Abstract: Machine Learning (ML) and Artificial Intelligence (AI) have become essential tools for intelligent decision-making in complex, data-intensive environments. Advances in supervised learning, deep learning, generative models, and signal processing have enabled effective solutions across domains such as finance, healthcare, intelligent transportation, IoT, and cyber-physical systems. Traditional rule-based and statistical approaches often lack scalability and adaptability for high-dimensional, heterogeneous, and dynamic data, driving the shift toward data-driven and learning-based methods for prediction, automation, and adaptive intelligence. This review synthesizes recent progress in AI-based decision-support systems, focusing on core algorithms, application areas, and emerging trends. It highlights developments in financial anomaly detection, learning analytics, radiomics-based medical imaging, IoT-enabled systems, generative AI, and advanced signal processing. Key challenges—including interpretability, data quality, scalability, security, and ethical governance—are critically examined. The paper concludes by outlining future directions toward explainable, multimodal, and responsible AI systems capable of robust real-world deployment.

Keywords: Artificial Intelligence; Machine Learning; Deep Learning; Generative AI; Intelligent Systems; Financial Analytics; Medical Imaging; IoT; Responsible AI