Chapter 9
Exploring the Synergy of Intelligent Systems: Cloud Computing, Industrial Internet of Things (IIoT), Big Data Analytics, and Neural Networks

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ABSTRACT

The rapid advancement of intelligent systems, driven by the integration of cloud computing, the Industrial Internet of Things (IIoT), big data analytics, and neural networks, is transforming industries and society. These technologies work in synergy to enable real-time data processing, predictive analytics, and automated decision-making, offering unprecedented benefits across sectors such as healthcare, manufacturing, urban planning, and agriculture. Despite their promise, the adoption of intelligent systems presents challenges, including ethical concerns, security vulnerabilities, and interoperability issues. This chapter provides a comprehensive overview of these technologies, explores their integration, highlights real-world applications, and examines trends in their adoption and benefits. The chapter concludes by addressing current challenges and proposing future directions to enhance the scalability, efficiency, and ethical alignment of intelligent systems.

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1. INTRODUCTION

The present human society is completely revolutionized with the advent of intelligent systems representing the convergence of various technological breakthroughs, such as cloud computing, large-scale collaboration and big data, industrial Internet of Things, big data analytics, machine learning and artificial intelligence, especially neural networks. In particular, the intelligent systems combining different technologies, such as cloud computing (Armbrust et al., 2010), data analytics, and/or big data, act as the foundation of digital businesses and support the digital transformation across various sectors, such as agriculture, disaster management, healthcare, heritage and culture, industry, supply chains, urban areas, etc. However, there are myriad challenges to face in order to achieve their promise (Gubbi, Buyya, Marusic, & Palaniswami, 2013). These are related to the integration of these technologies to provide cross-domain analytics, the design of the core methodologies and algorithms to support the intelligent systems, the development of the tools and platforms that can be customized to the needs of the users, and the identification of modular design to assure the systems' scalability and sustainability. (Manyika et al., 2011)

Some of the main functionalities of an "intelligent system" induced by the synergies of these technologies are: enhancement of operational efficiency through intelligent analytics and subsequently identifying and predicting events and possible solutions to improve outcomes; provision of location-based marketing; public information/event sharing; monitoring and optimizing supplies and production; demand-driven logistics and interconnected mobility; enhancing the decision-making processes and facilitating innovation; development of new or enhancement of existing services. This position paper provides a comprehensive overview of the ongoing research to develop and execute such emerging trendsetters and the challenges that ensue to openly discuss the existing forefront in developing the intelligent systems. We then discuss the key asymmetries and how they can be integrated to leverage the information sciences. Finally, we identify future research routes for synergies to unleash timely actions in perspectives of offering interesting services with high impact. In the next section, to begin with, the related works are discussed, covering an understanding of the industrial Internet of Things, cloud computing, big data analytics, and neural networks, which form the basic building blocks of intelligent systems. (LeCun, Bengio, & Hinton, 2015)

1.1. Background and Significance

Depending on the developments in technology (Chen, Mao, & Liu, 2014), intelligent systems based on cognitive computing models have great potential, as indicated by modern trends towards the wide use of cloud computing, the transformation