Jonathan Marty

Research CV

Contact Information

Email:	jonathan.n.marty@gmail.com
Phone:	732-397-1450
Website:	https://github.com/jonmarty, https://www.linkedin.com/in/jonathan-m-848204137/

Education

2019-Present — **BS in Computer Science, Minor in Applied Math:** School of Engineering, Columbia University, New York, NY

GPA: 3.8, Relevant Courses: Topology, Analytic Methods for PDEs, Modern Algebra I, Analysis of Algorithms I, Computational Neuroscience, Accelerated Physics I & II

2015-2019 — **High School Education:** Holmdel High School, Holmdel, NJ

GPA: 4.6/4.0 (weighted); SAT: 1550, Verbal: 750, Math: 800; SAT Subject Tests: 800 Physics, 800 Math II; 5/5 on 8 AP Exams

Research Experience

2020-Present — **Student Researcher, Bionet Lab, Columbia University:** A mentored individual project attempting to leverage recent advances in neuroanatomic data to push forward the functional understanding of the fruit fly (Drosophila Melanogaster) circadian clock. Currently focusing on using the frequency and phase dynamics of networks of relaxation oscillators to elucidate the transfer of relative time information in the circadian clock. Have demonstrated behaviors such as one oscillator "silencing" another and two oscillators "synchronizing" (both in phase and frequency) under mutual inhibition . Working to integrate these findings with existing connectomic and morphological data to create a computational model of the circadian clock.

Summer 2020 — **Intern, AT&T Labs Cyber Security Organization** Performed research aimed at detecting malicious activity in large-scale IP networks. Used temporal trends in graph structure, most notably the Triad Census of IP connections, to detect P2P (Peer to Peer) botnets, which do not share the hierarchical structure of most IP networks. Combined this analysis with several other security metrics and developed an ensemble decision tree model that detected 32% of all suspected malicious HTTP source devices with a 25% true positive rate.

Summer 2018 — **Intern, Bionet Lab, Columbia University:** Performed development and research at the Columbia University Bionet lab, whose mission is to develop computation models of brain function (http://www.bionet.ee.columbia.edu). Packaged Fruit Fly Brain Observatory software using Docker which led to the adoption of the research platform by other universities and is currently being used as the basis for a graduate class. Implemented a 47 layer recurrent convolutional neural network model of the fruit fly early visual system. This work was done to test the efficacy of research done in the paper "A Connectome Based Hexagonal Lattice Convolutional Network Model of the Drosophila Visual System" (https://arxiv.org/abs/1806.04793). This involved building the model from scratch in Keras, implementing custom Keras layers and functionality using Tensorflow as a backend (ex. implementing hexagonal convolution), and performing statistical tests and analyses to gauge the model's performance.

2017-2019	**Adjunct Employee, Perspecta Labs, Red Bank, NJ:** Participating in DARPA RADICS (https://www.darpa.mil/news-events/2015-12-14) project focused on securing our nations critical infrastructure. Developed methods to collect, clean, and normalize power grid network threat metrics. Evaluated data in unsupervised machine learning outlier detection algorithms. Developed novel method to enhance network intrusion detection techniques using neural spike train measures.
Summer 2017	**Intern, Vencore Labs, Red Bank, NJ:** Secured paid internship to participate in developing system for electric power grid control network security. Developed interface to dynamically add new threat detection metrics to power grid network security monitoring system. Contributed improvements to authentication and entitlements to support dynamic configuration. Invited to continue employment during 2017-2018 school year.
2016-2018	**Student Researcher, Holmdel High School and Vencore Labs, Red Bank, NJ:** Developed a method to reduce peak electrical power grid load from Personal Electric Vehicles (PEV) by employing distributed battery storage at charging stations. Performed large-scale power grid simulations to show that its adoption reduces average daily peak power levels by between 14% and 24% for typical urban and suburban grids. Presented results at IEEE conference.

Publications

Working Paper	*J. Marty, G. Di Crescenzo, "Analysis of Temporal Point Events for Network Intrusion Detection using Neural Spike Train Distance Measures".*
2018	*J. Marty, S. Pietrowicz, "Economic Incentives for Reducing Peak Power Utilization in Electric Vehicle Charging Stations", IEEE PES Innovative Smart Grid Technologies Conference, Washington DC, Feb 19-22, 2018*
	https://ieeexplore.ieee.org/document/8403377

Technical Skills

Languages
Python, R, Java, Golang, LaTeX, Processing, CUDA, Javascript, C++

Operating Systems
Linux, Windows, Mac, Cisco IOS

Tools
Docker, Ansible

Libraries
Keras, Tensorflow, PyTorch, SciPy, networkx

Other

Interesting video of me: https://www.youtube.com/watch?v=CZv1PpTdIZ4