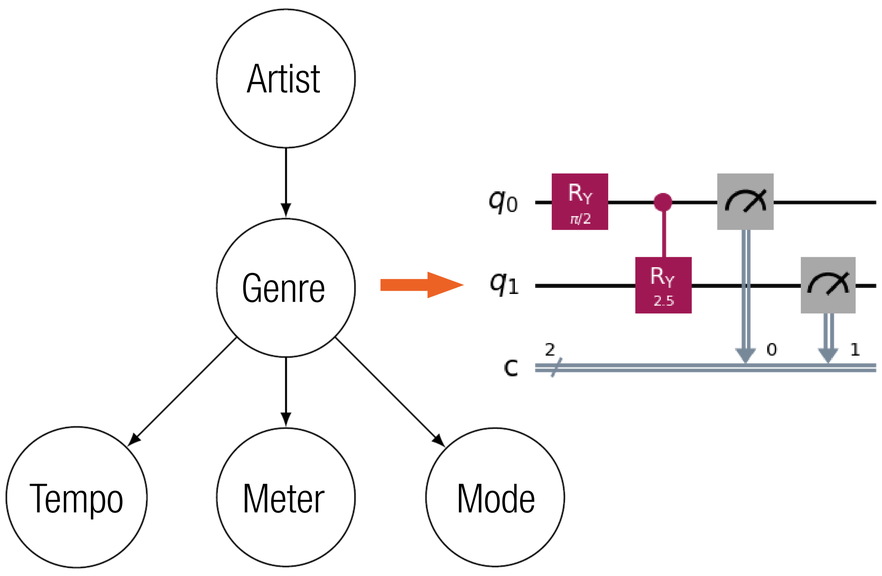
Quantum Computing at JOANNEUM RESEARCH

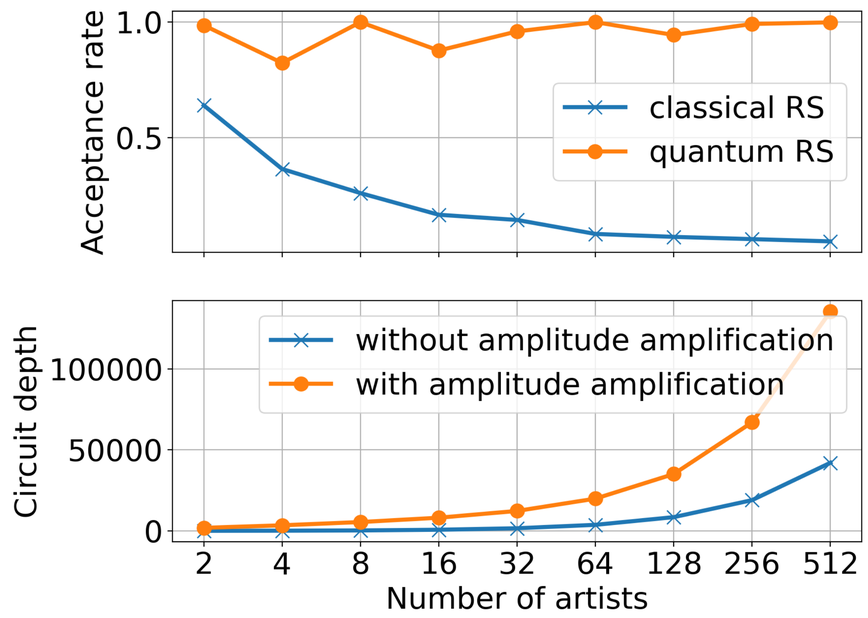
Quantum Bayesian Networks (QBN) for Decision Modelling

Abstract

Bayesian Networks are a popular tool for modelling dependencies among diverse attributes in data. However, performing inference in these models requires substantial computational resources. Therfore, we are investigating the implementation and inference of a Bayesian network on a quantum computer.We show how to translate the Bayesian model to a quantum circuit and perform inference using the quantum rejection sampling algorithm on a quantum simulator.

