Minghao Liu

Curriculum Vitae

Department of Computer Science
University of Oxford
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https://minghao-liu.github.io/

RESEARCH INTERESTS

Automated reasoning; Constraint programming; SAT/SMT solving; Inductive logic programming; Graph neural networks; Combinatorial optimization; Neuro-symbolic methods.

APPOINTMENT

University of Oxford — Oxford, UK
Research Associate — *Oct. 2023 – Now*
Supervised by Prof. Marta Kwiatkowska on EPSRC project FAIR (since Oct. 2024).
Supervised by Dr. Andrew Cropper on EPSRC project AutoCS (Oct. 2023 – Sep. 2024).

EDUCATION

University of Chinese Academy of Sciences — Beijing, China
Ph.D. in Computer Science — *Sep. 2017 – June 2023*
Supervised by Prof. Jian Zhang at Institute of Software, CAS.
Thesis: Symbolic and Neural Methods for Constraint Solving.

Northeast Normal University — Changchun, China
B.Sc. in Computer Science — *Sep. 2013 – June 2017*

PUBLICATIONS

Conference Papers

1. **Minghao Liu**, David M. Cerna, Filipe Gouveia, and Andrew Cropper. "Scalable Knowledge Refactoring using Constrained Optimisation", *The 39th AAAI Conference on Artificial Intelligence (AAAI)*, 2025.

2. Fuqi Jia, Yuhang Dong, Rui Han, Pei Huang, **Minghao Liu**, Feifei Ma, and Jian Zhang. "A Complete Algorithm for Optimization Modulo Nonlinear Real Arithmetic", *The 39th AAAI Conference on Artificial Intelligence (AAAI)*, 2025.

3. Fuqi Jia, Yuhang Dong, **Minghao Liu**, Pei Huang, Feifei Ma, and Jian Zhang. "Suggesting Variable Order for Cylindrical Algebraic Decomposition via Reinforcement Learning", *Advances in Neural Information Processing Systems 36 (NeurIPS)*, 2023.

4. **Minghao Liu**, Rui Han, Fuqi Jia, Pei Huang, Feifei Ma, Hantao Zhang, and Jian Zhang. "Investigating the Existence of Holey Latin Squares via Satisfiability Testing", *The 20th Pacific Rim International Conference on Artificial Intelligence (PRICAI)*, 2023.

5. **Minghao Liu**, Kunhang Lv, Pei Huang, Rui Han, Fuqi Jia, Yu Zhang, Feifei Ma, and Jian Zhang. "NRAgo: Solving SMT(NRA) Formulas with Gradient-Based Optimization", *The 38th IEEE/ACM International Conference on Automated Software Engineering (ASE)*, 2023.

6. Fuqi Jia, Rui Han, Xutong Ma, Baoquan Cui, **Minghao Liu**, Pei Huang, Feifei Ma, and Jian Zhang. "PSMT: Satisfiability Modulo Theories Meets Probability Distribution", *The 38th IEEE/ACM International Conference on Automated Software Engineering (ASE)*, 2023.

7. Fuqi Jia, Rui Han, Pei Huang, **Minghao Liu**, Feifei Ma, and Jian Zhang. "Improving Bit-Blasting for Nonlinear Integer Constraints", *The 32nd ACM SIGSOFT International Symposium on Software Testing and Analysis (ISSTA)*, 2023. **(ACM SIGSOFT Distinguished Paper Award)**

8. **Minghao Liu**, Pei Huang, Fuqi Jia, Fan Zhang, Yuchen Sun, Shaowei Cai, Feifei Ma, and Jian Zhang. "Can Graph Neural Networks Learn to Solve the MaxSAT Problem?", *The 37th AAAI Conference on Artificial Intelligence (AAAI), Student Abstract and Poster Program*, 2023. **(Best Student Abstract Honorable Mention Award)**

9. Pei Huang, Yuting Yang, **Minghao Liu**, Fuqi Jia, Feifei Ma, and Jian Zhang. "ϵ-weakened Robustness of Deep Neural Networks", *The 31st ACM SIGSOFT International Symposium on Software Testing and Analysis (ISSTA)*, 2022.

10. Pei Huang, Yuting Yang, Fuqi Jia, **Minghao Liu**, FeiFei Ma, and Jian Zhang. "Word Level Robustness Enhancement: Fight Perturbation with Perturbation", *The 36th AAAI Conference on Artificial Intelligence (AAAI)*, 2022.

