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Study on Machine Learning

Dr. Antony Cynthia[1], Joel Aasir K[2], Rohith R R[3]
Assistant Professor[1]
BCA Students[2,3,4]
Sri Krishna Arts and Science College, Coimbatore
antonycynthia@skasc.ac.in[1], joelaasirk23bca023@skasc.ac.in[2], rohithrr23bca048@skasc.ac.in[3]

Abstract: *Machine Learning (ML) is a swiftly evolving area within artificial intelligence that allows computers to learn from data and make decisions autonomously, without explicit programming. As the volume of digital data continues to increase at an unprecedented rate, ML has emerged as a fundamental technology across various sectors, including healthcare, finance, education, cybersecurity, and autonomous systems. This paper offers a thorough overview of machine learning, detailing its core principles, classifications, and applications. The research categorizes machine learning into supervised, unsupervised, and reinforcement learning, each characterized by distinct methodologies and use cases. Additionally, it emphasizes well-known algorithms such as decision trees, support vector machines, k-means clustering, and deep learning models, which encompass convolutional and recurrent neural networks. Moreover, the paper addresses the challenges encountered in the practical application of ML models, such as data quality issues, algorithmic bias, overfitting, and the necessity for interpretability. It also examines strategies to alleviate these challenges, including cross-validation, regularization, and ethical AI practices. Recent developments like AutoML, federated learning, and explainable AI are underscored to illustrate the future trajectory of the field. By integrating theoretical foundations with practical insights, this paper seeks to establish a robust introductory framework for researchers, students, and practitioners keen on utilizing machine learning for intelligent decision-making and predictive analytics. The study concludes with suggestions for further investigation and innovation in this transformative domain.*

Keywords: *Machine Learning*

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