Samuel Schmidgall

Johns Hopkins University | **NSF GRFP Fellow**
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Research Areas

Biological and artificial intelligence, Brain Organoids, Meta-learning, Online Learning, Neuromorphic Computing

Education

Johns Hopkins University — **Baltimore, MD**
PhD in Electrical and Computer Engineering — *beginning* August 2023

George Mason University — **Fairfax, VA**
BS in Computer Science — August 2017 - May 2021

Professional & Research Experience

Johns Hopkins University — **Baltimore, MD**
Graduate Research Fellow — *beginning* August 2023
- Developing *neuroscience-inspired* learning mechanisms toward applications in artificial intelligence & neuromorphic computing

Space Robotics Department @ U.S. Naval Research Laboratory — **Washington, D.C.**
Computer Scientist — since May 2021 (2 years)
- Research toward developing robotic learning systems which can adapt to new challenges during their lifetime. Robotic learning via **deep reinforcement learning** for quadrupedal (locomotion) and manipulation (articulated) systems using **neuromorphic hardware** in order to dramatically improve power-efficiency (low SWaP) for space applications. Deployment of trained models on physical robotic hardware (sim2real).

Undergraduate Research Intern — May 2019 – April 2021 (2 years)
- Developed **online reinforcement learning** algorithms for **neuromorphic hardware** (Intel Loihi gen1) on robotic learning applications via meta-learning online fast- and slow-weight learning rules.

Mason Experimental Geometry Laboratory — **Fairfax, VA**
Undergraduate Research Assistant — January 2020 – May 2020 (5 months)
- Research in wave propagation dynamics for locked fronts in a discrete time discrete space population model (Matthew Holzer).

Undergraduate Research Assistant — August 2018 – May 2019 (9 months)
- Research in robotic motion planning, finding optimal localized trajectories for the planning of multiple vehicles (Anton Lukyanenko & Damoon Soudbakhsh).

Gartner — **Arlington, VA**
Data Science Intern — May 2018 – March 2019 (10 months)
- Extracting and predicting performance based on resume features & language modelling for chat-bot automation.

Asymmetriq — **Marshall, VA**
Software Engineering Intern — May 2017 – May 2018 (1 year 1 month)
- Using computer vision learning models (via deep learning) for improving online license plate character recognition (i.e. optical character recognition).

Publications

Under Review/In-Preparation
- **Schmidgall, S.**, (2023). Backpropagation in networks of biophysical neuron models *In-Preparation*.
- **Schmidgall, S.**, Eshraghian, J., (2023). Surrogate gradient optimization with complex integrate-and-fire neuron models *In-Preparation*.
- **Schmidgall, S.**, Jascha, A., Louis, K., Hajiseyedrazi, P., Lindsey, J., Miconi, T., Andreas, A., (2023). Brain-inspired learning in artificial neural networks. *Nature Machine Intelligence (Under Review).*

Journal
- **Schmidgall, S.**, Hays, J. (2023). Meta-SpikePropamine: Learning to Learn with Neuromodulated Synaptic Plasticity in Spiking Neural Networks. *Frontiers in Neuroscience. (Accepted, in publication process)*

- Holzer, M., Richey, Z., Rush, W., **Schmidgall, S.**, (2022). Locked fronts in a discrete time discrete space population model. *Journal of Mathematical Biology.*
- **Schmidgall, S.**, Ashkanazy, J., Lawson, W., Hays, J, (2021). SpikePropamine: Differentiable Plasticity in Spiking Neural Networks. *Frontiers in Neurorobotics*.

Conference

- **Schmidgall, S.**, Hays, J., (2023). SMA: A three-factor learning rule for synaptic motor adaptation in spiking neural networks. *International Conference on Neuromorphic Systems (ICONS).*
- **Schmidgall, S.**, Parsa, M., (2023). Biological connectomes as a representation for the architecture of artificial neural networks. *Thirty-Seventh AAAI Conference on Artificial Intelligence (AAAI-23) "Systems Neuroscience Approach to General Intelligence" Workshop.*
- **Schmidgall, S.**, Hays, J., (2022). Stable Lifelong Learning: Spiking neurons as a solution to instability in plastic neural networks. *Neuro-Inspired Computational Elements (NICE).*
- Lukyanenko, A., Camphire, H., Austin, A., **Schmidgall, S.**, Soudbakhsh, D., (2021). Optimal Localized Trajectory Planning of Multiple Non-holonomic Vehicles. *5th Conference on Control Technology and Applications (CCTA).*
- **Schmidgall, S.** (2021). Self-constructing Neural Networks through Random Mutation. *International Conference on Learning Representations (ICLR).*
- **Schmidgall, S.**, (2020). Adaptive Reinforcement Learning through Evolving Self-Modifying Neural Networks. *The 2020 Genetic and Evolutionary Computation Conference (GECCO).*

Activities and Awards

Awards

- **2023 National Science Foundation Graduate Research Fellow (NSF GRFP)**, three year award of **$147,000** to study the application of neuroscience-inspired learning mechanisms in artificial intelligence for neuromorphic.
- **2022 Alan Berman Research Publication Award** of **$4,000** for paper *SpikePropamine: Differentiable Plasticity in Spiking Neural Networks.*
- **Best Poster Award** MEGL Symposium Poster Presentation Spring 2020
- **Outstanding Poster Award** Joint Mathematics Meeting Conference Spring 2019

Activities

- **Invited reviewer** at the *2022 NSF "Brain-Inspired Dynamics for Engineering Energy-Efficient Circuits and Artificial Intelligence"* Program.
- **Reviewer editor** for *Neural Networks* journal.
- **DoD Security Clearance** granted security clearance through my work at the US Naval Research Laboratory.

Presentations

- **Invited speaker** at the 2023 *Neuro-Inspired Computing Elements (NICE).*
- **Invited speaker** at the *Intel Labs INRC Spring 2022 Continual Learning Workshop* [link].
- **Invited speaker** for ECE556 *Neuromorphic Computing* at George Mason University [link].
- **Oral Presentation** at the *2022 Neuro-Inspired Computational Elements Workshop (NICE)* [link].
- **Oral Presentation** at the *2021 International Conference on Machine Learning "A Roadmap to Never-Ending Reinforcement Learning" (ICLR NERL) Workshop* [link].
- **Oral Presentation** at the *2020 Genetic and Evolutionary Computation Conference (GECCO)* [link].