Samuel Leblanc

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Education

Queen's University **2025 - 2027**
M.Sc. in Mathematics

Université de Sherbrooke **2022 - 2025**
B.Sc. in Mathematics

Research Interests

Representation theory, topological data analysis, machine learning, homological algebra.

Papers

1. Armenta, M., Leblanc, S., *Batalin-Vilkovisky structure on Hochschild cohomology with coefficients in the dual algebra.* arXiv:1810.13023 (2025)
2. Leblanc, S., Rasolomanana, A., Armenta, M., *Hidden Activations Are Not Enough: A General Approach to Neural Network Predictions.* arXiv:2409.13163 (2024)

Student Papers

1. Leblanc, S., *Dégénérations des représentations de carquois de type $\mathbb{A}_3$ à deux puits.* To appear in: Cahiers mathématiques de l'Université de Sherbrooke (2024)
   Supervisors: Emily Cliff and Shiping Liu
2. Leblanc, S., *Transformations de cercles orientés tangents sur la sphère de Riemann.* Submitted in: Cahiers mathématiques de l'Université de Sherbrooke (2023)
   Supervisor: Jean-Philippe Burelle

Posters

1. Leblanc, S., *Multiplicity of the Interval Module.* AARMS-CMS Student Poster Session (CMS Summer Meeting) (2025)
   Collaborators: Laurianne Baril and Justin Desrochers. Supervisor: Thomas Brüstle.
2. Desrochers, J., Leblanc, S., *Kernel of the Rank Invariant.* Summer Research School, Applications of Representation Theory in Topological Data Analysis and Geometric Invariant Theory (2024)

Teaching

Teaching Assistant

Méthodes quantitatives en communication marketing (MQG301) **Winter 2025**
École de gestion, Université de Sherbrooke

Calcul vectoriel (MAT298) **Fall 2024**
Département de mathématiques, Université de Sherbrooke

Statistique appliquée à la gestion (MQG222) **Summer 2024**
École de gestion, Université de Sherbrooke

Statistique appliquée à la gestion (MQG222) **Winter 2024**
École de gestion, Université de Sherbrooke

Grader

Algebraic Structures (MTHE 217) **Fall 2025**
Smith Engineering, Queen's University

Calculus I (APSC 171) **Fall 2025**
Smith Engineering, Queen's University

Differential and Integral Calculus (MATH 121) **Fall 2025**
Department of Mathematics and Statistics, Queen's University

Mathématiques discrètes (MAT120) **Fall 2024**
Département de mathématiques, Université de Sherbrooke

Tutor

Mathematics, 10th grade **2023 - 2024**
Volunteering with Le Diplôme avant la Médaille

Algèbre linéaire et géométrie vectorielle (MAT902) **Summer 2023**
Université de Sherbrooke

Biomécanique humaine (KIN325) **Winter 2023**
Université de Sherbrooke

Software

knowledgematrix GitHub

- A Python library for implementing neural networks and computing their associated *knowledge matrices* (i.e., N_V (Lemma 7.4) in this paper and $M(W, f)(x)$ in this paper).
- Tools: Python

simple_adversarial_detection GitHub

- Very simple version of the code used for the experiments in the paper Hidden Activations Are Not Enough: A General Approach to Neural Networks Predictions. arXiv:2409.13163
- Tools: Python

upperhalfplane GitHub

- Visualize the action of $\mathrm{PSL}(2, \mathbb{R})$ on the upper half plane (Poincaré half plane model) interactively. samueleblanc.com/software/upperhalfplane
- Tools: CindyJS, JavaScript, HTML, CSS

riemannsphere GitHub

- Visualize the action of $\mathrm{PSL}(2, \mathbb{C})$, i.e., Möbius transformations, and $\mathrm{PSP}(4, \mathbb{R})$ on the Riemann sphere interactively. samueleblanc.com/software/riemannsphere
  Supervisor: Jean-Philippe Burelle.
- Tools: CindyJS, JavaScript, HTML, CSS

MatTalX GitHub

- Chrome Extension and Firefox Add-on that allow the user to convert LaTeX commands into plain text, enabling them to write symbols anywhere. https://mattalx.org
- Tools: JavaScript, HTML, CSS, Bash

Talks

1. *Analyse topologique de données* (February 13, 2025)
   Club mathématiques de l'Université de Sherbrooke
2. *La propagation avant en tant que matrice* (November 14, 2024)
   Club mathématiques de l'Université de Sherbrooke
3. *Visualisation de transformations sur la sphère de Riemann* (March 21, 2024)
   Club mathématiques de l'Université de Sherbrooke
4. *Théorie des représentations des réseaux de neurones* (October 5, 2023)
   Club mathématiques de l'Université de Sherbrooke

Academic Activities

Canadian Mathematical Society (CMS) Meeting **Summer 2025**
Attended the 2025 CMS Summer Meeting at the Université Laval (Québec, QC). June 7 to 9, 2025.

34th RTA Meeting **Fall 2024**
Attended the 34th Meeting on the Representation Theory of Algebras and Related Topics at the Université de Sherbrooke (Sherbrooke, QC). October 4 and 5, 2024.

Research School **Summer 2024**
Attended the Summer Research School: Applications of Representation Theory in Topological Data Analysis and Geometric Invariant Theory, at the UQAM (Montréal, QC). June 3 to 7, 2024.

Introduction to Research (MAT523): Topological Data Analysis **Winter 2024**
Optional course. *Département de mathématiques, Université de Sherbrooke*
Supervisor: Thomas Brüstle

Reading group in category theory **Winter 2024**
Participated in weekly meeting with graduate students as well as undergraduates students. Made several talks about the week's readings.

BIRS Workshop **Winter 2024**
Assisted (online) to the BIRS Workshop: Representation Theory and Topological Data Analysis. April 8 to 11, 2024.

Research internship: Representation Theory of Quivers **Summer 2023**
Département de mathématiques, Université de Sherbrooke
Supervisors: Emily Cliff and Shiping Liu

Experimental Mathematics Lab (MAT001): Projective Geometry **Winter 2023**
Course taken beyond B.Sc. requirements. *Département de mathématiques, Université de Sherbrooke*
Supervisor: Jean-Philippe Burelle

Languages

French (native), English (advanced).