

# Eric Elmoznino

Cognitive Neuroscience  
Artificial Intelligence

## Contact

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## Websites



## Education

PhD | Computer Science  
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, Matlab, C++, C, C#,  
Swift/iOS, PyTorch, TensorFlow,  
JavaScript, HTML, CSS, Flask, LaTeX

### Subjects/Techniques

Machine 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** 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

- 2021-Now **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
- 2017 **Spatially-Aware AI**  
Machine learning model that uses CNN's to predict it's own position and orientation, trained using synthetic data from my ray tracer

## 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) 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

- 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 **Instructor for ECE1780** University of Toronto, Toronto, ON  
Taught lectures for a graduate course on DNNs deployed to mobile devices under Prof. Parham Aarabi
- 2015-16 **Finance Chair** 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 **Class Representative** 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> Masters (Cognitive Science)	Johns Hopkins University, Baltimore, MD
2020-21	<b>Adyant Balaji</b> Undergraduate (Computer Engineering & Cognitive Science)	Johns Hopkins University, Baltimore, MD
2019-20	<b>Maro Maged Doce</b> Undergraduate (Neuroscience)	Johns Hopkins University, Baltimore, MD

## Honors & Awards

2021	Elsevier/Vision Research Virtual Travel Award
2016	Class of 4T3 Engineering James Ham Award
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	McGill Science Award and Scholarship
2012	A.J. Grant Shield and Scholarship
2012	Royal Bank of Canada Shield
2012	Davies Family Shield
2012	Eakeley Shield
2011	Quebec French Public Speaking (Provincial Finals) — Silver Medal