Prediction of the dissipative phase transition using machine learning techniques

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In the last decade, there was tremendous progress in the application of machine learning techniques for various tasks, namely, image recognition, natural language processing, recommending systems. Technologically this progress is due to substantial development of GPU (graphics processing unit) technology which allowed to train deep CNN (convolutional neural network) with millions of parameters in a relatively short time. Recently, researchers have begun to apply machine learning techniques to mathematically ill-defined problems in physics, for example, the prediction of phase transitions. One could identify a few ways of using machine learning for problems in statistical physics. One way is to use neural networks (deep CNN and Restricted Boltzmann Machines - RBMs) as an efficient representation of the quantum state of the system. The other way is more typical for machine learning, where user supply labeled/unlabelled training data (for example spin configurations corresponding to different phases) and the algorithm performs classification/clustering tasks. In this presentation, we will demonstrate the application of the deep CNNs to a prediction of the steady-state properties of the in the dissipative-driven spin chain. It is shown that well tuned and trained ML architecture is capable of performing the thermodynamic limit and predicting dissipative phase transition. Possible application and generalizations will be discussed, as well.