# Yuhong Liu

+49(0) 1774038891 yuhong.echo.liu@gmail.com Zoom
@yuhongecholiu Personal Website Github

## Education

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

Jun. 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 developing models and theories to understand how the brain assembles sensory information into a representation of the world and how navigation decision is made. Three central research questions are: (1) How does the brain incorporate/fuse **different sensory information inputs** together? (2) How does the brain learn about and navigate environments with high **uncertainty**? (3) How does the brain **correct for error**? To this end, my specific areas of interests are:

1. **Topological analysis of population dynamics of neurons:** to better understand symmetry and latent space embedded in population activity
2. **Bayesian models for state estimation:** to construct models that represent and compute with sensory uncertainty
3. **Multi-modal models for error correction:** to build a framework that combines other sources of information to update visual inputs

## 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. *"A Multi-Protein Activity Model Pinpoints the Cause of Change in Synaptic Protein Composition",* Bernstein Conference 2022

**[P2]** **Yuhong Liu**, Jennifer Krummeich, Susann Schweiger-Seemann, Tatjana Tchumatchenko. *"A Protein Network Model of mTOR Signaling Pathway under Tuberous Sclerosis Complex Condition",* 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. *"A Biochemecial Model Reveals Reduced mRNA Level in Huntington's Disease"*

**[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"*

### Poster

**[P5-I]** **Yuhong Liu**, Sybille Krauß, Tatjana Tchumatchenko. *"Mutant Huntington Reduces mRNA Level in In-vivo Mice Model of Huntintong's Disease",* Dendrites: Molecules, Structure and Function, Gordon Research Conference 2023, Barga, Italy

## Employment Record

Oct. 2022 - Current **University of Bonn 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.

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

**Collaboration with Michael Schmeißer Group**

helped design a new ongoing 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)*

helped build visual and thermal data sets to train computer vision models for spotting humans in wilderness environment and design algorithms to fuse the visual and thermal data

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

developed a package in R-language for estimating GARCH process model parameters that addresses the issue of robustness toward additive outliers. Two approaches are implemented: 1) the basic approach obtains 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 additive outliers on subsequent predictors of conditional variance. The package exposes interfaces to a C++ library, which speeds up the total computation when estimating the likelihood function.

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

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

Feb. 2023 - Current **Mentorship Program**

initiated and currently launching the women mentorship program to advocate opportunities for women and increase their visibility in the network science community through mentorship.

Jan. 2022 - Current **Seminar**

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

Sep. 2022 **Bernstein Conference 2022** - Photographer

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

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

Mar. 2021 - Jun. 2021 **UW Women in Applied Mathematics Mentorship Program** - Mentor

### Research Feature

"Hide and Seek: Training a drone to save lives"

## 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

fluent in Mandarin and English. Conversational in German

## Professional Activity

### Training Program

Sep. 2022 **EITN Fall School in Computational Neuroscience 2022** - Student

Jul. 2022 **First Italian Summer School in Geometric Deep Learning 2022** - Student

### Membership

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 Advisor, Tchumatchenko Group PI
- **Email:** tatjana.tchumatchenko@uni-bonn.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