RICE QUANTUM GROUP MEETING SEMINAR SERIES

Generative Models as Representations of Quantum Spin States

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Jonathan is a graduate student in Han Pu's group, working at the intersection of machine learning and quantum many-body physics. His research focuses on applying supervised, unsupervised, generative, and reinforcement learning algorithms to quantum systems that are governed by simple physical laws, yet exhibit complex behavior.

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ABSTRACT

Machine learning methods have gained substantial popularity among computational physicists, in part due to their ability to approximate complex functions using a tractable number of parameters. Conversely, quantum systems also act as a testing ground for studying how neural networks learn their physical structure. In this talk, I will discuss how generative models, inspired by techniques from computer vision, can learn representations of quantum states through sampling the corresponding wavefunctions. Since the physical interpretation of these models is a necessary factor in extracting meaningful insights, I will discuss a way to improve accuracy and probe interpretability through physically relevant regularizers, taking inspiration from physics-informed neural networks. The results are benchmarked on ground states of 1D XXZ spin chains, and the methods can be extended to unknown experimental states.

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