

Chapter 4

Optimizing Performance Metrics in Blockchain-Enabled AI/ML Data Analytics: Assessing Cognitive IoT

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ABSTRACT

The convergence of blockchain technology with artificial intelligence (AI) and machine learning (ML) has significantly transformed data analytics within Cognitive

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Internet of Things (CIoT) systems. This chapter investigates the critical performance metrics and evaluation methods necessary to assess the impact and effectiveness of AI/ML-enhanced blockchain analytics. It examines how blockchain contributes to data integrity, transparency, and security, while AI/ML algorithms enhance data processing and decision-making capabilities. The chapter outlines essential performance indicators, analytical approaches, and evaluation techniques for measuring the success of these integrated systems. By presenting case studies and practical examples, it addresses the challenges and benefits associated with deploying these technologies, offering guidance for optimizing performance and achieving reliable results. This analysis is aimed at professionals and researchers who seek to leverage blockchain and AI/ML technologies for advancing CIoT systems.

INTRODUCTION

The fusion of blockchain technology with artificial intelligence (AI) and machine learning (ML) is driving significant advancements in data analytics, particularly within Cognitive Internet of Things (CIoT) systems. This chapter explores how the integration of these cutting-edge technologies can enhance the functionality and performance of CIoT applications. As CIoT systems become increasingly vital in domains such as smart cities, healthcare, and industrial automation, optimizing their performance through effective data analytics becomes crucial. Blockchain technology is renowned for its decentralized, immutable ledger, which ensures data integrity, security, and transparency. This feature is particularly beneficial in CIoT systems, where data security and trust are paramount. When combined with AI and ML, blockchain's capabilities are further augmented. AI and ML excel in analyzing large datasets, making predictions, and automating decision-making processes. The synergy between blockchain and AI/ML enables the creation of sophisticated analytics systems that can handle vast amounts of data generated by interconnected devices, providing insights that are both timely and accurate (Zhang & Xu, 2023). Performance metrics and evaluation play a critical role in assessing the effectiveness of blockchain-enabled AI/ML data analytics. These metrics are essential for understanding how well these technologies are performing, identifying any inefficiencies, and guiding improvements. Key performance indicators (KPIs) such as accuracy, throughput, latency, and scalability are commonly used to evaluate the performance of integrated systems. Accuracy measures the precision of AI/ML predictions, throughput assesses the system's data processing capacity, latency indicates the response time, and scalability reflects the system's ability to handle increased loads (Lee et al., 2023). This chapter aims to achieve several key objectives. First, it provides a detailed examination of how blockchain technology enhances AI/ML data

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