Quantum Machine Learning vs. Classical Machine Learning: A Case Study on Predicting University Performance Using Scientometric Indicators

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Abstract:
Quantum machine learning (QML) presents a promising computational paradigm for addressing complex data analysis challenges in higher education. This study evaluates the performance of quantum support vector machine (QSVM) compared to classical support vector machine (SVM) in predicting university performance by using scientometric indicators from 5,466 Indonesian universities in the SINTA database. Both models were assessed using standard classification metrics, with QSVM showing modest gains in accuracy (92.3%) and F1-score (91.2%) over SVM (88.7% and 87.2%, respectively), albeit with significantly longer processing time—approximately six times slower. The QSVM was implemented via the Qiskit Aer simulator, and was therefore limited to simulated rather than real quantum hardware. These findings indicate a trade-off between predictive performance and computational efficiency, suggesting that while QSVM offers potential, its latency currently limits practical deployment. Future research should investigate hybrid quantum-classical models, conduct experiments on real quantum devices, and apply explainability techniques to better understand feature contributions. Limitations related to dataset balance and generalizability should also be addressed.

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