NAYOUNG LEE

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EDUCATION

University of Wisconsin-Madison *Sep.2020 - Present*
Ph.D. Student, Electrical and Computer Engineering
Advisor: Prof. Dimitris Papailiopoulos & Kangwook Lee

Seoul National University, Korea *Mar.2018 - Aug.2020*
M.S., Electrical and Computer Engineering
Advisor: Prof. Jungwoo Lee
Thesis: Channel Estimation Using Deep Complex Networks in Massive MIMO OFDM System

Seoul National University, Korea *Mar.2014 - Feb.2018*
B.S., Electrical and Computer Engineering
Summa Cum Laude

RESEARCH INTEREST

My main research interests revolve around both theoretical and practical aspects of Machine Learning. In particular, I am interested in finding efficient, robust, and scalable machine learning algorithms.

PREPRINT

Can Mamba Learn How to Learn? A Comparative Study on In-Context Learning Tasks. J. Park, J. Park, Z. Xiong, **N. Lee***, J. Cho, S. Oymak, K. Lee and D. Papailiopoulos. Under Review

PUBLICATIONS

Teaching Arithmetic to Small Transformers. **N. Lee***, K. Sreenivasan*, J. D. Lee, K. Lee and D. Papailiopoulos. ICLR 2024

Super Seeds: Extreme Model Compression by Trading off Storage and Computation. **N. Lee***, S. Rajput*, J. Sohn, H. Wang, A. Nagle, E. Xing, K. Lee and D. Papailiopoulos. ICMLW 2022 (spotlight)

On the Design of Tailored Neural Networks for Energy Harvesting Broadcast Channels: A Reinforcement Learning Approach. H. Kim, J. Kim, W. Shin, H. Yang, **N. Lee**, S. Kim and J. Lee. IEEE Access 2020

Rate Maximization with Reinforcement Learning for Time-Varying Energy Harvesting Broadcast Channels. H.Kim, W. Shin, H. Yang, **N. Lee** and J. Lee. IEEE Globecom2019

Analog network coding using differential and double-differential modulation with relay selection. S. Heo, C. Kim, **N. Lee** and J. Lee. ICT Express 2019

ONGOING PROJECTS

Understanding the Emergent Abilities of Transformer Models
LLMs trained on vast amounts of data, eventually learn basic arithmetic, even when these tasks are not explicitly encoded in the next-prediction loss objective. To untangle various factors in play, we investigate the arithmetic capabilities of small Transformer models. We find the importance of data sampling, formatting, and prompting for the model to elicit arithmetic capabilities.

Super-Seeds: Exploring the trade-off in storage and computation
We explore the trade-off between extreme model compression and computation of neural networks. We

aim to answer the following question: *For a given level of model compression, what is the minimum computation required to recover a high-accuracy model?* We discover that one can trade off some accuracy of the model with significant gains in storage cost, at a relatively small decompression cost.

RESEARCH EXPERIENCE

Communications and Machine Learning Lab *Jan.2018 - Aug.2020*
Seoul National University, Seoul, Korea
- Supervisor: Prof. Jungwoo Lee
- Research area: Channel Estimation, Non-Orthogonal Multiple Access

Summer Research Intern *Jun. - Aug.2017*
Graduate Research Internship Program, Nanyang Technological University, Singapore
- Supervisor: Prof. Junsong Yuan
- Project: Hand Gesture Recognition Task Using Deep Learning Based on Google Soli

Undergraduate Research Intern *Dec.2016 - Jun.2017*
Seoul National University, Seoul, Korea
- Supervisor: Prof. Jungwoo Lee
- Project: Image Completion Task with Generative Adversarial Networks

TEACHING EXPERIENCE

Graduate Teaching Assistant
(CS/ECE 561) Probability and Information Theory in Machine Learning *2022 Fall*
(CS/ECE/ME 532) Matrix Methods in Machine Learning *2021 Fall*
Information Theory *2019-1*
Introduction to Communications *2018-2*

Undergraduate Teaching Assistant, Seoul National University
Foundation of Physics 1 & Foundation of Physics 2 (3 sem. each) *2015 - 2017*

AWARDS AND HONORS

The Korean Government Scholarship Program for Overseas Study *Sep.2020 - Aug.2022*
funded by the Korean Government (NIIED, Korea)

Wisconsin Distinguished Graduate Fellowship-Morgridge (WDGF) *Sep.2020 - Aug.2021*

Presidential Science Scholarship *Mar.2014 - Feb.2018*
funded by the Korean Government (KOSAF, Korea)

Graduation with Honor (Summa cum Laude) *Feb.2018*

University Students Contest of Mathematics, Korea (Silver Prize) *Dec.2017*
hosted by the Korean Mathematical Society

Overseas Research Internship Support Fund *Jun.2017*
granted by the College of Engineering, SNU

TALKS

(08.18.2023) Short Talk at the Simons Institute LLM Workshop - Video

RELEVANT COURSES TAKEN

(CS 760) Machine Learning, (CS 761) Mathematical Foundations of Machine Learning, (CS 861) Mathematical Foundations of Machine Learning, (CS 726 & 730) Nonlinear Optimization 1 & 2
Deep Learning, Random Signal Theory, Optimization Theory and Applications, Analysis 1
Information Theory, Channel Coding Theory, Advanced Error Correcting Codes