Quantum Technology Initiative Journal Club

Report of Contributions

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José Ramón Pareja Monturiol (Univ. Madrid)

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TITLE: Tensorizing high-dimensional densities

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ABSTRACT:
Tensor networks are compressed and efficient representations of high-dimensional tensors that have found successful applications in physics, mathematics and machine learning. A significant challenge is determining the smaller tensors that constitute the network, when these cannot be derived analytically. In such cases, two approaches are typically employed: optimization techniques or direct factorization methods.In our work, we propose an adaptation of an algorithm of the second type (Tensor Train Recursive Sketching), that is applicable when a high-dimensional density is provided along with a small set of samples. To evaluate the performance of the algorithm, we investigate two different applications: machine learning and condensed matter physics. In the former application, we apply the decomposition to derive a Tensor Train model from a pre-trained neural network binary classifier. We demonstrate that this translation from a black-box model, the neural network, to a tensor network can be advantageous in terms of privacy, interpretability and efficiency. For the latter application in condensed matter physics, we show that TT-RSS enables the reconstruction of the AKLT state from black-box observations of the same state. Although this serves as a sanity check, it paves the way for more intriguing applications, such as finding TN representations of Quantum Neural States to enhance interpretability.

Presenter: PAREJA MONTURIOL, JJosé Ramón (Univ. Madrid)

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