Alexander Detkov

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EDUCATION

University of Alberta, Edmonton, Canada. 2019 - 2024
Bachelor of Science, Engineering Physics Co-op, Minor in Mathematics
GPA: 4.00/4.00

INTERESTS

Deep Learning, Graph and Convolutional Neural Networks, Neuro-Symbolic AI, Trustworthy and Explainable AI, AI-Driven Scientific Discovery.

PUBLICATIONS

A. Detkov, M. Salameh, M. Fetrat, J. Zhang, R. Luwei, S. Jui, D. Niu. Reparameterization through Spatial Gradient Scaling. *International Conference on Learning Representations (ICLR)*, 2023.
Synopsis: Reparameterization is a powerful technique used to improve CNN training (e.g. YOLOv7), yet its underlying mechanism remains unknown. We investigate how and why reparameterization may positively affect model training, as well as propose a new analytical approach for finding high-performance reparameterizations.

HONORS & AWARDS

NSERC Undergraduate Student Research Award ($6,000)	2023
University of Alberta Undergraduate Scholarship ($2,500)	2023
Louise McKinney Post-Secondary Scholarship ($2,500)	2023
University of Alberta Dean's Research Award ($500)	2021
Joseph and Edwina Charyk Scholarship in Engineering Physics ($2,000)	2021
Louise McKinney Post-Secondary Scholarship ($2,500)	2020
Enbridge Inc Dean of Engineering 2nd Year Scholarship ($1,825)	2020
The Faculty of Engineering Entrance Scholarship ($5,000)	2019

RESEARCH EXPERIENCE

Explainable Graph Neural Networks May 2023 - Current
Prof. Di Niu University of Alberta

- Investigating novel methods for interpretable Graph Neural Networks (GNN). Emphasis on extracting global-level symbolic explanations that are faithful to the original GNN, even on out-of-distribution data.
- Exploring the merger of neural and symbolic understanding with neuro-symbolic GNNs. Using symbolic methods to improve GNN interpretability and reliability.
- Collaborating with a PhD student on leveraging reinforcement learning to improve GNN performance through learned graph augmentations.

Neural Architecture Search Jan 2022 - Dec 2022
Prof. Di Niu and Dr. Mohammad Salameh Huawei Research

- Explored the learning dynamics of Convolutional Neural Networks (CNN) under structural reparameterization to improve model accuracy at no computational cost. Led to a first-author conference publication at ICLR 2023.
- Worked on hardware-aware Neural Architecture Search (NAS) for low-latency deep learning on edge devices like mobile phones. Implemented state-of-the-art graph level optimizers for convolution and transformer-based architectures.
- Studied novel GNNs with expressive power beyond Weisfeiler-Lehman as a method of enhancing the heuristic search of NAS.

Computational Biosystems May 2021 - Mar 2022
Prof. Wylie Stroberg University of Alberta

- Investigated the influx of polymeric solutions into nanotubes through molecular dynamics (MD) and numerical solutions of Langevin differential equations.
- Demonstrated the existence of a "Goldilocks zone" for the maximum polymer adsorption time, through MD simulations and random process theory.

- Assisted in the development of a Langevin dynamics simulator to study polymer imbibition over extended time and length scales unachievable through MD.
- Presented findings at CSME 2022 Symposium for Micro and Nanotechnology.

Experimental Particle Physics May 2021 - Aug 2021
Prof. Juan Pablo Yáñez IceCube Neutrino Observatory

- Investigated the calibration of the detector's digital optical modules through the analysis of Cherenkov radiation emitted by atmospheric minimum ionizing muons.
- Conducted data cleaning of reconstructed muon tracks with high stochastic losses via statistical analysis.

RELATED EXPERIENCE

AI Research Competition - ProjectX Sept 2023 - Current
University of Toronto University of Alberta
Selected as one of six students to represent the University of Alberta at the competition. The research theme is efficient AI.

P-ONE Neutrino Telescope Sept 2023 - Current
Prof. Juan Pablo Yáñez University of Alberta
Construction and testing of DOM photomultipliers and scintillators that will be used towards the soon to be constructed Pacific Ocean neutrino telescope.