

# Mehrab Hamidi

M.s. Student at McGill University

Research Assistant at Mila



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## About me

I am Mehrab Hamidi, an M.S. student in Computer Science at McGill University and a Research Assistant at Mila, specializing in Deep Learning Theory and Computational Biology. My work focuses on the geometrical analysis of deep ReLU networks and statistical inference. With a strong foundation in mathematics and a passion for collaborative research, I have contributed to several significant publications. Outside academia, I enjoy a range of activities from sports to music, which enrich my professional journey in computer science.

## Interests

Deep Learning Theory  
Geometrical Analysis of Deep ReLU Networks  
Optimization  
Statistical Inference  
Computational Biology

## Education

since 2022	M.s. in Computer Science Computer Science Department	McGill University/Mila
2017-2022	B.Sc. in Computer Science Mathematics and Computer Science Department	Sharif University of Technology
2018-2022	Minor in Mathematics Mathematics and Computer Science Department	Sharif University of Technology

## Publications

2023	Predicting Survival of Iranian COVID-19 Patients Infected by Various Variants Including Omicron from Ct Scan Images and Clinical Data Using Deep Neural Networks (Helyion)
2023	A New R Package for Categorizing Coding and Non-Coding Genes (pre-print)
2022	Somatic point mutations are enriched in non-coding RNAs with possible regulatory function in breast cancer (Nature Communication Biology)
2020	Accurate and Rapid Diagnosis of COVID-19 Pneumonia with Batch Effect Removal of Chest CT-Scans and Interpretable Artificial Intelligence (pre-print)

## Research Experience

Since 2023	Hidden Symmetries of Deep ReLU Networks This ongoing research explores the function spaces of deep ReLU networks, focusing on uncovering architectural symmetries. The project is a collaborative effort with Dr. Elisenda Grigsby and Dr. Kathryn Lindsey from the Mathematics Department at Boston College.
2022-2023	Reverse-Engineering Deep ReLU Networks This project involved the development of techniques to deduce the weights, biases, and architecture of deep ReLU networks solely from input-output queries, without prior assumptions about their structure.
2020	Likelihood-Free Method for Estimating Trait Phenotype Posterior Distributions We aimed to identify causal SNPs and predict phenotypes for specific traits using likelihood-free Bayesian methods. The research also extended to applications in Longitudinal Genome-wide Association Studies.
2019	Landscape Analysis of Non-Coding RNA in Cancer This pioneering study introduced an integrative pipeline to analyze the mutational load across non-coding RNA genes in six cancer types, identifying significant cancer-specific mutations. I have authored two of the four papers from this project, with the remaining papers under review or in preparation for publication.
2019	Enhancing Variable Selection for Categorical Data Using the Knockoff Method This study focuses on improving the performance and applicability of variable selection methods for categorical data, specifically through the enhancement of the Knockoff method.

## Relevant Courses

### • Graduates Courses

- Theory of Deep Learning (2023) - Université de Montréal  
Ioannis Mitliagkas
- Mathematical Tools in Computer Science (2022) - McGill University  
Prof. David Rolnick
- Bayesian Method in Statistics and Learning (2019) - SUT  
Efron, B., Hastie, T. (2016). Computer age statistical inference (Vol. 5)
- Machine Learning (2018) - SUT  
Bishop, C. M. (2006). Pattern recognition. Machine learning, 128(9).
- Convex optimization (Audit)  
Boyd, S., Boyd, S. P., Vandenberghe, L. (2004). Convex optimization. Cambridge university press.
- Deep Learning (Audit)
- Advanced Bioinformatics (Audit)

### • Undergraduates Courses

- Statistics  
Wonnacott, T. H., Wonnacott, R. J. (1969). Introductory statistics.
- Linear Algebra
- Game Theory  
Ross, S. M. (1976). A first course in probability (No. 519.2 R6). New York.
- Mathematical Real Analysis
- Information Theory
- Operation Research
- Artificial Intelligence
- Stochastic Process  
Lawler, G. F. (2018). Introduction to stochastic processes. Chapman and Hall/CRC.

## Work Experience

- |            |   |                   |
|------------|---|-------------------|
| since 2021 | Research Assistant Intern<br>Currently working on a project about bayesian inference using likelihood free variational methods  | McGill University |
| 2018-2021  | Undergraduate Research Assistant<br>Involved in several research projects in genomics such as landscape analysis of non-coding RNAs   | DML               |
| 2020-2021  | Data Scientist<br>Provided comprehensive analysis and recommend solutions to address complex medical-related problems and issues using data (mostly image type data) from internal and external sources and applied advanced analytical methods such as DL to assess factors impacting growth and profitability across product and service offerings. | AI-Med            |
| 2019-2020  | Machine Learning Engineer<br>Implemented and evaluated artificial intelligence and machine learning algorithms and neural networks for diverse industries. I worked as a member of team on a project about Automatic Speech Recognition   | Fanap             |

## Honors and Awards

- |      |   |
|------|---|
| 2017 | Ranked 130 among one hundred thousand student attendance in university entrance exam (Konkur) |
| 2016 | Best poet of the state  |
| 2015 | Gold medal of national swimming competition and a member of the university swimming team      |
| 2017 | A member of the Iranian Mathematical Society.   |

## Skills

Languages Farsi/Persian (native)

English (fluent)

TOEFL iBT - November 27, 2021 (Overall: 100)

Reading: 27 - Listening: 28 - Speaking: 23 - Writing: 22

Software Python, R, Java, L<sup>A</sup>T<sub>E</sub>X, C++

Tools Pytorch, Tensorflow, Scipy, CVX, ggplot, limma

Mathematics Linear Algebra, Variational Inference, Bayesian Statistics, Convex and Linear Optimization, Probability, Stochastic Processes, Combinatorics, Graph Theory, Real Analysis

## Other Experiences

- Teacher Assistant
  - Foundations of Programming (COMP202) – Artificial Intelligence (2020)  
McGill University - Fall 2022 – Discrete Mathematics (2019)
  - Statistical Machine Learning (graduate course) (2020) – Fundamentals of Programming (2018)
- Teaching Combinatory  
National Olympiad in Informatics - since 2018

## Hobbies

- Playing Tennis
- Working out
- Hiking
- Mountain Climbing
- Watching Movies
- Reading books
- Playing Violin/Kamancheh

## References

David Rolnick

Assistant Professor, Computer Science at McGill University and Mila Quebec AI Institute.

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