly represent and compute with sensory uncertainty

Publication

Conference Paper

[C1] Christopher R. Hayner, Timothy Zhou, Neil Gupta, **Yuhong Liu**, Parker Mayhew, and Juris Vagners. *"Real-time Human Detection with Integration of Visual and Thermal Data from High Altitude sUAS,"* AIAA 2021-0397. *AIAA Scitech 2021 Forum.* January 2021

Poster

[P4] **Yuhong Liu**, Jennifer Krummeich, Susann Schweiger-Seemann, Tatjana Tchumatchenko. *"Data-Driven Model of Multi-Protein Activity Quantitatively Links Mutations to Synaptic Pathophysiology",* Society for Neuroscience Conference 2022

[P3] **Yuhong Liu**, Jennifer Krummeich, Susann Schweiger-Seemann, Tatjana Tchumatchenko. *"Data-Driven Model of Multi-Protein Activity Quantitatively Links Mutations to Synaptic Pathophysiology",* Bernstein Conference 2022

[P2] **Yuhong Liu**, Jennifer Krummeich, Susann Schweiger-Seemann, Tatjana Tchumatchenko. *"Data-Driven Model of Multi-Protein Activity Quantitatively Links Mutations to Synaptic Pathophysiology",* FENS Forum 2022

[P1] Christopher R. Hayner, **Yuhong Liu**, Howard Peng, Parker Mayhew, Neil Gupta, Helen Kuni, Juris Vagners, *"An Autonomous Machine Learning Approach to Search and Locate Operations",* AIAA PNW Symposium 2020

In Preparation

Journal Paper

[J2-I] **Yuhong Liu**, Sybille Krauss, Tatjana Tchumatchenko. *"Mutant Huntington Reduces mRNA Level in In-vivo Mice Model of Huntintong's Disease",* the EMBO journal

[J1-I] Damien Depannemaecker, Federico Tesler, Pierre Houzelstein, Chloe Duprat, **Yuhong Liu**, Christoffer Alexandersen, Jerome Emonet, Ambre Ledoux, Sandra Saghir, Aitakin Ezzati. *"A Mean-Field to Capture Asynchronous Irregular Dynamics of Spiking Networks of Quadratic Neuron Models with Adaptation"*

Talk

[T1-I] **Yuhong Liu**, Sybille Krauß, Tatjana Tchumatchenko. *"A Biochemecial Model Reveals Reduced mRNA Level in Huntington's Disease",* Dendrites: Molecules, Structure and Function, Gordon Research Seminar 2023, Barga, Italy

Poster

[P5-I] **Yuhong Liu**, Sybille Krauß, Tatjana Tchumatchenko. *"A Biochemecial Model Reveals Reduced mRNA Level in Huntington's Disease",* Dendrites: Molecules, Structure and Function, Gordon Research Conference 2023, Barga, Italy

Employment Record

From Sept. 2023 **University of Bonn Medical Center** - Research Assistant *(26 Hrs/Week)*

Institute of Experimental Epileptology and Cognition Research (IEECR)

I will officially join the institute in September 2023

Oct. 2021 - Current **University of Mainz Medical Center** - Research Assistant *(26 Hrs/Week)*

Collaboration with Sybille Krauß Group

built a mathematical model implementing MID1-complex formation mechanism that links CAG repeat length to translation rate in Huntington's Disease Model. Together with measurements from previous studies, I used this translation rate model to determine the steady-state HTT protein level in neurons and predict mRNA level in mutant neurons.

Collaboration with Michael Schmeißer Group

helped design a new experiment to measure temporal dynamics of 6 synaptic proteins that are downstream of mTOR signaling pathway

Collaboration with Susann Schweiger Group

constructed protein network that is critical for the function of mTOR signal pathway and built a mathematical model to study the affected protein synthesis dynamics under disease condition

Nov. 2019 - Jun. 2021 **University of Washington, AFSL** - Research Assistant *(20 Hrs/Week)*

I helped build visual and thermal data sets to train computer vision models for spotting humans in wilderness environment

Jun. 2020 - Aug. 2020 **Google Summer of Code** - Contributor *(40 Hrs/Week)*

I developed a package in R-language for the estimation and forecasting of GARCH processes that addresses the issue of robustness toward additive outliers. Two approaches are implemented: 1) the basic approach obtain parameters using a modified likelihood function based on a bounded loss function, 2) the second approach improves on the first by using a filter that limits the effect of an additive outlier on subsequent predictors of conditional variance. The package exposes interfaces to a C++ library that can be called from any higher level language for estimating the likelihood functon, which speeds up the total computation.

Jan. 2020 - Mar. 2020 **University of Washington** - Teaching Assistant *(20 Hrs/Week)*

CFRM 425 B: R Programming for Quantitative Finance: Worked with the Instructor to develop homework assignments and exam problems for a class of >50 students.

Mentorship

Undergraduates

Sabrina Zerrade (Now applying for graduate school in computational biology)
Karen Ji (Master's student in Applied Mathematics at Columbia University)
Samuel Bouiss (Master's student in Applied Mathematics at Columbia University)

Public Outreach

Outreach and Service

2022-Current **Women in Network Science (WiNS) Society**

2023 – Current **Mentorship Program**

Initiated and currently launching the women mentorship program to advocate expand women's opportunities for leadership and increase their visibility in the network science community through mentorship.

2022 – Current **Seminar**

currently helping organize weekly seminar promoting the influence of female network science researchers.

2022 **Bernstein Conference 2022** - Photographer

2022 **12th German Neuroscience Olympiads** - Backyard Brain Experiment Demonstrator

2022 **Cosyne 2022 Tutorial on Spiking Neural Networks** - Teaching Assistant

2021 **UW Women in Applied Mathematics Mentorship Program** - Mentor

Skill

Package Development

Developed an R package, `robGarch`.

Programming

Competent with `Python` (`NEST`, `Pytorch`, `Brian2`, `NEURON`), `MATLAB`, `C++` (`Eigen`, `Boost`), `Linux`, `Git`. Working knowledge in `Julia`.

Language

Native in Mandarin. Proficient in English. Conversational in German.

Professional Activity

Memberships

Bernstein Network Student Member

SfN Student Member

Reference

Tatjana Tchumatchenko

- **Position:** Professor, Institute of Experimental Epileptology and Cognition Research, University of Bonn
  Institute of Physiological Chemistry, University of Mainz
- **Relationship:** PhD Co-Advisor, Tchumatchenko Group PI
- **Email:** tatjana.tchumatchenko@uni-mainz.de

Sybille Krauß

- **Position:** Professor, Institute of Biology, University of Siegen
- **Relationship:** Collaborator
- **Email:** sybille.krauss@uni-siegen.de

Juris Vagners

- **Position:** Professor Emeritus, Aeronautics and Astronautics Department, University of Washington
- **Relationship:** Autonomous Flight Systems Lab PI
- **Email:** vagners@uw.edu

Douglas Martin

- **Position:** Professor Emeritus, Statistics and Applied Mathematics Department, University of Washington
- **Relationship:** Master's Advisor, Google Summer of Code Mentor
- **Email:** doug@amath.washington.edu