

# Eric Elmoznino

Artificial Intelligence  
Cognitive Neuroscience

## Contact

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## Websites



## Education

PhD | Computer Science  
Mila (Université de Montréal)  
2022-Now

MA | Cognitive Science  
Johns Hopkins University  
2019-2020

BASc | Computer Engineering  
University of Toronto  
2014-2019

DCS | Health Sciences  
Dawson College  
2012-2014

## Skills

### Languages/Frameworks

Python, PyTorch, TensorFlow, sklearn,  
Matlab, C++, C, C#, Swift/iOS,  
JavaScript, HTML, CSS, Flask, LaTeX

### Subjects/Techniques

ML, Deep learning, MVPA,  
Computational modeling, Human  
vision, Linguistics, Full-stack web

### Spoken Languages

English, French (Fluent in both)

## Interests

### Mind, Brain, and AI

Consciousness, Causal reasoning,  
Knowledge representation, Rapid OOD  
generalization, Lifelong learning,  
Modularity/compositionality, Vision

### Public Speaking

Technical presentations, Teaching

### Other Disciplines

Data Science, Genetics, Astrophysics,  
Philosophy of mind, Epistemology

### Hobbies

Reading, Piano, Snowboarding,  
Tennis, Basketball, Ice hockey

## Research Positions & Work Experience

- 2022-Now **AI Researcher** Mila (Université de Montréal), Montreal, QC  
Development of AI with inductive biases from conscious high-level cognition, supervised by Profs. Guillaume Lajoie and Yoshua Bengio
- 2020-Now **Data Science Instructor** Lighthouse Labs, Toronto, ON  
Teach lectures on machine learning topics at a full-time data science bootcamp to students with no coding background
- 2019-2022 **Cognitive Science Researcher** Johns Hopkins University, Baltimore, MD  
Research on information representation and algorithms in the visual system of the human brain with Prof. Michael Bonner
- 2021 **Computational Neuroscience TA** Neuromatch Academy, Remote  
Lead groups of students through tutorial exercises ◦ Review lecture material and answer student questions
- 2017-19 **Machine Learning Researcher** ModiFace, Toronto, ON  
Work on computer vision machine learning models for the beauty industry ◦ Research papers on makeup rendering and skin condition diagnostics using deep learning
- 2018 **Computer Vision Contractor** Precious, Remote  
Work on computer vision machine learning models related to facial perception for a mobile app that automatically makes photo albums of babies for new parents
- 2016 **Software Developer Intern** Orbis Investments, Vancouver, BC  
Full-stack web development using AngularJS, Angular Material, ASP.NET MVC, Web API, and SQL Server in order to improve internal workflow efficiency for financial reporting
- 2012-14 **Private, Infantry Division** Canadian Armed Forces (Reserves), Valcartier, QC  
Discipline and weapons training ◦ Participation in combat and reconnaissance exercises

## Projects

- 2022-Now **Sampling compositions of modular neural networks**  
Jointly learning a set of neural network modules and how to sample context-conditioned compositions of them using GFlowNets
- 2021-22 **Dimensionality and Manifold Geometry of Visual Representations**  
Quantifying the relationship between a) the geometry of representations in a CNN and b) its similarity to visual cortex
- 2020-21 **Multiplicative Feature Interactions as Neural Computations**  
Investigation into multiplicative interactions between features as a canonical neural computation ◦ Use in models of neural data
- 2019-20 **Computational Modeling of Human Scene Representation**  
Design of deep neural networks to model how humans represent environments ◦ Comparisons to behavioural and neural data
- 2019-20 **Stimulus Synthesis for Brain Region Manipulation**  
Generative model of images that would elicit a desired pattern of brain activity in a given region ◦ Behavioural experiments
- 2020 **Language Model With Compositional Grammar Inductive Bias**  
Tree-RNN provided part-of-speech tags and sentence parses in order to learn compositional representations of language
- 2018-19 **The History of You (human memory augmentation)**  
Mobile app and algorithms to record, transcribe, and store your conversations, as well as later retrieve their content through search
- 2017 **Music-Generating AI**  
Music generating machine learning model that uses DBN's conditioned on the state of LSTM's to probabilistically play different notes

## Publications

- 2022 **High-performing neural network models of visual cortex benefit from high latent dimensionality.** Elmoznino E. & Bonner M. F. *Preprint*
- 2022 **Context predicts commonsense notions of object similarity.** Magri C., Elmoznino E., Bonner M. F. *Preprint*
- 2020 **Visual representations derived from multiplicative interactions.** Elmoznino E., & Bonner M. F. *NeurIPS Workshop SVRHM*
- 2019 **A new procedure, free from human assessment that automatically grades some facial skin structural signs. Comparison with assessments by experts, using referential atlases of skin ageing.** Jiang R., Kezele I., Levinshtein A., Flament F., Zhang J., Elmoznino E., Ma J., Ma J., Coquide J., Arcin V., Omoyuri E., Aarabi P. *International Journal of Cosmetic Science*

