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Neural networks for Quantum Physics

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The state of a quantum system is completely determined by its wave-function or density-matrix, which evolve according to an equation of motion. When the system is composed of many interacting particles, the many-body problem increases exponentially the size of those objects, which eventually cannot be stored in the memory of a computer. For decades researchers approached the issue by constructing approximations based on our physical understanding that could reduce the complexity. This approach, while successful, requires a through study of every system. In the field of machine learning a different technique has been developed: Neural-Networks are a general class of functions which are able to represent the solutions to very disparate problems. By combining a quantum variational principle with an iterative procedure, we show that it is possible to optimize neural-networks in order to encode the ground- (or steady-)state of a quantum system. Such procedure, similar in spirit to supervised learning, can be performed efficiently by means of a Montecarlo sampling, which sidesteps the problem of exponential complexity. In this talk we will also showcase several other applications of machine learning to quantum physics.

Field

Machine learning/Quantum physics

Language

English

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