Nuri Mert Vural

https://nurimertvural.github.io vural@cs.toronto.edu github.com/nurimertvural

Research interests

High-dimensional statistics, optimization, neural-network training, transformers, scaling laws

Education

PhD (Computer Science) — **University of Toronto**
Advisor: Murat A. Erdogdu — *Sept 2020 – Present*

MSc (Electrical Engineering) — **Bilkent University**
Advisor: Süleyman S. Kozat — *2018 – 2020*

BS (Electrical Engineering) — **Bogazici University**
Honors thesis advisor: Hamdi Torun — *2013 – 2018*

Research articles

Submitted works

- Nuri Mert Vural, Alberto Bietti, Mahdi Soltanolkotabi, Denny Wu. "Learning to Recall with Transformers Beyond Orthogonal Embeddings." *(submitted)*, 2025.

Peer-reviewed conference publications

- 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 Digitial 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

Summer Research Associate **Flatiron Institute, CCM, New York**
Mentors: Dr. Alberto Bietti (primary) and Dr. Denny Wu (secondary) *June 2025 – Sept 2025*

Focus: Scaling laws for memorization-capacity of large language models (which quantifies how training-set size and compute budget trade off to achieve accurate factual recall).

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

- **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

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

- **Journals.** *Journal of Machine Learning Research* (JMLR), *Mathematics of Operations Research*
- **Conferences.** *COLT*: 2025, *NeurIPS*: 2023-2024-2025, *ICLR*: 2023-2024-2025-2026, *AISTATS*: 2023

Teaching experience

- **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

- **Murat Erdogdu** erdogdu@cs.toronto.edu
- **Stanislav Volgushev** stanislav.volgushev@utoronto.ca
- **Gérard Ben Arous** benarous@cims.nyu.edu