On the Generating Quantum Feature Maps for SVM Classifier

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Abstract

In this talk, we compare two techniques for generating quantum feature maps that can be used in quantum-enhanced support vector machines, which rely on kernel methods to access high dimensional Hilbert spaces efficiently. The first approach involves using a genetic algorithm with a multi-objective fitness function, which employs a penalty method to maximize classification accuracy while minimizing the gate cost of the quantum feature map's circuit. The second method employs a variational quantum circuit and focuses on constructing an ansatz based on unitary matrix decomposition. We present numerical results and comparisons that demonstrate how the fitness function can reduce gate cost while maintaining high accuracy. We also show that conducting the circuit through unitary matrix decomposition leads to even better performance. Additionally, we propose some ideas for reducing and optimizing circuit gate cost while maintaining perfect accuracy. This is a joint work with Bang-Shien Chen.