Shysta Sehgal

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Canada

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Education

Doctoral Candidate, Biomedical Engineering *2025-2030*
University of Toronto *Toronto, Canada*

- Supervisors: Dr. Luka Milosevic, Dr. Benjamin Davidson
- Lab: Translational Neurophysiology and Brain Stimulation Lab
- Affiliations: Sunnybrook Research Institute, Krembil Research Institute
- Focus: Deep brain surgical stimulation for psychiatric disorders (depression, OCD, and substance addiction)

B.Sc. (Hons), Computer Science and Cognitive Science *2020-2025*
University of Toronto – Victoria College *Toronto, Canada*

- GPA: 3.72/4.0
- International Scholar Award (merit-based scholarship valued at $100,000)
- Laidlaw Scholarship (valued at $10,000 to conduct independent university-level summer research and leadership projects)

Research Experience

Research Assistant *September 2024 – March 2025*
BMO Lab, University of Toronto *Toronto, Canada*
Supervisor: Professor David Rokeby

- Researched sparse autoencoders for extracting interpretable features from neural networks, inspired by Anthropic's work on scaling monosemanticity (reference)
- Implemented a proof-of-concept using the Llama 2 model to study how scaling feature representations impacts neural network responses
- Demonstrated the potential of sparse encoding techniques for improving feature interpretability in large language models, contributing to neural network transparency and explainability

Research Intern *September 2024 – March 2025*
Tidal Care Inc. *Alberta, Canada*
Manager: Shawn Brown (CEO)

- Researched the therapeutic potential of psychedelics (psilocybin, LSD-25, ayahuasca) for managing neurodegenerative disorders such as Parkinson's, Alzheimer's, and dementia
- Conducted a comprehensive literature review, analyzing quantitative and qualitative studies as well as case reports from pharmacology and neuroscience journals
- Identified limitations in existing research hindering the clinical application of psychedelics for these disorders
- Collaborated with Dr. Krista Leicht, a psychiatrist at Tidal, to design future clinical trial plans and develop marketable products grounded in scientific evidence

Research Intern *May 2022 – August 2022*
Vector Institute and **PAIR Lab** *Toronto, Canada*
Supervisor: Dr. Animesh Garg
Award: University of Toronto Excellence Award (valued at $7500)

- Developed simulation environments (e.g., suturing, needle grasp, peg transfer) in NVIDIA Isaac Sim for surgical robots to enable learning on soft objects and facilitate real-life surgical interventions
- Integrated the dVRK surgical robot into Isaac Sim and resolved issues with pose tracking and inverse kinematics

Research Assistant *May 2022 – June 2022*
Computational and Psycholinguistics Lab, University of Toronto *Scarborough, Canada*
Supervisor: Dr. Blair Armstrong
Title: Improving Reading Curricula
Award: Jackman Scholars-in-Residence (awarded $1000 and living expenses to conduct intensive research in a team of four for one month)

- Developed confusion matrices in Python to analyze phoneme similarity and their impact on learning outcomes.
- Created a Python-based decoder to generate all possible pronunciations of words by integrating rules taught to students.
- Performed data analysis using NumPy and Pandas, and visualized findings in Matplotlib to assess the effectiveness of various reading curricula in Ontario for pre-literate students.

Laidlaw Scholar *May 2021 – August 2021*
Laidlaw Foundation *Toronto, Canada*
Supervisor: Dr. Caroline Manion
Title: Drivers of Women's Participation in STEM in the Academy

Award: Laidlaw Scholarship (valued at $10,000 to conduct independent university-level summer research and leadership projects)

- Conducted a literature review of 25 peer-reviewed psychological journal articles, employing qualitative research methods to analyze enabling and constraining factors for women in tertiary STEM education
- Authored a research paper and designed a poster summarizing findings, with actionable recommendations to improve participation and retention of women in tertiary STEM education

Work Experience

Data Science Intern *May 2024 – August 2024*
City of Toronto *Toronto, Canada*

- Analyzed data submissions from private transportation companies, like Uber and Lyft, using PostgreSQL to identify incorrect or suspicious records
- Designed and implemented validation rules, flagging over 4,000 records daily to improve data accuracy and reliability

Machine Learning Intern *May 2023 – December 2023*
Qualcomm *Markham, Canada*

- Researched and built proof-of-concept for forward gradients with sparse weight updates to eliminate backpropagation, enabling low-power on-device AI solutions
- Optimized machine learning functions, such as softmax, using C for improved performance the Runtime Team
- Integrated codebase updates across multiple sub-teams, enhancing the efficiency of AI systems

Projects

Deciphering Cognition: An Investigation into CNN Architecture

- Used PyTorch, MNIST, CIFAR-10, NumPy to build neural architecture comparison framework
- Implemented controlled experiments analyzing fixed-node CNNs with standardized training parameters across multiple depths achieving 97.7% MNIST and 60.7% CIFAR-10 accuracy
- Developed statistical analysis pipeline using ANOVA and OLS regression with systematic data cross-validation validating significant depth effects ($p < 0.004$) on model performance

Deep Music Generation Robustness Study for Augmented Inputs

- Used PyTorch, MusicGen, RMSE, NumPy, SciPy, MIDI to build robust music generation system
- Built multi-threaded data pipeline using Python concurrent futures processing 10K+ MIDI samples with custom augmentation handlers for pitch, volume, and temporal variations
- Engineered statistical analysis system with Pandas and automated error detection using SciPy achieving 95% test coverage across Mann-Whitney, Spearman, and human perception metrics

TTC Alerts (But, Like, Better)!

- Collaborated with a team of three to develop a real-time Toronto Transit emergency alert application using React (frontend) and Python (backend).
- Integrated the Twint API to collect TTC-related tweets and the Cohere API to classify tweets as high-alert or false alarms.
- Fine-tuned an Information Extraction model from the Cohere API to summarize high-alert tweets for user notifications.

Conferences

Presented & authored "**Towards the Ontological Unfolding of Generative AI: An Interdisciplinary Exploration of Creativity, Epistemology, and Ethics**", XXVI Generative Art Conference, December 2023

Technical Skills

Programming Languages: Python, Java, C, R, C++, C#
Technologies: Scikit-learn, PyTorch, Tensorflow, Matplotlib, NumPy, Pandas, ROS, PostgreSQL
Developer Tools: Git, GitHub, GitLab, Linux, Visual Studio

Websites

GitHub: https://github.com/shysta-sehgal
LinkedIn: https://www.linkedin.com/in/shysta-sehgal/