Chapter 10
Quantum Machine Learning in Cloud-Based Security Services and Applications

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ABSTRACT

The integration of Quantum Machine Learning (QML) into cloud-based security services represents a transformative shift in cybersecurity. By leveraging quantum computing's ability to process data exponentially faster than classical systems, QML enhances cloud security with real-time threat detection, anomaly recognition, and intrusion prevention. It introduces quantum-inspired algorithms, quantum versions of classical algorithms, and hybrid quantum-classical models, each offering unique

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advantages in processing speed and scalability. However, the rise of quantum computing also threatens conventional encryption methods like RSA and ECC, necessitating the development of quantum-resistant encryption techniques. Despite challenges posed by current quantum devices, QML's potential to revolutionize cloud security is immense, providing faster, more efficient, and robust protection against evolving cyber threats.

1. INTRODUCTION

Quantum computing capabilities in cloud computing have preconditioned major breakthroughs in developing quantum computing which is a fast-evolving branch of computer science (Malhotra, 2022). The unification between cloud services and quantum computers has brought about new possibilities, especially in the field of quantum machine learning (QML) that has achieved outstanding developments over the past years. This paper investigates the symbiotic nature between cloud platforms and quantum computing, in particular, the way such compilation can bring quantum resources closer to the machine learning process. The concept of quantum computing has also been opened up because cloud-based quantum computing has removed common impediments, including the requirement of expert machinery and knowledge Whyte, 2024).

What is more, the growth of volume and complexity of data with an exponential scale has only boosted the development of machine learning, which still serves as the foundation of artificial intelligence (AI) (Anagolum et al., 2024). Machine learning Quantum computing in clouds in a way is transforming the form of data analytics and decision-making, which may even be subjective to quantum-improved algorithms over their classical analogs. The paradigm change between quantum computing and machine learning announces a new bountiful era of inventions in AI and data-driven technologies.