## Conference Talks & Posters

- 2022 **(Talk) High-performing neural network models of visual cortex benefit from high latent dimensionality.** Elmoznino E., & Bonner M. F. *Montreal AI Symposium*
- 2022 **(Poster) High-performing neural network models of visual cortex benefit from high latent dimensionality.** Elmoznino E., & Bonner M. F. *Cognitive Computational Neuroscience*
- 2022 **(Talk) Latent dimensionality scales with the performance of deep learning models of visual cortex.** Elmoznino E., & Bonner M. F. *Vision Sciences Society*
- 2021 **(Talk) Model dimensionality scales with the performance of deep learning models for biological vision.** Elmoznino E., & Bonner M. F. *Neuromatch 4.0*
- 2021 **(Poster) High-performing computational models of visual cortex are marked by high effective dimensionality.** Elmoznino E., & Bonner M. F. *Vision Sciences Society*

## Invited Talks

- 2022 Why can't we describe our conscious experiences? An attractor dynamics perspective of the ineffability of qualia — University of Toronto guest lecture
- 2020 How does the brain work? Cognitive science research — SABES
- 2020 Introduction to Programming with Python — UofTHacks

## Patents

- 2022 **System and method for image processing using deep neural networks.** Levinshtein A., Chang C., Phung E., Kezele I., Guo W., Elmoznino E., Jiang R., Aarabi P. *U.S. Patent No. 11216988*. Washington, DC: U.S. Patent and Trademark Office
- 2021 **Image-to-image translation using unpaired data for supervised learning.** Elmoznino E., Kezele I., Aarabi P. *U.S. Patent Application No. 17096774*. Washington, DC: U.S. Patent and Trademark Office
- 2020 **System and method for augmented reality using conditional cycle-consistent generative image-to-image translation models.** Elmoznino E., Ma H., Kezele I., Phung E., Levinshtein A., Aarabi P. *U.S. Patent Application No. 16683398*. Washington, DC: U.S. Patent and Trademark Office
- 2020 **Machine image colour extraction and machine image construction using an extracted colour.** Elmoznino E., Aarabi P., Zhang Y. *U.S. Patent Application No. 16854975*. Washington, DC: U.S. Patent and Trademark Office
- 2020 **Automatic image-based skin diagnostics using deep learning.** Jiang R., Ma J., Ma H., Elmoznino E., Kezele I., Levinshtein A., Charbit J., Despois J., Perrot M., Antoinin F., Flament R.S., Parham A. *U.S. Patent Application No. 16702895*. Washington, DC: U.S. Patent and Trademark Office

## Other Activities

- |         |  |   |
|---------|--|---|
| 2018    | <b>Instructor for ECE1780</b>  | University of Toronto, Toronto, ON                    |
|         | Taught lectures for a graduate course on DNNs deployed to mobile devices under Prof. Parham Aarabi |   |
| 2015-16 | <b>Finance Chair</b>   | Electrical and Computer Engineering Club, Toronto, ON |
|         | Elected by peers at the University of Toronto to manage the club budget and plan social activities |   |
| 2014-15 | <b>Class Representative</b>  | Electrical and Computer Engineering Club, Toronto, ON |
|         | Elected by peers at the University of Toronto to represent student interest at faculty meetings    |   |

## Advising

- |         |  |   |
|---------|--|---|
| 2021-22 | <b>Atlas Kazemian</b>                                    | Johns Hopkins University, Baltimore, MD |
|         | Masters (Cognitive Science)                              |   |
| 2020-21 | <b>Adyant Balaji</b>                                     | Johns Hopkins University, Baltimore, MD |
|         | Undergraduate (Computer Engineering & Cognitive Science) |   |
| 2019-20 | <b>Maro Maged Doce</b>                                   | Johns Hopkins University, Baltimore, MD |
|         | Undergraduate (Neuroscience)                             |   |

## Scholarships

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|------|---|
| 2022 | UNIQUE Neuro-AI Excellence Scholarship (\$15,000 value)   |
| 2016 | Class of 4T3 Engineering James Ham Award (\$10,000 value) |
| 2015 | Class of 5T6 Award of Merit (\$15,000 value)              |
| 2012 | McGill Science Award and Scholarship                      |
| 2012 | A.J. Grant Shield and Scholarship                         |

## Honors & Awards

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|------|---|
| 2015 | Class of 5T6 Award of Merit                                       |
| 2013 | First Choice Science Award  |
| 2012 | Quebec English Public Speaking (Provincial Finals) — Bronze Medal |
| 2012 | Governor General of Canada Academic Medal                         |
| 2012 | Royal Bank of Canada Shield                                       |
| 2012 | Davies Family Shield  |
| 2012 | Eakeley Shield  |
| 2011 | Quebec French Public Speaking (Provincial Finals) — Silver Medal  |