Quantum evolution kernel: Machine learning on graphs with programmable arrays of qubits

Loic Henriet
Louis-Paul Henry, Slimane Thabet, Constantin Dalyac

PASQAL, 7 rue Leonard de Vinci, 91130 Massy, France

loic@pasqal.com

The rapid development of reliable Quantum Processing Units (QPU) opens up novel computational opportunities for machine learning. Here, we introduce a procedure for measuring the similarity between graph-structured data, based on the time-evolution of a quantum system. By encoding the topology of the input graph in the Hamiltonian of the system, the evolution produces measurement samples that retain key features of the data. We study analytically the procedure and illustrate its versatility in providing links to standard classical approaches.

We then show numerically that this scheme performs well compared to standard graph kernels on typical benchmark datasets. Finally, we study a concrete implementation on a realistic neutral-atom quantum processor.

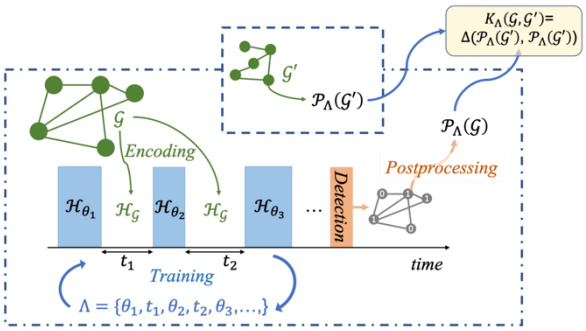

Figure 1: Schematics of the feature map at the heart of the
QE kernel.

References

[1] Henry, Thabet, Dalyac, Henriet, Phys. Rev. A 104, 032416 (2021)