Results





Conclusion

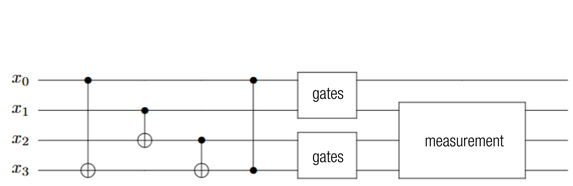
A quantum circuit representing the joint probability distribution of the network was created and inference was performed using the quantum rejection sampling algorithm on a quantum simulator. Our results showed that the quantum algorithm significantly improves the acceptance rate of generated samples, thereby improving posterior probability estimates. However, in order to fully exploit the benefits of quantum computing in practice, further efforts are needed to develop fault-tolerant quantum hardware capable of handling deep circuits.

Quantum Computer Vision: Test-Driving Real-World Implementations

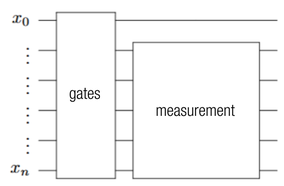
Abstract

We explore and evaluate different implementation strategies for computer vision algorithms on quantum computer systems, focusing on quantum-accelerated media descriptor search (CDVA). Our 512-bit implementations target distinct regions of the Hilbert space, allowing us to investigate the trade-offs between different quantum representations and algorithms. We compare the performance of quantum implementations with classical computer systems, highlighting the advantages and limitations of quantum acceleration. Additionally, we estimate the required hardware specifications for practical quantum-accelerated media search applications, providing a roadmap for future development and deployment.

Qiskit qrisp

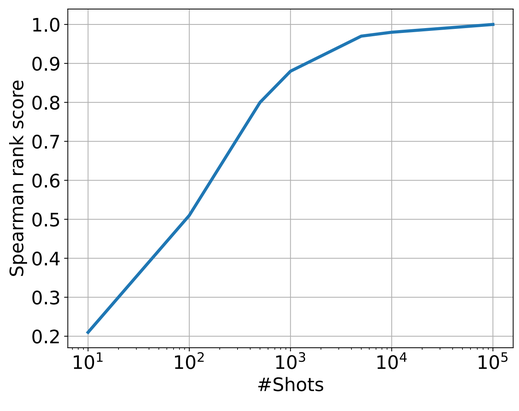


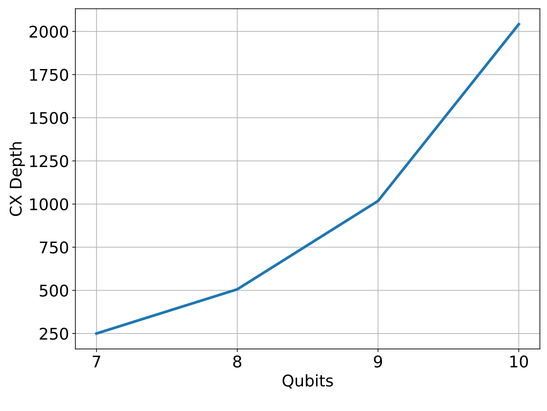
(a) Small but deep cirquit with large number of gates.

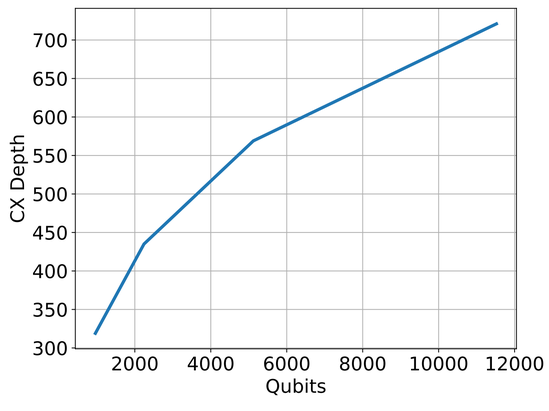


(b) Wide but shallow circuit with large number of qubits.

	Qiskit		Qrisp	
Descriptor	#Qubits	CX Depth	#Qubits	CX Depth
64	7	250	961	319
128	8	506	2241	435
256	9	1018	5121	569
512	10	2042	11521	721







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