

# Buyun Liang

MSc Student in CS @ UMN

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## EDUCATION

**University of Minnesota, Twin Cities**

M.Sc in Computer Science

**Minneapolis, MN, USA**

Jun 2020 - Jun 2023 (expected)

- GPA: 4.0/4.0

- Research Focus: Constrained Optimization & Robustness in Deep Learning (Advisor: Prof. Ju Sun)

**University of Minnesota, Twin Cities**

M.Sc in Materials Science (Ph.D. Track)

**Minneapolis, MN, USA**

Sep 2018 - Aug 2020

- GPA: 3.66/4.0 | GPA of Machine Learning related courses : 4.0/4.0

- Research Focus: Monte Carlo & Molecular Dynamics Simulation (Advisor: Prof. J. Ilja Siepmann)

**Nanjing University**

B.Sc in Physics (Elite Program)

**Nanjing, Jiangsu, China**

Sep 2014 - Jul 2018

- GPA: 89.6/100 | Rank: 11/159

## PUBLICATIONS

- [1] **Buyun Liang**, Hengyue Liang, Tim Mitchell, Ying Cui, Ju Sun. *Constrained Optimization in Machine and Deep Learning with NCVX and Its Practical Tricks*. Under review at IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI). [[slides](#)][[website](#)]
- [2] Hengyue Liang, **Buyun Liang**, Ying Cui, Tim Mitchell, Ju Sun. *Optimizers Matter in Adversarial Robustness*. Under review at IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI). [[slides](#)]
- [3] **Buyun Liang**, Ryan de Vera, Hengyue Liang, Tim Mitchell, Ying Cui, Qizhi He, Ju Sun. *On optimization and Optimizers in Neural Structural Optimization*. Under review at International Conference on Acoustics, Speech, and Signal Processing (ICASSP 2023).
- [4] Bhargav Joshi<sup>†</sup>, **Buyun Liang**<sup>†</sup>, Taihui Li<sup>†</sup>, Roger Rusack<sup>†</sup>, Ju Sun<sup>†</sup>. *Using Neural Networks to Predict Radiation Damage to Lead Tungstate Crystals at the CERN LHC*. Under review at Nature Machine Intelligence. (<sup>†</sup> Equal contributors) [[paper](#)]
- [5] **Buyun Liang**, Tim Mitchell, Ju Sun. *NCVX: A General-Purpose Optimization Solver for Constrained Machine and Deep Learning*. Under review at NeurIPS Workshop on Optimization for Machine Learning (OPT 2022). [[paper](#)]
- [6] Hengyue Liang, **Buyun Liang**, Ying Cui, Tim Mitchell, Ju Sun. *Optimization for Robustness Evaluation beyond  $\ell_p$  Metrics*. Under review at International Conference on Acoustics, Speech, and Signal Processing (ICASSP 2023) & NeurIPS Workshop on Optimization for Machine Learning (OPT 2022). [[paper](#)]
- [7] **Buyun Liang**, Tim Mitchell, Ju Sun. *NCVX: A User-Friendly and Scalable Package for Nonconvex Optimization in Machine Learning*. ArXiv preprint arXiv:2111.13984. [[paper](#)]
- [8] J. Ilja Siepmann, Jingyi L. Chen, **Buyun Liang**, Krishnan Mahesh. *Effect of Non-Condensable Gas on the Thermophysical Properties of Bubbly Water and on Bubble Collapse Dynamics Probed by Molecular Simulations*. 33rd Symposium on Naval Hydrodynamics, Osaka, Japan, 18-23 October 2020. [[paper](#)]

## RESEARCH EXPERIENCE

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### NCVX: A General-Purpose Solver for Constrained Deep Learning

Apr 2021 - Present

Graduate Research Assistant. Advisors: Prof. Ju Sun, Prof. Tim Mitchell, Prof. Ying Cui

- Created a software package for constrained optimization problem in machine & deep learning. See papers [5] & [7] for the software announcement and constrained deep learning examples.
- Provided practical tricks to speed up convergence of PyGRANSO and benchmarked the performance of PyGRANSO on constrained deep learning problems. See paper [1] for experimental details.
- Created and maintained a website <https://ncvx.org> for detailed documentation and tutorials.

### On Optimization and Optimizers in Adversarial Robustness

Dec 2021 - Dec 2022

Graduate Research Assistant. Advisors: Prof. Ju Sun, Prof. Tim Mitchell, Prof. Ying Cui

- Proposed an algorithmic framework blends PyGRANSO with a constraint-folding technique and benchmarked its performance on robustness evaluations. See paper [2] & [6] for details.
- Experimented PyGRANSO on robustness evaluation problems beyond the standard  $\ell_p$  norms, and explored the implications of solution patterns. See paper [2] for detailed discussion.

### Neural Structural Optimization with General Physical Constraints

Aug 2022 - Dec 2022

Graduate Research Assistant. Advisors: Prof. Ju Sun, Prof. Qizhi He, Prof. Tim Mitchell, Prof. Ying Cui

- Customized PyGRANSO to solve general constrained optimization in neural structural optimization, which usually involves nonlinear physical constraints. See paper [3] for detailed experiments.

### Machine Learning for High Energy Physics

May 2022 - Oct 2022

Graduate Research Assistant. Advisors: Prof. Ju Sun, Prof. Roger Rusack

- Applied sequence-to-sequence model with teacher forcing strategy to predict laser response in ECAL crystals. See paper [4] for detailed architectures and experimental results.

### Monte Carlo & Molecular Dynamics Simulation for Multi-Phase Flow

Nov 2018 - Aug 2020

Graduate Research Assistant. Advisor: Prof. J. Ilja Siepmann

- Simulated multi-phase systems via Gibbs Ensemble Monte Carlo methods, and performed molecular dynamics simulations to calculate physical properties. See paper [8] for details.

## PROFESSIONAL SERVICE

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Conference Reviewer for Artificial Intelligence and Statistics (AISTATS)

Nov 2022

Conference Reviewer for Computer Science and Application Engineering (CSAE)

Aug 2022

## TEACHING EXPERIENCE

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Elementary Computational Linear Algebra (University of Minnesota, TA)

Spring 2022

Intro to the Science of Engineering Materials (University of Minnesota, TA)

Spring 2019

## HONORS AND AWARDS

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- UMII Seed Grant Awards, University of Minnesota 2021
- Erling A. Dalaker Fellowship, University of Minnesota 2019
- Outstanding Graduate, Nanjing University 2018
- Aegon-Industrial Fund Management Company Scholarship, Top 2%, Nanjing University 2017
- National Scholarship, Top 2%, Ministry of Education of China 2016
- Elite Program Scholarship×3, Top 4%, Nanjing University 2015, 2016, 2017