Chapter 10
Emerging Trends in Artificial Intelligence of Things With Machine Learning and Semantic Web Convergence

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ABSTRACT

This chapter explores the dynamic convergence of artificial intelligence of things (AIoT), machine learning algorithms, and the semantic web. The fusion of AI and the internet of things (IoT) creates context-aware applications with transformative potential. Machine learning enhances AIoT capabilities, empowering systems to process IoT data effectively. Simultaneously, the semantic web, with its knowledge representation frameworks, augments adaptability. Delving into deep learning, reinforcement learning, and ensemble methods, the chapter elucidates how machine learning drives autonomous decision-making in AIoT. In the semantic web, the integration of machine learning introduces dynamic knowledge adaptation. Case studies in smart environments, predictive maintenance, and recommendation systems highlight practical implementations. The chapter addresses challenges, including scalability, security, and ethical implications. Emerging trends, interdisciplinary approaches, and societal impacts are explored, emphasizing the transformative potential of AIoT and semantic web integration.

I. INTRODUCTION

The dawn of the Artificial Intelligence of Things (AIoT) marks a pivotal moment in technological convergence. This paradigm brings together the realms of Artificial Intelligence (AI) and the Internet of

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Things (IoT) to create a synergy that transcends traditional boundaries (Al-Amin et al., 2019; Kaundal et al., 2006). AI empowers machines with cognitive capabilities, endowing them with the capacity to analyze data, make informed decisions, and dynamically adapt to ever-changing environments (Das, Mallick, & Dutta, 2020). Concurrently, the IoT comprises a vast network of interconnected devices, sensors, and actuators, facilitating the seamless collection and exchange of data from the physical world (Hsieh et al., 2019). The fusion of AI and IoT in AIoT heralds a new era, characterized by intelligent, context-aware applications poised to revolutionize diverse industries (Krishnamoorthy et al., 2021). Applications range from healthcare, where AIoT systems can optimize patient care, to smart cities, where they can enhance urban planning and resource allocation. This paper embarks on a comprehensive exploration of the intricate relationship between machine learning algorithms, AIoT, and the Semantic Web. At its core, the study aims to elucidate how machine learning models amplify the capabilities of AIoT systems, enabling them to process and interpret data from IoT devices more effectively. Additionally, it investigates the symbiotic relationship between the Semantic Web and machine learning, demonstrating how knowledge representation frameworks benefit from such integration, fostering more adaptable and intelligent systems.

The overarching objective is to provide a nuanced understanding of how the integration of AIoT, machine learning, and the Semantic Web converges to create a robust framework for intelligent systems. By unraveling the intricacies of these intersections, this paper seeks to contribute valuable insights into the potential applications, challenges, and future trajectories of this dynamic field. A literature survey has been taken to analyse related works. Juihung Chang et al. (2022) replaced current medicine stations with a new IoT-based artificial intelligence system that can identify medicine bags using PP-OCR v2 and the most advanced OCR (optic character recognition) model. Healthcare staff who record data can be replaced by using OCR to identify drug bags. Furthermore, this study suggests a system's overseeing and tracking the system to keep an eye on the apparatus and offer a mobile application that allows patients to log their medication times and see the most recent state of their prescription bags in real time. The experiments' findings showed that the recognizing model performs admirably under many circumstances. Dmytro Chashyn et al. (2023) proposed model's main goal is to quickly rebuild destroyed and damaged structures. It accomplished through developing recovery strategies in post-conflict Ukraine and other nations. The strategy suggested utilizing artificial intelligence (AIoT) and building information modeling (BIM) to expedite, improve, and lower the cost of rehabilitation. By selecting retrofitting techniques, the author also obtained a decrease in energy usage and an extension of the building's lifespan. The efficiency of BIM and AIoT techniques made it possible to implement contemporary specifications to cut down on design time and expense, optimize design choices based on knowledge gained from creating new structures and buildings, and supply the information required to support a construction venture throughout its entire life cycle. Wen Tsai Sung et al. (2022) suggested an AIoT-based system which offered real-time flood analysis, enabling the authorities to keep an eye on locals living near mountainous regions and issue early warnings. With consideration for cost, time effectiveness, and safety measurement, this study focused on the flood monitoring system as a warning mechanism to effectively track the flood-prone slopes of mountains in real time. The suggested system design incorporates sensors into the microcontroller, and data is sent to the cloud server over the Internet via SIM900 and LoRa communication between the posts. Alerts are transmitted via SMS as well as the app, and all readings from sensors for every post are shown on the app.