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GeoQAI: A Quantum Machine Learning Paradigm with Geospatial Data

Quantum Machine Learning (QML) lies at the intersection of classical Machine Learning (ML) and Quantum Computing (QC) and is currently experiencing significant growth in terms of both efficiency and applications. This expansion is largely driven by the availability of Noisy Intermediate-Scale Quantum (NISQ) processors, which enable the use of Quantum Computing without needing to tackle the challenges of error correction. As a result, there has been a surge in Quantum Computing applications, including QML. However, most QML implementations to date have relied on generic classical ML datasets, such as the Iris dataset, MNIST (Modified National Institute of Standards) dataset, and Fashion MNIST dataset. In this work, we introduce a novel QML paradigm called GeoQAI (Geospatial Quantum Artificial Intelligence). This paradigm explores the application of Quantum Machine Learning to geospatial data. Our goal is to unlock deeper insights into spatial dynamics, improve predictive capabilities, and facilitate better decision-making in various fields, including environmental science, urban planning, and resource management. Furthermore, we report on the use of QML for Land Use and Land Cover (LULC) classification. The results obtained in this study suggest the potential for further investigation into the GeoQAI paradigm, particularly for exploring QML applications in other geospatial contexts beyond LULC. This work provides insights on improving the accuracy and efficiency of spatial analysis tasks and developing new tools and frameworks for integrating geographic information systems with other disciplines.

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