ANTON SUGOLOV

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Toronto, Canada

EDUCATION

HBSc. Applied Mathematics and Statistics Sep. 2020 - Jun. 2024
Victoria College at the University of Toronto, St. George *3.80*

- Fourth year Applied Mathematics specialist and Statistics major interested in mathematical methods for deep learning.
- **Highlights:** Deep Learning, Nonlinear Optimization, Partial Differential Equations, Probability, Data Analysis

EXPERIENCE

LLMs, Empirical Study of Hidden Representations and Prediction Nov. 2023 - Present
Prof. Vardan Papyan *University of Toronto*

- Investigated Llama-2, Falcon, and GPT-2 token embeddings at hidden layers with their linearity, alignment of Jacobians, and intermediate prediction entropy. Discovered distinct phases appearing in all metrics, varying by layer depth.
- Reviewed relation of intermediate regularity and generalization, training decisions in LLMs, and transformer dynamics.
- Technical experience with LLM inference and implementations with PyTorch and HuggingFace API.

Quantum Computing May 2023 - Aug. 2023
Prof. Hans-Arno Jacobsen and Dr. Viki Kumar Prasad *Middleware Systems Research Group, University of Toronto*

- NSERC USRA research opportunity in quantum circuit architecture for chemical bond separation energy prediction.
- Technical experience with PennyLane, PyTorch Geometric, Shell scripting, Slurm for HPC training.

Statistical Genetics June 2020 - June 2021
Prof. Lei Sun and Dr. Andrew Paterson *University of Toronto*

- Created open-source tutorial for running Genome Wide Association Studies using publicly available 1000 Genomes gene expression data, wrote accompanying 40-page documentation and published pipeline.
- Lead a PLINK v1.9, R workshop for data quality control, PCA, GWAS association tests, and visualization for 15 students.

PUBLICATIONS

- **Sugolov, A.**, Emmenegger, E., Paterson, A.D., Sun L. Statistical Learning of Large-Scale Genetic Data: How to Run a Genome-Wide Association Study of Gene-Expression Data Using the 1000 Genomes Project Data. *Statistics in Biosciences* (2023).

SKILLS & INTERESTS

Programming & Markup	Python, R, Java, HTML, LaTeX
Packages	PyTorch, HuggingFace, PennyLane, Numpy, Pandas, Sklearn
Technical	GitHub, Arch Linux, Shell, Slurm, Hugo
Languages	*Native:* English, Ukrainian *Basic:* French, German

PRESENTATIONS

Clustering in Self-Attention Dynamics Nov. 2023
Applied^2 *Graduate Seminar*

- Presented results from 'The emergence of clusters in self-attention dynamics' as discovered by Geshkovski et al.
- Discussed further tests with multihead dynamics, effect of token number, and extensions with trained ALBERT weights.

Quantum circuit architecture selection via local optimization towards quantum machine learning of bond dissociation energy chemical data
Middleware Systems Research Group

- **Best Poster**: Data Sciences Institute Undergraduate Research Day, Data Sciences Institute. *August 10, 2023.* Poster
- Undergraduate Engineering Research Day, University of Toronto. *August 16, 2023.* Podium
- Data Sciences Institute Research Day, MaRS Discovery District. *September 27, 2023.* Poster
- Q-Site Conference, University of Toronto. *September 30, 2023.* Poster

Course Presentations Sep. 27, 2023
MAT477: Seminar in the Dimer Model and Discrete Riemann Surfaces

- *Introduction to the Inverse Kasteleyn Matrix*: Introduced and proved a result about the probability of a choice of dimers in a uniformly randomly selected configuration, relation to partition function of dimer configurations. *September 27, 2023.*
- *Introduction to the Ising, Potts, Percolation, and Random Cluster Models*: Introduced study of clustering behaviour in Ising, Potts, Percolation models through FK-Percolation/Random Cluster Model. *November 15, 2023.*

PROJECTS

Machine Learning and Statistical Modeling

- **Coursework:** Stochastic variational inference, probabilistic graphical models, additive, generalized linear models, multilevel models, random forests, gradient boosting, LDA, QDA, regression.

Course Scheduling Application Dec. 2021
CSC207, Software Design

- Created Java-based course scheduler implementing SOLID design principles, design patterns, and clean architecture.

HONOURS

NSERC Undergraduate Summer Research Award May - Aug. 2023
Prof. Hans-Arno Jacobsen, Middleware Systems Research Group
Department of Electrical and Computer Engineering, University of Toronto

Best Poster Presentation (1/3) Aug. 10, 2023
Data Sciences Institute Undergraduate Research Day

Mrs. F. N. G. Starr Memorial Scholarship 2023
Victoria College

Regents Scholarship I, II 2021 - 2022
Victoria College

Dean's List Scholar 2021 - 2023
University of Toronto

University of Toronto Scholar 2020 - 2021
University of Toronto