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AI-Enabled Cloud and Edge Computing for Secure Financial and E-Commerce Applications

Goldi Soni, V. Sangeetha
Amity University Chhattisgarh, Dr. N. G. P Arts and Science College

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[1]Goldi Soni, Assistant Professor, Amity School of Engineering and Technology, Amity University Chhattisgarh, Chhattisgarh, India. gsoni@rpr.amity.edu

[2]V. Sangeetha, Assistant Professor, Department of Computer science with Data Analytics, Dr. N. G. P Arts and Science College, Coimbatore, Tamil Nadu, India. sangeetha.swetha2003@gmail.com

Abstract

The convergence of artificial intelligence, cloud computing, and edge computing is transforming the landscape of financial and e-commerce systems by enabling secure, intelligent, and real-time decision-making. Rapid growth in digital transactions, heterogeneous data streams, and high-performance service requirements has created a need for hybrid computing architectures that combine the scalability of cloud platforms with the low-latency processing capabilities of edge nodes. This chapter explores AI-enabled frameworks that optimize transactional analysis, predictive modeling, portfolio management, supply chain operations, and fraud detection within distributed computing environments. The integration of AI across cloud and edge layers enhances system responsiveness, operational efficiency, and security while ensuring regulatory compliance and data privacy. Distributed intelligence supports real-time insights into market dynamics, customer behavior, and logistics processes, enabling adaptive and resilient financial and e-commerce ecosystems. Emerging techniques, including federated learning, predictive analytics, and hybrid orchestration strategies, are discussed to highlight their role in improving performance, reducing risk, and enhancing user experience. The chapter provides a comprehensive examination of challenges, methodologies, and applications of AI-enabled cloud-edge computing, offering a roadmap for future research and practical implementation in secure, large-scale digital platforms.

Keywords: Artificial Intelligence, Cloud Computing, Edge Computing, Financial Systems, E-Commerce, Predictive Analytics.

Introduction

The rapid evolution of digital financial services and e-commerce platforms has generated unprecedented challenges in data management, computational efficiency, and system security [1]. These platforms produce massive volumes of heterogeneous data, including transaction histories, user interactions, market signals, and logistical information [2]. Traditional centralized computing infrastructures struggle to meet the demands for high-speed processing, real-time analytics, and secure operations due to limitations in bandwidth, latency, and scalability [3]. Cloud computing has emerged as a transformative technology capable of addressing many of these challenges by offering on-demand access to scalable computational resources, dynamic storage capabilities, and

virtualization-based workload management [4]. By leveraging the elasticity of cloud environments, financial institutions and e-commerce platforms can deploy complex applications at scale while reducing infrastructure costs and operational overhead. The ability to process and analyze large-scale datasets supports predictive analytics, risk assessment, and intelligent decision-making, which are critical in environments where milliseconds can affect financial outcomes or customer experience [5].

Edge computing has become an essential complement to cloud infrastructures, particularly in applications where low latency and real-time responsiveness are required [6]. By relocating computation closer to data sources such as point-of-sale terminals, mobile devices, or warehouse sensors, edge computing reduces the dependency on centralized servers and mitigates network congestion [7]. In financial systems, edge nodes enable rapid detection of anomalous transactions, high-frequency trading signals, and risk events without the delay associated with transmitting data to remote cloud servers [8]. E-commerce platforms benefit from edge computing through real-time personalization, dynamic pricing, and localized inventory management [9]. The integration of edge nodes with cloud resources allows hybrid architectures that combine the global scalability of centralized systems with the localized responsiveness of distributed nodes, resulting in enhanced operational efficiency, improved user experience, and better resilience against network or system failures [10].