

# 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 direction: Constrained Optimization in Deep Learning; Robustness in Recognition

**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 direction: Monte-Carlo and Molecular Dynamics Simulation in Computational Chemistry

**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* In preparation for IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI), 2022. [[slides](#)][[website](#)]
- [2] Hengyue Liang, **Buyun Liang**, Ying Cui, Tim Mitchell, Ju Sun. *Optimizers Matter in Adversarial Robustness*. In preparation for IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI), 2022. [[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*. In preparation for 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*. In preparation for Nature Machine Intelligence, 2022. (<sup>†</sup> Equal contributors) [[paper](#)]
- [5] **Buyun Liang**, Tim Mitchell, Ju Sun. *NCVX: A General-Purpose Optimization Solver for Constrained Machine and Deep Learning*. Submitted to 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*. Submitted to 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*. Submitted to Journal of Machine Learning Research. [[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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### General-Purpose Solver for Constrained Deep Learning [1][5][7]

Apr 2021 - Present

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

- Created a software package for nonsmooth, nonconvex, constrained optimization problem.
- Provided practical tricks to speed up convergence of PyGRANSO on large scale problems.
- Benchmarked the performance of PyGRANSO on constrained machine/deep learning problems.
- Created and maintained a website <https://ncvx.org> for detailed documentation and tutorials.

### On Optimization and Optimizers in Adversarial Robustness [2][6]

Dec 2021-Present

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

- Proposed an algorithmic framework blends PyGRANSO with a constraint-folding technique.
- Benchmarked the performance of PyGRANSO and other SOTA solvers on robustness evaluations.
- Experimented PyGRANSO on robustness evaluation problems beyond the standard  $\ell_p$  norms.
- Explored the implications of solution patterns on robustness evaluation.

### Neural Structural Optimization with General Physical Constraints [3]

Aug 2022 - Present

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

- Customized PyGRANSO to solve constrained deep learning problems in neural structural optimization.
- Provided algorithmic framework that could handle nonlinear physical constraints.

### Machine Learning for High Energy Physics [4]

May 2022 - Present

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

- Applied Seq2Seq model with teacher forcing strategy to predict laser response in ECAL crystals.

### Monte Carlo & Molecular Dynamics for Multi-Phase Flow [8]

Nov 2018 - Aug 2020

Research Assistant. Advisor: Prof. J. Ilja Siepmann

- Simulated different phases in nitrogen-water mixture via Gibbs Ensemble Monte Carlo methods
- Performed molecular dynamics simulations to calculate physical properties of multi-phase systems.

## PROFESSIONAL SERVICE

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- Reviewer for International Conference on Artificial Intelligence and Statistics (AISTATS 2023)
- Reviewer for International Conference on Computer Science and Application Engineering (CSAE 2022)

## TEACHING EXPERIENCE

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### Elementary Computational Linear Algebra (CSCI 2033)

Teaching Assistant, Spring 2022

### Intro to the Science of Engineering Materials (MATS 2002)

Teaching Assistant, 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  $\times 3$ , Top 4%, Nanjing University (2015, 2016, 2017)