MARGOT WAGNER

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EDUCATION

University of California, San Diego Expected: May 2023
Ph.D. in Bioengineering *La Jolla, CA*
- Thesis Advisors: Gert Cauwenberghs (Bioengineering), Terrence J. Sejnowski (Salk)
- Working Thesis Title: "Markov Models: From Molecules to the Mind"
- Focus: Data Science, Computational Neuroscience, Machine Learning, Artificial Intelligence
- Relevant Coursework: Principles of AI: Probabilistic Reasoning, Web Mining & Recommender Systems, Deep Learning

University of Delaware 2014 – 2018
B.Ch.E in Chemical and Biomolecular Engineering (Honors with Distinction) *Newark, DE*
- Minors: International Business, Chemistry
- Exchange program in Chemical Engineering at National University of Singapore, 1 of 2 selected students

HONORS AND AWARDS

- **NSF Graduate Research Fellowship Program Award** 2018 – 2023
- **Benjamin E. Herring Scholarship** 2017
- **Myrick Family Scholarship** 2017
- **General Honors Award** 2016
- **Telkes Distinguished Scholar Award** (4-year full tuition scholarship) 2014 – 2018

RESEARCH AND PROFESSIONAL EXPERIENCE

Graduate Student Researcher June 2019 – Present
The Computational Neurobiology Lab and Integrated Systems Neuroengineering Lab, UCSD *La Jolla, CA*
- Building forward probabilistic graphical model for fMRI data representation using a 11,500 subject longitudinal dataset
- Discovering main predictors of mental illness using machine/deep learning in the large-scale multimodal and longitudinal ABCD dataset utilizing behavioral, demographic, clinical measurement, imaging, and biological data
- Working to create a next generation biologically inspired AI neural network with biophysically meaningful parameters tunable for specific learning tasks utilizing probabilistic graphical models
- Built a biophysically realistic stochastic 3D reaction-diffusion model for synaptic transmission using MCell software and Python scripts containing 120 molecular states
- Developed equivalent stochastic Markov chain synapse abstraction in Python with biologically tunable parameters, decreasing runtime by 93% and FLOPs by an order of magnitude for use in artificial neural networks models
- Optimized parameters to match biological conditions using parameter sweep techniques by running models on supercomputer clusters and analyzed subsequent large-scale datasets

Google Computer Science Research Program Mentee, *Google* Feb 2021 – June 2021
- Collaborated with a Google researcher to design a research project utilizing large-scale psychiatric healthcare data

Consulting Analyst, *Mindful Care* Feb 2021 – May 2021
- Worked collaboratively with a team of 6 analysts to explore market fit for Mindful Care's talk therapy AI technology

Simula Computational Physiology Summer School June 2019, Aug 2019
Simula Research Laboratory, University of Oslo and UCSD *Oslo, Norway and La Jolla, CA*
- Selected as one of twenty researchers to attend and participate in this fully funded summer school
- Collaborated with a team of international researchers on a project modeling Hodgkin-Huxley type neurons

Graduate Research Rotations, *UCSD* Sept 2018 – June 2019

- Developed patient-specific MATLAB machine learning models to classify attention states using EEG data for 27 patients achieving 70% accuracy for use in ADHD diagnostics
- Classified oddball responses in Parkinson's patients using nonlinear dynamical system embeddings
- Designed and ran pilot study with a single participant for an EEG reading comprehension experiment and created data analysis pipeline including ICA to locate biomarkers for use in classroom applications

SELECT PROJECTS

- Wrote the backend for an application tracking and monitoring medication usage in polypharmacy patients including reminders and warnings for potential drug interactions (MedHacks Hackathon, 2nd place)
- Implemented NLP sentence generator for 3 conditions and classified generated sentences using BERT classifier
- Analyzed 7k gene RNA-seq dataset from Allen Brain Atlas using ICA, PCA, clustering, and classification to predict brain regions (98.7% accuracy for 3 regions, 67.1% accuracy for 10 regions)
- Predicted collision severity (66.25% acc) using 5.78 GB traffic records with ~100 features from 2001-2020

LEADERSHIP AND MENTORING EXPERIENCE

Co-Director and Co-Founder of Science in Society Seminar Series Sept 2019 – June 2020
The Collaboratory, Institute of Neural Computation, UCSD
- Organized with Roger Bingham, hosting expert speakers to discuss topics, such as loneliness, with the general public, obtaining attendance of >200 people. Ran student roundtable discussions. Analyzed feedback to optimize attendance.

High School Outreach Co-Chair and Student Mentor Sept 2019 – Mar 2020
Bioengineering Graduate Society, UCSD
- Created and ran curriculum for 30 high school students, with topics such as EEG/ECG collection and data analysis.
- Mentored 4 first-year graduate students with monthly one-on-one meetings

Teaching Assistant, *UCSD* Jan 2019 – Mar 2020
- Ran a lab and discussion section with 30 undergraduate students (BENG 1) and 50 graduate students (BENG 260) various modules including 3D printing, wearable sensors, biomechanics, and neurodynamics programming

Student Research Mentor June 2018
Science Department, Maine South High School *Park Ridge, IL*
- Helped 12 high school students design and execute their own 4-week projects and experiments to compete at the Illinois Junior Academy of Science and the Intel Science Fair in May 2019.

SELECT PUBLICATIONS AND PRESENTATIONS

Publications
- **M Wagner**, T Bartol, T Sejnowski, G Cauwenberghs, "Markov Abstractions of Electrochemical Reaction-Diffusion in Synaptic Transmission for Neuromorphic Computing," *Front Neurosci,* in review.
- J Forder, M Smith, **M Wagner**, R Schaefer, J Gorky, K van Golen, A Nohe, and P Dhurjati, "A Physiologically-Based Pharmacokinetic Model for Targeting Calcitriol-Conjugated Quantum Dots to Inflammatory Breast Cancer Cells," *Clin Transl Sci,* 12: 617-624, July 2019.

Poster Presentations
- **M Wagner**, T Bartol, T Sejnowski, G Cauwenberghs, "Towards Biophysically-Based Neuromorphic Computing at Scale: Markov Abstractions of Electrochemical Reaction-Diffusion in Synaptic Transmission." *IBM IEEE AI Compute Symposium* Oct. 2020.

SKILLS

Programming Languages Python · Java · C++ · MATLAB · SQL
Software Tools Git · Linux/Unix · PyTorch · NumPy · scikit-learn · pandas · matplotlib