SEAN MCGOWAN

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EDUCATION

2016 – 2020 **Dartmouth College**, Hanover NH
GPA: 3.8/4.00 Bachelor of Arts in Cognitive Science
Cum Laude

2011 – 2015 **Collegiate High School School,** New York, NY
GPA: 3.8/4.00 SAT: 800 Math, 800 Writing, 760 Critical Reading
Cum Laude; National AP Scholar

Relevant Coursework:

• **Machine Learning Engineering Self Study**:

- Dartmouth CS 31: Algorithms & CS 76: Artificial Intelligence (Audited)
- Zero to Mastery: Deep learning with Pytorch, Data Structures and Algorithms (200 hrs)
- CodeCademy Data Science Career Course (200 hrs)
- Dive into Deep Learning (d2l.ai) (45 hrs)
- NeuroMatch Academy 2022: Deep learning (20 hrs)
- Yale Introduction to Data Science
- Yale Machine Learning for Single Cell Analysis Workshop - Krishnaswamy lab (20 hrs)
- MIT Deep Learning in the Life Sciences (20 hrs)

• Mechanics I & II; E&M I; Quantum Mechanics I & II
• Multivariable Calc; Differential equations; Linear Algebra; Evolutionary Game Theory; Combinatorics
• Intro Neuroscience; Computational Neuroscience; Brain Evolution
• Scientific Computing; Network Science

WORK EXPERIENCE (CONTRACT PROJECTS)

Oct - Present 2022 **Minds, Machines, Society, Dartmouth College**
Researcher
• Research with Prof. Soroush Vosoughi and Prof Richard Granger to build Neurosymbolic Program Synthesis models to perform solve Francois Chollet's Abstraction & Reasoning Corpus (ARC), a challenging benchmark for machine fluid intelligence and few-shot abstract rule learning.

Aug - Oct 2022 **Fund for Alignment Research (FAR)**
(https://far.ai/)
FAR is an AI Safety non-profit aiming to align advanced AI systems with human values
Technical Research Writer
• Blog post summarizing and elaborating on how a 2022 Neurips paper titled: "*Path Independent Equilibrium Models Can Better Exploit Test-Time Computation*" is relevant to AI alignment.
Topics included:
• Deep Equilibrium Models (DEQs) - a type of neural network that may implement a narrow kind of optimization
• DEQs as a potentially interesting toy model for studying mesa optimization empirically.
• Equilibrium models demonstrate very strong upward generalization compared to *non weight-tied*, *fixed-depth* models.
Findings:
• A system's path independence correlates strongly with its performance on difficult task instances, given enough computation

• Path independent models improve performance monotonically with the number of test-time iterations
• Path dependent models degrade when the number of test time iterations exceeds those at training time.
• Promoting or punishing path independence has a *causal* effect on upwards generalization accuracy (accuracy on harder problem instances).

Feb - July 2022 **[Stealth] Fund**
A **"**stealthmode" fund investing in basic and applied engineering projects in neurotechnology (for-profit and nonprofit), founded by a handful of cryptocurrency philanthropists
NeuroAI Researcher
• Briefed fund managers on the state of the neuroscience-inspired AI field, from leading researchers at MILA, MIT, DeepMind, Stanford)
• Produced a 40 page white paper to:
1) Present the taxonomy of capabilities that our AI systems do not currently have
2) Forecast the promise and pitfalls of using systems neuroscience to build these capabilities
3) Identify key researchers and institutions that are pursuing this goal
4) Present technically detailed project proposals.

