A MACHINE LEARNING PERSPECTIVE ON THE MANY-BODY PROBLEM IN CLASSICAL AND QUANTUM PHYSICS

Juan Felipe Carrasquilla

D-Wave Systems inc.
Perimeter Institute for Theoretical Physics, Canada

E-mail: juanfelipe.carrasquilla@gmail.com

The technological success of machine learning techniques has motivated a research area in the condensed matter physics and quantum information communities, where new tools and conceptual connections between machine learning and many-body physics are rapidly developing. I will discuss two ideas that exemplify this connection.
First, I will discuss a supervised approach to machine learning phases of matter using neural networks. Second, by interpreting the wave function in quantum physics as a generative model, I will show that ground states of quantum systems, in particular Kitaev's topological quantum error correcting code, can be written in terms of convolutional neural networks.
In the same vein, I will also discuss restricted Boltzmann machines (RBM) as a tool to model the full wave function of large many-body systems and explore their use in the problem of quantum state tomography. In this setting, RBMs enable accurate learning of the wave function of quantum systems of unprecedented size directly from measurements mimicking experimental data.