# Aman **Bhargava**

University of Toronto Engineering Science · Machine Intelligence

*Toronto, Ontario, Canada*

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## Education

### University of Toronto
*Toronto, Ontario*

BASc. Engineering Science — *Sept. 2018 - May 2022*

- Major in Machine Intelligence, Minor in Robotics Engineering.
- *Relevant Coursework*: Matrix Algebra & Optimization, Algorithms and Data Structures, Fundamentals of Bioengineering, Digital and Computer Systems.

### Trinity College School
*Port Hope, Ontario*

AP Capstone Diploma & Ontario Secondary School Diploma — *Sept. 2014 - June 2018*

- Graduating Average: 99%
- Governor General's Medal (Valedictorian), AP National Scholar.

## Skills

**Programming:** Python, C, JavaScript, MATLAB, Arduino, ESP32, Java, HTML5/CSS3, ARM Assembly, Verilog

**Software:** PyTorch, NumPy, Pandas, SciKit Learn, Git, OpenCV, Vue.js, Firebase, Vim

**Techniques:** Supervised Machine Learning, Reinforcement Learning, Scientific Computing Workload Parallelization, Object-Oriented Programming, PCA

## Scientific and Professional Experience

### MannLab Canada
*Toronto, Ontario*

Researcher — *Oct. 2019 - Present*

- **Collaborated with and lead** teams of Masters students, undergraduates, and industry professionals to produce a variety of peer-reviewed research publications on **machine learning, signal processing, brain-computer interface, and wearable technology.**
- Generated novel scientific & engineering research questions, set out project plans, designed systems and apparatus, performed testing and validation, and published results in **peer-reviewed venues.**
- Rapidly acquired mathematical and scientific skill sets in order to carry out research objectives.
- Performed **stakeholder analysis** and prototyping for COVID-19 technology development projects and grant applications.

### CareTrack.io
*Toronto, Ontario*

Co-Founder and CEO — *June 2019 - Present*

- 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. Incorporated in July 2019.
- Utilizes Angular, Firebase, Chart.js, Python/Flask.

### Venture13
*Cobourg, Ontario*

Software Engineer — *June 2019 - August 2019*

- 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.
- Assisted with **microprocessor programming**, implementing low power machine learning and signal processing with Nordic Semiconductor's SDK for Amy Arthur's CLAXON project.

## Extracurricular Activity

### University of Toronto Consulting Association
*Toronto, Canada*

Consulting Group Director — *May 2020 - PRESENT*

- Recruited a team of 36 University of Toronto students (undergraduates, Masters, and Ph.D's) out of a pool of over 100 applicants to solve management consulting problems for local **non-profits and startups** at UofT's largest consulting club.
- Worked with client organizations to understand issues with their operations and draft **problem statements.**
- Managed **on-boarding and training** of associates consultants and team-leads.
- Oversaw progress of 6 independent teams working to solve problems for real-world clients.
- **Presented** on behalf of the UTCA at a variety of venues to widen outreach and communicate professional and communal objectives.

# Honors & Awards

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|---|---|---|
| 2020 | **Undergraduate Student Research Award**, Natural Sciences and Engineering Research Council of Canada | *Govt. of Canada* |
| 2020 | **Shaw Design Scholarship**, University of Toronto Faculty of Engineering Science | *EngSci* |
| 2019 | **Engineering Alumni Network Scholarship**, University of Toronto Faculty of Applied Science and Engineering | *EngSci* |
| 2018 | **President's Scholarship**, University of Toronto | *UofT* |

# Publications

### Adaptive Chirplet Transform-Based Machine Learning for P300 Brainwave Classification

*MannLab Canada*

Lead Researcher — *Sept. 2020*

[1] **A. Bhargava** and S. Mann, "Adaptive Chirplet Transform-Based Machine Learning for P300 Brainwave Classification", *IEEE Engineering in Medicine and Biology Society Conference on Biomedical Engineering and Sciences*, 2020 (Pending Review)

- Wrote a novel signal transform library in Python and NumPy to implement an improved version of the adaptive chirplet transform algorithm.
- Utilized signal processing library in conjunction with machine learning techniques to classify P300 brain waves (event-related potential's) with high accuracy.
- Optimized algorithm and experiments to run in parallel on Google Compute Engine architecture.
- Paper pending review at IEEE Engineering in Medicine and Biology Society Conference on Biomedical Engineering and Sciences.

### Mind over Music: Reinforcement Learning for EEG Brain State Optimization in Meditation

*MannLab Canada*

Lead Researcher — *July 2020*

[2] **A. Bhargava**, K. O'Shaughnessy, and S. Mann, "A Novel Approach to EEG Neurofeedback via Reinforcement Learning", *IEEE Sensors*, 2020 (Accepted & Presented)

- Designed and implemented a novel reinforcement learning-based real time EEG neurofeedback loop for optimizing users' meditation.
- Utilized PyTorch, PortAudio, RTAudio, ESP32, and Muse 2 by InteraXon.
- Ran trials to test efficacy of the proposed system.
- Found $p = 0.06$ for the null hypothesis that there is no or negative difference between the proposed system and a state-of-the-art conventional neurofeedback system.
- Presented findings at IEEE Sensors 2020.

### Vironment: Sensing of the Self, Society, and the Environment

*MannLab Canada*

Biosignal Processing for Wearables Researcher — *July 2020*

[3] S. Mann, C. Pierce, **A. Bhargava**, C. Tong, K. Desai, K. O'Shaughnessy, "Sensing of the Self, Society, and the Environment", *IEEE Sensors*, 2020 (Accepted & Presented)

- Designed and implemented biosignal processing algorithms to non-invasively determine users' biometrics include heart rate and blood pressure.
- Worked closely in collaboration with the hardware team to optimize algorithms for use in the wearable's design.
- Designed & implemented signal processing pipelines based on PPG, RADAR, accelerometer, ECG, infrared, and optical data streams.
- Assisted in generating and publishing a novel sense-making taxonomy.

### Ayinograph: Determining and Visualizing Veillance Flux via SSVEP

*MannLab Canada*

Mechatronics Engineering — *June 2020*

[4] D. E. Garcia, Y. Liu, K. W. Zheng, Y. Tao, C. Pierce, P. V. Do, **A. Bhargava**, and S. Mann, "Ayinography: Assessing the Visual Acuity of the Human Eye with SSVEP", *International Workshop on Multimedia Signal Processing*, 2020 (Submitted)

- Created physical apparatus for experimentation by performing hardware hacking on a commercial engraving machine to work with a custom PCB I had designed for another project.
- Developed control system software and associated documentation for use by in-lab team as they conducted their tests.
- Collaborated remotely to alter and augment the functionality of the mechatronic system.

# Selected Presentations

### Mind over Music: Reinforcement Learning with Brain Scans, Music, and Meditation

*IEEE Sensors 2020*

Presenting Author — *Oct. 2020*

- Virtual presentation of research paper at IEEE Sensors 2020.
- **Presentation Link**

### Genetic Algorithms for Generative Bridge Design

*ESC101: Praxis I, UofT*

Invited Presentation — *2018*

- Presentation on my use of genetic algorithms for generating effective bridge designs.
- **Presentation Link** (Excerpt)