

# Nuri Mert Vural

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## Research interests

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High-dimensional statistics, optimization, deep learning theory, transformers, scaling laws

## Education

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### PhD (Computer Science)

Advisor: Murat A. Erdogdu

University of Toronto

Sept 2020 – Present

### MSc (Electrical Engineering)

Advisor: Süleyman S. Kozat

Bilkent University

2018 – 2020

### BSc (Electrical Engineering)

Honors thesis advisor: Hamdi Torun

Bogazici University

2013 – 2018

## Research articles

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### Peer-reviewed conference publications

- Nuri Mert Vural, Alberto Bietti, Mahdi Soltanolkotabi, Denny Wu. “Learning to Recall with Transformers Beyond Orthogonal Embeddings.” *International Conference on Learning Representations 14 (ICLR 2026, to appear)*, 2025. [[PDF](#)]
- Gérard Ben Arous, Murat A. Erdogdu, Nuri Mert Vural, Denny Wu. (alphabetical) “Learning Quadratic Neural Networks in High Dimensions: SGD Dynamics and Scaling Laws.” *Advances in Neural Information Processing Systems 39 (NeurIPS)*, 2025. [[arXiv](#)]
- Nuri Mert Vural, Murat A. Erdogdu. “Pruning is Optimal for Learning Sparse Features in High-Dimensions.” *37th Annual Conference on Learning Theory (COLT)*, 2024. [[arXiv](#)]
- Nuri Mert Vural, Lu Yu, Krishnakumar Balasubramanian, Stanislav Volgushev, Murat A. Erdogdu. “Mirror Descent Strikes Again: Optimal Stochastic Convex Optimization under Infinite Noise Variance.” *35th Annual Conference on Learning Theory (COLT)*, 2022. [[arXiv](#)]
- Nuri Mert Vural, Yigit Yoleri, and Hamdi Torun. “On Feasibility of Near-Infrared Spectroscopy for Noninvasive Blood Glucose Measurements.” *SPIE Photonics West 2019, 108850R* (20 February 2019). [SPIE Digital Library](#).

### Journal publications

- Nuri Mert Vural, Fatih Ilhan, Selim Yilmaz, Salih Ergüt, Süleyman S. Kozat. “Achieving Online Regression Performance of LSTMs with Simple RNNs.” *IEEE Transactions on Neural Networks and Learning Systems*, 2022. [[arXiv](#)]
- Nuri Mert Vural, Salih Ergüt, Süleyman S. Kozat. “An Efficient and Effective Second-Order Training Algorithm for LSTM-based Adaptive Learning.” *IEEE Transactions on Signal Processing*, 2021. [[arXiv](#)]
- Nuri Mert Vural, Hakan Gokcesu, Kaan Gokcesu, Süleyman S. Kozat. “Minimax Optimal Algorithms for Adversarial Bandit Problem with Multiple Plays.” in *IEEE Transactions on Signal Processing*, 2019. [[arXiv](#)]

## Work experience

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### Summer Research Associate

Flatiron Institute, CCM, New York

Mentors: Dr. Alberto Bietti (primary) and Dr. Denny Wu (secondary)

June 2025 – Sept 2025

*Focus:* Information-storage capacity of transformers depending on model size and dataset size

### Research Engineer

Turkcell, Ankara, Turkey

Mentors: Dr. Salih Ergüt

Sept 2019 – Sept 2020

*Focus:* Applications of recurrent neural networks to anomaly detection in communication networks

## Awards and scholarships

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- **Vector Institute Research Grant** (amount: 6000 CAD per year) in 2021-2022-2023-2024-2025
- **DCS Doctoral Completion Awards.** (amount: 4000 CAD per term), Fall 2024, 2025-Winter 2025
- **5G and Beyond Graduate Research Support** (amount: 12000 USD) during M.S. Studies.
- **Student Travel Grant** (amount: 800 USD) by COLT2024.
- **DeepMind Student Travel Grant** (amount: 250 USD) by COLT2022.
- **Student Travel Grant** (with the maximum amount - 750 USD) by SPIE Photonics West.

## Academic talks

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### Learning Quadratic Neural Networks in High Dimensions

2025

*Invited:* CRM Workshop on High-Dimensional Learning Dynamics, Montreal, Canada

### Pruning is Optimal for Learning Sparse Features in High-Dimensions

2024

COLT, Edmonton, Canada

### Optimal Stochastic Convex Optimization under Infinite Noise Variance

2022

COLT, London, UK

### Near-Infrared Spectroscopy for Noninvasive Blood Glucose Measurements

2019

SPIE Photonics West, San Francisco, USA

## Peer reviewing

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- **Journals.** *Transactions on Pattern Analysis and Machine Intelligence (TPAMI)*, *Journal of Machine Learning Research (JMLR)*, *Mathematics of Operations Research*
- **Conferences.** COLT: 2025, NeurIPS: 2023-2024-2025, ICLR: 2023-2024-2025-2026, AAAI: 2024, AISTATS: 2023 (**Top-10% Reviewer**)

## Teaching experience

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- **Head Teaching Assistant.** CSC311: Introduction to Machine Learning (Fall 2024, Winter 2025)
- **Teaching Assistant.**
  - *Graduate level courses.* CSC2506: Probabilistic Machine Learning (Winter 2024), CSC2532: Statistical Learning Theory (Winter 2022-2024)
  - *Undergraduate level courses.* CSC384: Introduction to Artificial Intelligence (Fall, Winter 2023)

## References

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- **Murat Erdogdu, Associate Professor** [erdogdu@cs.toronto.edu](mailto:erdogdu@cs.toronto.edu)
- **Stanislav Volgushev, Associate Professor** [stanislav.volgushev@utoronto.ca](mailto:stanislav.volgushev@utoronto.ca)
- **Alberto Bietti, Research Scientist at the Flatiron Institute** [abietti@flatironinstitute.org](mailto:abietti@flatironinstitute.org)