

# Monica Liu

liu.monica.f@gmail.com • <https://mfliu.github.io> • (703) 401-3782

## EDUCATION

**University of Pittsburgh** Pittsburgh, Pennsylvania, USA  
PhD in Bioengineering with a focus in neural engineering August 2016 – August 2021  
*Advisors:* Dr. Douglas Weber, Dr. Aaron Batista  
*Research focus:* Population analysis of neural mechanisms of sensorimotor integration in the dorsal root ganglia and in motor cortex.

**University of Virginia** Charlottesville, Virginia, USA  
B.S. in Biology August 2011 – May 2015  
B.A. in Computer Science

## RESEARCH EXPERIENCE

**Shanahan Postdoctoral Fellow**, Allen Brain Institute, University of Washington  
Mentors: Dr. Adrienne Fairhall, Dr. Cindy Poo, Dr. Matthew Golub October 2021 – Present  
· Examine neural mechanisms of learning generalization and abstraction through study of neural dynamics in population neural activity.  
· Use deep recurrent neural networks to identify patterns of communication between brain areas.

**Rehab Neural Engineering Labs**, University of Pittsburgh  
Mentors: Dr. Douglas Weber and Dr. Aaron Batista August 2016 – September 2021  
· Identified interactive effects of contact force and texture on neural coding of tactile stimuli in the periphery.  
· Characterized coordinated muscle responses to electrical stimulation of proprioceptive fibers in the dorsal root ganglia.  
· Examined influence of proprioceptive feedback on brain-computer interface control in M1.

**Center for Diabetes Technology**, University of Virginia  
Mentor: Dr. Marc Breton May 2014 – June 2015  
Assisted in clinical trials that tested a closed-loop artificial pancreas system in people with type I diabetes and built an algorithm to estimate insulin sensitivity over time.

**Automated detection of axon blebbing**, University of Virginia  
Mentor: Dr. Karsten Siller June 2014 – May 2015  
Built a MATLAB script to automate axon bleb counting, distinguishing between axon blebs and axon crossings in a fluorescent microscopy image with 85% accuracy.

**Biochemistry and Molecular Genetics**, University of Virginia  
Mentor: Dr. Ronald Taylor March 2011 – May 2014  
Assisted in the development and testing of a monoclonal antibody therapy to recruit the innate immune system to target cancerous B-cells and quantified off-target effects on platelets.

## INDUSTRY EXPERIENCE

**Novartis**, Institute for Biomedical Research Cambridge, Massachusetts, USA  
Data Engineer August 2015 – August 2016  
Developed software to support large-scale genomics research by implementing infrastructure to support processing and analysis of large datasets and building a distributed processing system using Apache Spark.

## PUBLICATIONS

Liu, M.F., Gaunt, R.A., Collinger, J.L., Downey, J.E., Batista, A.P. Boninger, M.L., Weber, D.J. (2024). Volitional control of movement interacts with proprioceptive feedback in motor cortex during brain-computer interface control in humans. *medRxiv*. <https://doi.org/10.1101/2024.02.26.24303289>

**Liu, M.F.**, Batista, A.P., Bensmaia, S.J., Weber, D.J. (2021). Information about contact force and surface texture is mixed in the firing rates of cutaneous afferent neurons. *Journal of Neurophysiology*. <https://doi.org/10.1152/jn.00725.2019>

Urbini, M.A., **Liu, M.F.**, Bottorff, E.C., Gaunt, R.A., Fisher, L.E., Weber, D.J. (2019). Hindlimb motor responses evoked by microstimulation of the lumbar dorsal root ganglia during quiet standing. *Journal of Neural Engineering*. <https://doi.org/10.1088/1741-2552/ab4c6c>

Dalrymple, A.N., Bose, R., Sarma, D., Petersen, B.A., Barra, B., Nanivadekar, A., Madonna, T.J., **Liu, M.F.**, Levy, I., Helm, E.R., Miele, V.J., Capogrosso, M., Fisher, L.E., Weber, D.J. (2023). Reflex modulation and functional improvements following spinal cord stimulation for sensory restoration after lower-limb amputation. *medRxiv*, <https://doi.org/10.1101/2023.09.08.23295273>

Pokrass, M.J. **Liu, M.F.**, Lindorfer, M.A., Taylor, R.P. (2013). Monoclonal Antibodies that Target cell-associated HLA or  $\beta$ 2-microglobulin exhibit differential complement activity: Implications for cancer immunotherapy. *Molecular Immunology*. <https://doi.org/10.1016/j.molimm.2013.05.242>

## HONORS AND SCHOLARSHIPS

Graduate Research Fellowship Program, **National Science Foundation** 2018  
Best Presentation, **Computational Sensorimotor Neuroscience Summer School** 2017  
Bevier Award, **University of Pittsburgh Bioengineering Department** 2016

## TEACHING

**Lecturer**, Introduction to Computational Neuroscience February 2023  
Designed and taught a 1-week module on population coding and neuronal variability, covering Fano factor, encoding, decoding, regression, and multivariate Gaussians as models of neural activity.

