

IOT AND ITS APPLICATIONS WITH AI: PRESENT AND BEYOND

IOT Y SUS APLICACIONES CON IA: PRESENTE Y MÁS ALLÁ

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The convergence between the Internet of Things (IoT) and artificial intelligence (AI) has established itself as the technological backbone driving advanced automation, contextual analysis, and real-time decision-making. The so-called Artificial Intelligence of the Internet of Things (AIoT) is a deep integration between connected sensors and intelligent algorithms that reduces latency, improves energy efficiency, and extends device autonomy, primarily through Edge AI techniques that shift inference to the edge of the network. Recent studies show that these hybrid ecosystems are radically expanding the ability of systems to process data without relying entirely on the cloud, improving resilience and performance in critical applications [1, 2, 3].

In the healthcare sector, the combination of IoT and deep learning models has demonstrated a tangible impact on early disease detection, continuous monitoring, and the optimization of personalized treatments. Intelligent systems based on wearables, biomedical sensors, and distributed analytics enable the evaluation of physiological patterns with previously unattainable accuracy. However, challenges remain, such as device heterogeneity, edge computing constraints, and exposure to vulnerabilities, which require robust security schemes, federated learning, and differential privacy mechanisms. Recent literature on the Internet of Medical Things (IoMT) and connected clinical environments underscores the urgency of strengthening cybersecurity and data integrity to prevent breaches that compromise medical care and user trust [1], [4], [5].

In innovative industries and cities, AIoT has become the driving force behind predictive and autonomous processes: connected factories capable of self-adjusting production lines, transportation systems that optimize traffic in milliseconds, and logistics networks that anticipate failures before they occur. The integration of blockchain for traceability, distributed model orchestration, and sustainable energy automation is emerging as a dominant line of innovation. However, scalability and governance remain substantial challenges: standardization, secure model updates, and interoperability between manufacturers require consistent regulatory frameworks that balance innovation and user protection. Recent research highlights that future advances will depend on both new efficient algorithms and reliable architectures for managing the lifecycle of devices and their AI models [2], [6, 7, 8].

Looking ahead to the next decade, the direction of AIoT is shaping up around four strategic axes: the miniaturization of models that enable autonomous inference in microcontrollers; collaboration between devices through distributed and federated learning; the integration of lightweight cybersecurity mechanisms capable of operating on limited hardware; and the development of global regulations that establish standards for interoperability, privacy, and certification of intelligent systems. Current reports agree that investment in Edge AI and AIoT will continue to accelerate, driven by the need for more sustainable, personalized, and resilient solutions. Consequently, the challenge is not only technological, but also ethical and



social: ensuring that this new intelligent layer of the physical world is secure, equitable, and transparent for all users [3], [7], [9], [10].

Finally, various applications combine AI and IoT. In the field of e-farming, digital technologies have driven advances across multiple domains, including precision agriculture using IoT [11]. In the area of e-health, machine learning algorithms are used for the analysis and management of COVID-19 [12], and opinion mining applied to hotel reviews in Spanish using the ANEW lexicon [13]. These studies demonstrate how data analytics and artificial intelligence synergize with hardware platforms such as IoT, enabling optimized decision-making and the extraction of practical knowledge from large volumes of information.

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