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Deep Reinforcement Learning Model Using Parameterised Quantum Circuits

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Abstract : With the evolution of technology, the need to solve complex computational problems like machine learning and deep learning has shot up. But even the most powerful classical supercomputers find it difficult to execute these tasks. With the recent development of quantum computing, researchers and tech-giants strive for new quantum circuits for machine learning tasks, as present works on Quantum Machine Learning (QML) ensure less memory consumption and reduced model parameters. But it is strenuous to simulate classical deep learning models on existing quantum computing platforms due to the inflexibility of deep quantum circuits. As a consequence, it is essential to design viable quantum algorithms for QML for noisy intermediate-scale quantum (NISQ) devices. The proposed work aims to explore Variational Quantum Circuits (VQC) for Deep Reinforcement Learning by remodeling the experience replay and target network into a representation of VQC. In addition, to reduce the number of model parameters, quantum information encoding schemes are used to achieve better results than the classical neural networks. VQCs are employed to approximate the deep Q-value function for decision-making and policy-selection reinforcement learning with experience replay and the target network.

Keywords : quantum computing, quantum machine learning, variational quantum circuit, deep reinforcement learning, quantum information encoding scheme
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