11. Pei Huang, Rundong Li, **Minghao Liu**, Feifei Ma, and Jian Zhang. "Efficient SAT-Based Minimal Model Generation Methods for Modal Logic S5", *The 24th International Conference on Theory and Applications of Satisfiability Testing (SAT)*, 2021.

12. **Minghao Liu**, Fan Zhang, Pei Huang, Shuzi Niu, Feifei Ma, and Jian Zhang. "Learning the Satisfiability of Pseudo-Boolean Problem with Graph Neural Networks", *The 26th International Conference on Principles and Practice of Constraint Programming (CP)*, 2020.

13. Pei Huang, **Minghao Liu**, Ping Wang, Wenhui Zhang, Feifei Ma, and Jian Zhang. "Solving the Satisfiability Problem of Modal Logic S5 Guided by Graph Coloring", *The 28th International Joint Conference on Artificial Intelligence (IJCAI)*, 2019.

14. Pei Huang, **Minghao Liu**, Cunjing Ge, Feifei Ma, and Jian Zhang. "Investigating the Existence of Orthogonal Golf Designs via Satisfiability Testing", *The 44th International Symposium on Symbolic and Algebraic Computation (ISSAC)*, 2019.

15. **Minghao Liu**, Feifei Ma, and Jun Yan. "A Community-Division Based Algorithm for Finding Relations Among Linear Constraints", *The 11th International Conference on Knowledge Science, Engineering and Management (KSEM)*, 2018.

Journal Papers

16. Jian Gao, Yiqi Lv, **Minghao Liu**, Shaowei Cai, and Feifei Ma. "Improving Simulated Annealing for Clique Partitioning Problems", *Journal of Artificial Intelligence Research (JAIR)*, 2022.

17. Yupeng Zhou, **Minghao Liu**, Feifei Ma, Na Luo, and Minghao Yin. "Modelling and Solving the Supply Marketing Order Allocation Problem with Time Consistency and Bundle Discounts", *Journal of the Operational Research Society (JORS)*, 2021.

PRESENTATIONS

1. "Investigating the Existence of Holey Latin Squares via Satisfiability Testing", Presentation at *PRICAI 2023*, Online. Nov. 2023.

2. "Can Graph Neural Networks Learn to Solve the MaxSAT Problem?", Presentation at *AAAI 2023*, Online. Feb. 2023.

3. "Automated Reasoning: Principle and Application", Presentation at *ByteDance AI Lab*, Beijing, China. Oct. 2022.

4. "Learning the Satisfiability of Pseudo-Boolean Problem with Graph Neural Networks", Presentation at *CP 2020*, Online. Sep. 2020.

5. "Learning the Satisfiability of Pseudo-Boolean Problem with Graph Neural Networks", Presentation at *Northeast Normal University*, Changchun, China. July 2020.

6. "A Community-Division Based Algorithm for Finding Relations Among Linear Constraints", Presentation at *KSEM 2018*, Changchun, China. Aug. 2018.

TEACHING

Foundations of Theoretical Computer Science Spring 2020; Spring 2021
Teaching Assistant, University of Chinese Academy of Sciences

Logic and Proof Hilary 2024; Michaelmas 2024
Class Tutor, University of Oxford

Knowledge Representation and Reasoning Hilary 2025
Class Tutor, University of Oxford

Design and Analysis of Algorithms Hilary 2024; Hilary 2025
Practical Demonstrator, University of Oxford

Group Design Practical Hilary 2024; Hilary 2025
Student Project Supervisor, University of Oxford

Financial Computing with C++ Part I Michaelmas 2024
Teaching Assistant, University of Oxford

SELECTED AWARDS AND SCHOLARSHIPS

SMT Competition, Nonlinear Real Arithmetic (QF_NRA) Track, 2nd Place	Aug. 2022
First Prize Scholarship of UCAS (*Top 10%*)	Oct. 2021
Alibaba Guangdong Intelligent Manufacturing Innovation Contest, 3rd Place	Dec. 2019
The NENU Medalist (*The highest honor for undergraduate students; Top 0.5%*)	June 2017
ACM International Collegiate Programming Contest Asia Regional, Gold Medal	Sep. 2016
National Scholarship of China (*Top 2%*)	Nov. 2014

ACADEMIC SERVICES

PC Member: AAAI 2023, 2024, 2025; ECAI 2024; ICTAI 2023.
Journal Reviewer: IEEE TNNLS; IEEE TKDE; CSSE.

Last updated: March 4, 2025