A Comparative Analysis of Quantum-inspired Algorithms for Optimizing Machine Learning Models

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Abstract. This article investigates the efficacy of quantum-inspired algorithms in optimizing machine learning models. By exploring variational quantum algorithms and their classical counterparts, we identify performance metrics and computational efficiency. Our results demonstrate that quantum-inspired approaches can offer significant improvements in optimization, particularly in high-dimensional datasets. This warrants further investigation into their practical applications across various domains.

Keywords: quantum-inspired algorithms, machine learning optimization, variational quantum algorithms, computational efficiency, high-dimensional datasets

Introduction

In the evolving landscape of computer science, the need for efficient and robust machine learning models continues to grow as they become integral to numerous applications ranging from data analytics to artificial intelligence. The optimization of these models is a fundamental challenge, often requiring significant computational resources and time. Quantum computing, with its promise of unparalleled computational speed and efficiency, presents a novel approach to optimization. However, the current technological limitation of quantum computers prompts the need for intermediate solutions, leading to the

development of quantum-inspired algorithms. Quantum-inspired algorithms emulate certain quantum computational strategies using classical systems, offering potential improvements in solving optimization problems. Recent advancements have shown that these algorithms can leverage quantum principles to significantly reduce computation time while maintaining accuracy, making them highly relevant in today's fast-paced digital environment. This paper delves into the comparative performance of various quantum-inspired algorithms in optimizing machine learning models, examining their computational efficiency and scalability. The subsequent sections of this article are structured as follows: Section 2 presents a detailed overview of quantum-inspired algorithms and their fundamental principles. Section 3 describes the methodology and experimental setups utilized in this study. Section 4 discusses the findings and compares the results with traditional optimization methods. Finally, Section 5 offers conclusions and potential directions for future research.

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