Ziming Liu

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https://kindxiaoming.github.io/

Education

2020 – present **PhD student in physics, Massachusetts Institute of Technology, MA, USA**
Conduct research in the intersection of artificial intelligence (AI) and physics.

2016 – 2020 **B.S. in Physics, Peking University, Beijing, China**

Research Publications

1. Z. Liu, O. Kitouni, N. Nolte, E. J. Michaud, M. Tegmark, and M. Williams, "Towards understanding grokking: An effective theory of representation learning," *NeurIPS Oral*, 2023.
2. Z. Liu, E. J. Michaud, and M. Tegmark, "Omnigrok: Grokking beyond algorithmic data," *ICLR Spotlight*, 2023.
3. E. J. Michaud, Z. Liu, and M. Tegmark, "Precision machine learning," *Entropy*, vol. 25, no. 1, p. 175, 2023.
4. Y. Xu, Z. Liu, Y. Tian, S. Tong, M. Tegmark, and T. Jaakkola, "Pfgm++: Unlocking the potential of physics-inspired generative models," *arXiv:2302.04265*, 2023.
5. Z. Liu, V. Madhavan, and M. Tegmark, "Machine learning conservation laws from differential equations," *Physical Review E*, vol. 106, no. 4, p. 045 307, 2022.
6. Z. Liu, A. M. Stuart, and Y. Wang, "Second order ensemble langevin method for sampling and inverse problems," *arXiv preprint arXiv:2208.04506*, 2022.
7. Y. Xu, Z. Liu, M. Tegmark, and T. Jaakkola, "Poisson flow generative models," *NeurIPS (spotlight)*, 2022.
8. H. Huang, B. Xiao, Z. Liu, Z. Wu, Y. Mu, and H. Song, "Applications of deep learning to relativistic hydrodynamics," *Physical Review Research*, vol. 3, no. 2, p. 023 256, 2021.
9. Z. Liu, Y. Chen, Y. Du, and M. Tegmark, "Physics-augmented learning: A new paradigm beyond physics-informed learning," *arXiv preprint arXiv:2109.13901*, 2021.
10. Z. Liu, S. Qian, Y. Wang, Y. Yan, and T. Yang, "Schrödinger principal-component analysis: On the duality between principal-component analysis and the schrödinger equation," *Physical Review E*, vol. 104, no. 2, p. 025 307, 2021.
11. Z. Liu, B. Wang, Q. Meng, W. Chen, M. Tegmark, and T.-Y. Liu, "Machine-learning nonconservative dynamics for new-physics detection," *Physical Review E*, vol. 104, no. 5, p. 055 302, 2021.
12. Z. Liu, A. Behera, H. Song, and J. Jia, "Robustness of principal component analysis of harmonic flow in heavy ion collisions," *Physical Review C*, vol. 102, no. 2, p. 024 911, 2020.
13. Z. Liu and Z. Zhang, "Quantum-inspired hamiltonian monte carlo for bayesian sampling," *arXiv preprint arXiv:1912.01937*, 2019.
14. Z. Liu, W. Zhao, and H. Song, "Principal component analysis of collective flow in relativistic heavy-ion collisions," *The European Physical Journal C*, vol. 79, no. 10, p. 870, 2019.

Miscellaneous

Research Interests

- **Building AI scientists that act like human scientists**
- **Using artificial intelligence to boost scientific discoveries and designs**
- **Understanding deep learning from the perspective of physics and information**
- **Physics-inspired generative models**
- **AI safety: mechanistic interpretability, emeregent behavior and phase transitions**

Responsibilities and Duties

2022 **Oraganizer of the ICML 2022 "AI for Science" workshop.**

2021 **Oraganizer of the NeurIPS 2021 "AI for Science" workshop.**

Reviewer of IEEE Transactions on Emerging Topics in Computational Intelligence