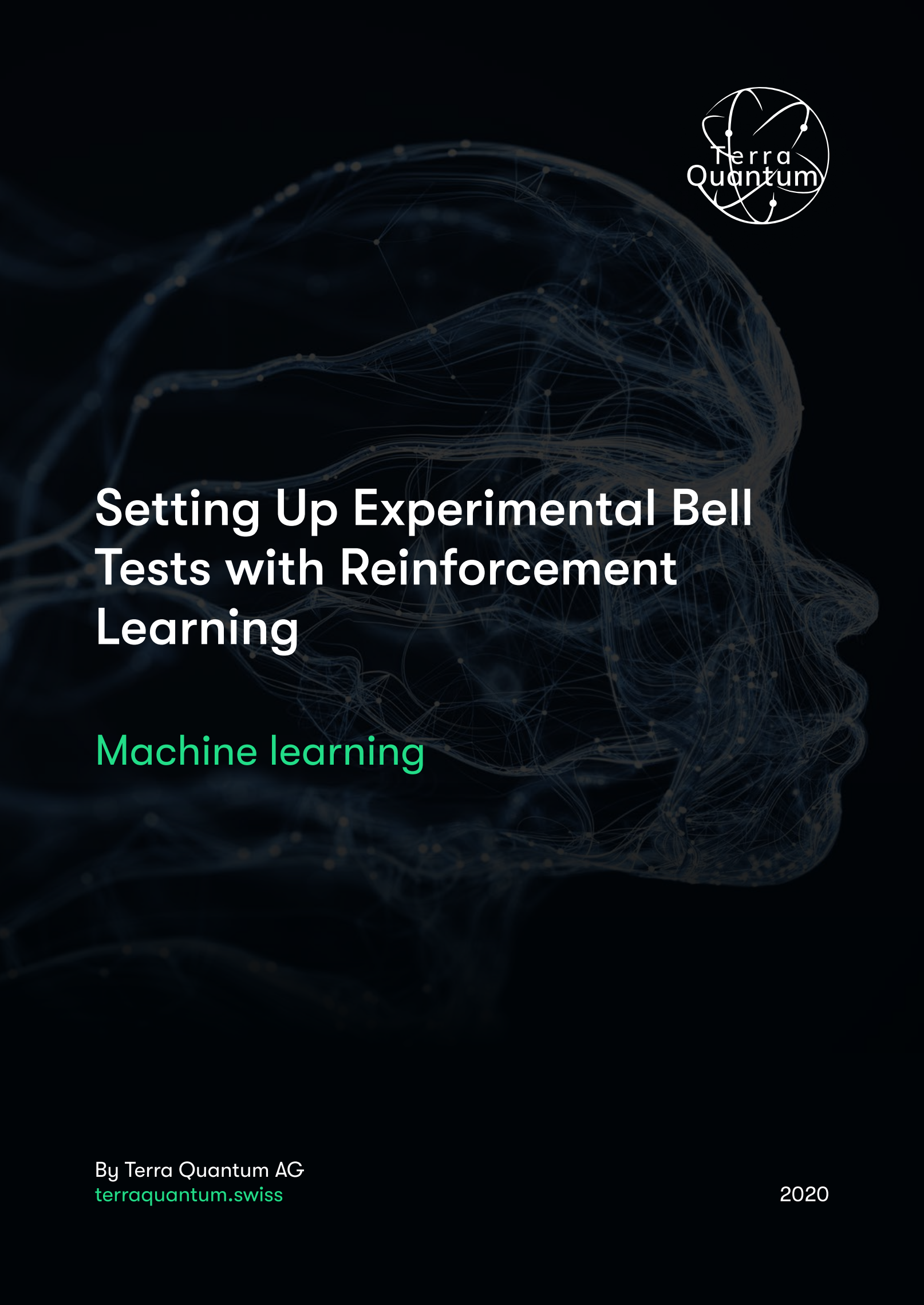

Setting Up Experimental Bell Tests with Reinforcement Learning

Machine learning

By Terra Quantum AG
terraquantum.swiss

2020

Setting Up Experimental Bell Tests with Reinforcement Learning

Alexey A Melnikov, Pavel Sekatski, Nicolas Sangouard

ABSTRACT

Finding optical setups producing measurement results with a targeted probability distribution is hard, as a priori the number of possible experimental implementations grows exponentially with the number of modes and the number of devices. To tackle this complexity, we introduce a method combining reinforcement learning and simulated annealing enabling the automated design of optical experiments producing results with the desired probability distributions. We illustrate the relevance of our method by applying it to a probability distribution favouring high violations of the Bell-Clauser-Horne-Shimony-Holt (CHSH) inequality. As a result, we propose new unintuitive experiments leading to higher Bell-CHSH inequality violations than the best currently known setups. Our method might positively impact the usefulness of photonic experiments for device-independent quantum information processing.

The full article can be found here:
https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.125.160401