**Lecturer, Teaching Assistant**, Quantitative Systems Neuroscience Spring 2017-Spring 2021  
Gave lectures on quantitative methods such as principal components analysis and K-means in the context of building a BCI decoder.  
*Lecture Notes*: <http://mfliu.github.io/files/BCI.Theory.pdf>

**Myoelectric Tetris**, Bioelectric Signals Lab April 2018  
Created a myoelectric-controlled Tetris game to teach undergraduate students about processing of EMG signals and basic classification.  
*Code*: <https://github.com/mfliu/Myoelectric.Tetris>

## TALKS

**How S1 spiking activity encodes sensory feedback for goal-directed movements in a grasping task** November 2017  
**Liu, M.F.**, Arbuckle, S.A., Okorokova, E., Herrera, A.J., Kaiser, A.  
Motor Learning and Motor Control (MLMC)  
Our group won "Best Student Presentation" at the Computational Sensorimotor Neuroscience summer school and were awarded with a time slot to give this talk during MLMC.

## POSTERS

**Liu, M.F.**, Dekleva, B., Chowdhury, R., Batista, A.P., Boninger, M., Collinger, J., Gaunt, R., Weber, D.J. "The effect of visual and proprioceptive feedback on brain-computer interface control of a robotic arm". *Neural Control of Movement*, 2020. (Cancelled due to Covid-19)

**Liu, M.F.**, Winberry, J.E., Versteeg, C., Simpson, T., Oby, E.R., Degenhard, A.D., Urbin, M.A., Batista, A.P., Gaunt, R.A., Miller, L.E., Bensmaia, S.J. Weber, D.J. "Effect of surface texture on the encoding of touch, pressure, and shear in the glabrous skin of a rhesus macaque". *Society for Neuroscience*, 2018.

**Liu, M.F.**, Winberry, J.E., Versteeg, C., Simpson, T., Oby, E.R., Degenhard, A.D., Urbin, M.A., Batista, A.P., Gaunt, R.A., Miller, L.E., Bensmaia, S.J. Weber, D.J. "Dorsal root ganglion neuronal population responses to tactile stimuli in rhesus monkey hand". *Society for Neuroscience*, 2017

## RESEARCH TOOLS

**Messaging framework for data collection and syncing** September 2020  
A messaging framework that can be used to sync timing across multiple independent data streams with frequencies of 30kHz or more.  
Code: <https://github.com/mfliu/networkedMessaging>

**Virtual reality and haptic interface for Force Dimensions robots** November 2019  
A framework for building behavioral experiments using a [haptic robot](#). Provides physics simulations of object interactions in complex tasks, such as fluid in a cup.  
Code: <https://github.com/mfliu/hapticEnvironment>

## SERVICE AND OUTREACH

**Obama Academy**, Life Skills and College Prep Class February 2021 – April 2021  
Collaboratively built a 7-session introduction to STEM for 9th graders that focused on the range and application of STEM careers, as well as the social and ethical responsibility of scientists and engineers.

**Neuroscience Activities Website** November 2020  
Built a website focused on giving students hands-on experience with well-known neuroscience behavioral tasks and analyses.  
Link: <https://mfliu.github.io/neuroActivities/>

**Training and Discussion**, Rehab Neural Engineering Labs March 2020 – September 2021  
Organized a series of lectures and seminars focused on the history of racism in academia and healthcare in America, how this history has contributed to racial inequity in STEM today, and steps to take to begin to remedy these inequities moving forward.

**Center for the Neural Basis of Cognition**, Retreat Committee Fall 2019 – Present  
Planned the annual retreat and helped other student committees organize and run events for the CNBC as a whole.

**Ingenium**, Co-Editor-In-Chief Summer 2019 – Spring 2020  
Served as co-editor-in-chief for the undergraduate engineering research journal by coordinating review and publication process.

## SKILLS

**Programming Languages:**  
Python, MATLAB, C++, Java, Javascript, Scala, OCaml, Haskell, HTML

**Technical Skills:**  
Neural recording systems (Ripple, Plexon, Intan), EMG recording systems (Delsys Trigno), Kinematic recording systems (Optitrack, DeepLabCut), ML Libraries (PyTorch, Numpy, Scipy, Scikit-Learn, Pandas), MongoDB, Linux, Git, Jupyter

**Languages:**  
English (fluent), Cantonese (advanced), Mandarin (advanced), Spanish (intermediate)