Oct 2021 - Jan 2022 **RTHM**
RTHM is a Long Covid Research & Treatment start-up founded by post-docs at the Snyder Genetics Lab at Stanford
(https://rthm.com/)
• I built a research repository consolidating data on etiology, biomarkers, and treatment on Long Covid, for researchers, clinicians, and patients

Sep 2021 **Astera Institute**
Astera is a 501c3 non-profit dedicated to developing high leverage technologies that have no other natural home in today's research and development landscape
(https://astera.org/)
• Proposal for Focused Research Organization (FRO) around novel Geothermal Energy drilling techniques (Link)
1. Whether super-deep geothermal energy could meaningfully contribute to our energy needs;
2. What kind of geothermal drilling systems are most promising;
3. What technological advances are required for GT to be a significant source of energy
• Focus on Quaise Energy's Millimeter Wave drilling

Aug 2021 **Numenta**
(https://www.numenta.com/)
Numenta is an neuroscience-inspired AI company
• Primer to Subutai Ahmad's work on neural networks that utilize Active Dendrites, titled: *How Active Dendrites Enable Prediction and Context Integration in Neurons*. (Link)
• Active dendrites are a more biologically realistic model of individual neurons, enabling better prediction, more flexible learning, and efficient, sparse representations in Artificial Neural Networks.

May 2020- Aug 2021 **Qualia Research Institute,** Menlo Park, CA
(https://qri.org/)
QRI is a neuroscience research institute studying the neurological underpinnings of happiness and suffering
Researcher
• Designed and built a multi-sensory stimulation device that uses light, sound, and haptic vibration to induce targeted emotional states, for use in psychedelic therapy clinics
• Mapped the phenomenal space of haptic stimulation and presented to Imperial College London
• Spearheaded the collection of neuroimaging data (FMRI, FNIRS, DTI, EEG) from a wide variety of highly blissful states to be analyzed in-house
• Assisted research and writing of papers on nervous system dynamics, novel kidney stone treatment, and neuroscience theories of pleasure and pain

Sep. 2018-
May 2019

Brain Engineering Laboratory, Dartmouth College

Research Assistant, to Prof. Richard Granger

Project Description: What geometry best describes our perceptual systems, and how can we use this to more efficiently encode information (eg. building a new audio file format that compresses information more effectively than MP3, while retaining perceived audio quality)?

- Designed and ran psychophysics studies to model the geometry of the visual and auditory perceptual system
- Lab found that visual perception can be best modeled using non-Euclidean (Riemannian) geometry

Nov. 2018 –
Dec. 2018

Experimental Cosmology Lab, UC Santa Barbara

Project Description: Build Remote Laser Evaporative Molecular Absorption (R-LEMA) spectroscopy protocol that CubeSat spacecrafts can use to probe the molecular composition of remote targets (eg. asteroids)

- Created optical laser system as prototype of the "directed energy beam" used for the R-LEMA protocol
- Used above system to heat various materials, eject molecules and create a "plume" of surface materials
- Created library of spectra for various solid compounds, to use as comparison to spectra obtained from samples in the gas phase (generated by process above)

ADDITIONAL RELATED PROJECTS

Sep 2021

Transcranial Ultrasound Stimulation & Photobiomodulation Landscape (Link)

- Two separate presentations to a group of neurotechnology investors and researchers on: 1) the landscape of Focused Transcranial Ultrasound Stimulation (fTUS) and 2) transcranial Photobiomodulation, for neuromodulation in the treatment of brain disorders and mental health conditions

May 2020

Investigating Motif Significance in the Drosophilidae Drosophila (Link)

- Investigated recently mapped *Drosophila* fruit-fly connectome to measure the prevalence of complex structural network motifs, compared to *C.elegans* and simulated rat somatosensory cortex
- Found a decrease in basic motifs, such as basic linked chains; an increase in more complex feedback structures (ie. 3-node structures with bidirectional connections)

March 2020

Eating their Seed Corn: Artificial Intelligence Researchers to Industry

- Built Systems Dynamics model of the flux of AI researchers leaving academia to industry. Modeled the impact of this flux on the nature of the research being done and the transfer of implicit knowledge between professors and their graduate students
- Invited to present research at 2020 International Systems Dynamics Conference (canceled due to Covid)

Skills and Interests:

- *Computer Languages*: Python, Pytorch, Numpy, R, ScanPy, Seurat, PANDAS, Seaborn, MatLab, MatPlotLib, SQL, Stella
- *Dartmouth Men's Baseball Team (Walk-on)*: 25+ hours per week year round
- *Interests*: Tibetan Buddhist Philosophy