

Aman Bhargava

Curriculum Vitae

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Education

- Sep 2022 – Ongoing | **California Institute of Technology**
Ph.D., Computation and Neural Systems.
- Sep 2018 – May 2022 | **University of Toronto**
BASc. with Honours: Engineering Science, Machine Intelligence Option.
Relevant Coursework: Decision Support Systems (#1 ranked student), Matrix Algebra and Optimization, Neural Bioelectricity, Probabilistic Reasoning, Systems Software, Artificial Intelligence, Control Theory I-II, Digital & Computer Systems, Distributed Systems, Optimization in Machine Learning.
- Sep 2014 – June 2018 | **Trinity College School**
Secondary School Diploma & AP Capstone Diploma. Governor General's Bronze Medal (#1 ranked student).

Research Experience

- Feb 2021 – Ongoing | **Neural System & Brain Signal Processing Lab – Krembil Research Institute**
Researcher: Theoretical Neuroscience
- Led investigation on **reinforcement learning** approaches for reverse-engineering **learning rules** in neural networks.
 - Designed and optimized large scale neural network simulations in **Julia**.
 - Generated a **robust, biologically feasible synaptic** learning policy for rate-based neural networks using novel reinforcement learning approach [1].
- Jun 2021 – Aug 2021 | **Turaga Lab – HHMI Janelia**
Research Intern: ML-Based Protein Engineering
- Designed and tested a variety of **large scale deep learning** models for **GCaMP protein functionality prediction** task.
 - Leveraged **pre-trained** transformer (ESM-1b) and RNN-LSTM (UniRep) language models for semantically rich sequence representations.
 - Introduced data **transformations** and **dimensionality reduction** techniques to increase final model performance on key prediction targets.
- Oct 2019 – Jan 2021 | **MannLab – University of Toronto**
Researcher: ML, BCI, Signal Processing
- **Collaborated with and lead** teams of masters students, undergraduates, and industry professionals to produce a variety of publications on **machine learning, signal processing, brain-computer interface, and wearable technology** [4, 2, 5, 3].
 - Generated research questions, designed systems and apparatus, performed experiments, and published results in **peer-reviewed venues**.
 - Rapidly acquired mathematical and scientific skill sets in order to carry out research objectives.

Awards and Honors

- 2022: **Chen Fellowship**, California Institute of Technology.

- 2022: **Predocutorial Training in Quantitative Neuroscience**, National Institutes of Health (NIH).
- 2021: **Janelia Undergraduate Scholars Fellowship**, Howard Hughes Medical Institute.
- 2020: **Undergraduate Student Research Award**, Natural Sciences and Engineering Research Council of Canada (NSERC USRA).
- 2020: **Shaw Design Scholarship**, University of Toronto Faculty of Engineering Science.
- 2019: **Engineering Alumni Network Scholarship**, University of Toronto Faculty of Applied Science and Engineering.
- 2018: **President's Scholarship**, University of Toronto.
- 2018: **Global Top Scoring Thesis Paper & Presentation**, AP Capstone Diploma.

Publications

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| 2022 | 1. Bhargava, A. , Rezaei, M. R. & Lankarany, M. Gradient-Free Neural Network Training via Synaptic-Level Reinforcement Learning. <i>AppliedMath</i> 2 , 185–195 (2022). |
| 2021 | 2. Bhargava, A. & Mann, S. <i>Adaptive Chirplet Transform-Based Machine Learning for P300 Brainwave Classification in 2020 IEEE-EMBS Conference on Biomedical Engineering and Sciences (IECBES)</i> (2021), 62–67. |
| | 3. Bhargava, A. , Zhou, A. X., Carnaffan, A. & Mann, S. Deep Learning for Enhanced Scratch Input. arXiv: 2111.15053 [cs.LG] (2021). |
| 2020 | 4. Bhargava, A. , O'Shaughnessy, K. & Mann, S. <i>A Novel Approach to EEG Neurofeedback via Reinforcement Learning in 2020 IEEE SENSORS</i> (2020), 1–4. |
| | 5. Mann, S. <i>et al.</i> <i>Sensing of the Self, Society, and the Environment in 2020 IEEE SENSORS</i> (2020), 1–4. |

Skills

- **Programming:** Python, Julia, MATLAB, C, JavaScript, Java, HTML5/CSS3, ARM Assembly, Verilog.
- **Software:** PyTorch, Tensorflow, JAX, NumPy, Pandas, SciKit Learn, Git, Arduino, ESP32, OpenCV, Vue.js, Firebase, Vim.
- **Techniques:** Supervised/Unsupervised/Statistical Machine Learning, Deep Learning, Reinforcement Learning, Supercomputing, Object-Oriented Programming.

Professional and Leadership Experience

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| Apr 2020 – Apr 2022 | University of Toronto Consulting Association
<i>Consulting Group Director</i> <ul style="list-style-type: none"> • Recruited & onboarded a group of 90 University of Toronto students (undergraduate, Masters, and Ph.D.) over 2 years to solve management consulting problems for local non-profits and startups at UofT's largest consulting club. • Worked with client organizations to understand issues in their operations and draft problem statements. • Mentored 15 independent teams working to solve problems for real-world clients. |
| Jul 2019 – Ongoing | CareTrack
<i>Co-Founder & CEO</i> <ul style="list-style-type: none"> • Designed and implemented a full-stack web-based medical data entry & analytics platform for assisted living facilities. • Leverages modern UI, data visualization, and predictive algorithms to improve patient outcomes and nurse, doctor, and administrator productivity. Currently in private beta for data collection. • Utilizes Angular, Firebase, Chart.js, Python/Flask. |

Jun 2019 – Aug 2019

Venture13

Software Developer

- Conceptualized and developed **full-stack web applications** using Angular and Firebase incorporating Google Calendar, Maps, Directions API's for **TheWeekendRoute, Venture13,** and the **Cobourg Police Force.**
- Created **robotics software suite** for CrossWing Solutions using OpenCV, Python, and JavaScript.
- Performed **microprocessor programming**, implementing low power machine learning and signal processing with Nordic Semiconductor's SDK for wearable personal security device.