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A Marketing Perspective on the Roles of AI and ML in Shaping Contemporary Programmatic Advertising

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ABSTRACT

Artificial intelligence (AI) and machine learning (ML) have revolutionized programmatic advertising by enhancing precision targeting, operational efficiency, and consumer engagement. This systematic literature review uses the PRISMA framework to synthesize recent advancements, emphasizing personalization and real-time optimization while addressing challenges such as algorithmic bias, privacy concerns, and ethical considerations. Findings reveal that AI-driven advertising significantly improves campaign effectiveness, though its implementation requires careful management to mitigate cultural and data biases. The study identifies key ethical frameworks and consumer transparency gaps, proposing future research directions in AI-integrated creativity, privacy, ethics, and consumer trust dynamics. These insights contribute to developing sustainable and responsible programmatic advertising ecosystems, aligning technological innovation with ethical and cultural sensitivity.

KEYWORDS

Artificial Intelligence, Machine Learning, AI-Driven Marketing, Programmatic Advertising, Personalized Advertising, Contextual Advertising, Digital Marketing

1. INTRODUCTION

Programmatic advertising is integral to digital marketing and has revolutionized how businesses connect with their audiences. It automates ad space purchasing through algorithms and real-time bidding (RTB) platforms, allowing for precise targeting within milliseconds. This automated process contrasts sharply with traditional advertising, which relies on manual negotiations, predefined schedules, and fixed placements, often limiting flexibility and responsiveness (Chen et al., 2019; Ford et al., 2023; Yuan et al., 2013). These real-time platforms significantly improve key advertising metrics, such as click-through rates and conversions (Shan et al., 2018). Within this evolving industry, Artificial Intelligence (AI) and Machine Learning (ML) applications have steadily advanced the precision of audience analysis, predictive modeling, and ad placement optimization. These technologies allow advertisers to explore psychographic and contextual elements, enabling them to design tailored advertising experiences (Bakpayev et al., 2020; Meirezaldi, 2023).

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Programmatic advertising stands out from traditional methods by using automation, real-time data analysis, and dynamic optimization, while traditional advertising relies on manual negotiations and fixed placements. (Taylor, 2019). Real-time bidding platforms underpin programmatic advertising, facilitating campaign adjustments in response to live data. This enhances targeting precision by incorporating psychographic insights and contextual factors, surpassing the broad demographic segmentation typical of traditional methods (Ciuchita et al., 2022). Furthermore, programmatic systems improve cost efficiency, minimizing wasted impressions and maximizing return on investment in ways that static campaigns cannot achieve (Bakpayev et al., 2020; Yuan et al., 2013).

Applying AI and ML within programmatic advertising has transformed consumer engagement possibilities. AI-driven algorithms facilitate real-time adjustments to advertising strategies based on behavioral patterns, accurately predicting user intent (Meirezaldi, 2023; Shan et al., 2018). Meanwhile, ML processes vast datasets to uncover patterns that drive strategic decision-making (Nishant et al., 2023). Techniques such as reinforcement learning refine bidding strategies in live auctions, while natural language processing (NLP) improves contextual targeting by evaluating content sentiment and relevance (Bakpayev et al., 2020; Häglund & Björklund, 2022). These developments illustrate the expanding capabilities of AI and ML in shaping advanced advertising ecosystems.

Despite these innovations, programmatic advertising is not without challenges. Concerns related to privacy, data security, and ethical considerations of personalized targeting demand continued attention (Malthouse & Copulsky, 2022). The increasing complexity of AI and ML algorithms also raises risks, including algorithmic bias that can perpetuate systemic inequities or produce suboptimal results for underrepresented groups (Meirezaldi, 2023; Nishant et al., 2023). Addressing these issues requires a nuanced understanding of the balance between technological innovation and regulatory oversight, coupled with transparent and accountable system design (Yuan et al., 2013).

This study examines less-explored dimensions of AI and ML in programmatic advertising. While prior research has concentrated on technological innovations and efficiency improvements, limited attention has been given to their adoption's strategic and ethical aspects (Bakpayev et al., 2020). By employing a systematic literature review following the PRISMA protocol, this study seeks to

This study addresses critical gaps identified in prior research across ethical, strategic, and operational dimensions. While earlier studies emphasize the technological innovations of AI and ML in programmatic advertising (Chen et al., 2019; Häglund & Björklund, 2024), limited attention has been paid to the ethical concerns surrounding algorithmic transparency and consumer trust (Bakpayev et al., 2020; Ford et al., 2023; Sjøvaag & Owren, 2021). As Kerr et al. (2023) highlighted, strategic gaps include a lack of frameworks integrating AI capabilities with organizational performance and decision-making processes. On the operational side, challenges such as algorithmic bias and cultural variability in ad personalization remain underexplored (Kuang, 2022; Xie & Huang, 2023). This study uniquely synthesizes these dimensions by providing a systematic analysis that bridges technological advancements with their ethical, strategic, and operational implications in the programmatic advertising ecosystem. It analyzes opportunities and challenges for integrating AI and ML into programmatic advertising systems (Shan et al., 2018).

The relevance of this research stems from the growing academic and industry emphasis on leveraging AI and ML to refine marketing strategies (Ford et al., 2023). This work contributes valuable insights into how these technologies reshape programmatic advertising, offering practical and theoretical perspectives for researchers, practitioners, and policymakers (Ford et al., 2023; Häglund & Björklund, 2022; Malthouse & Copulsky, 2022). This paper uniquely synthesizes findings from recent studies to explore underexamined dimensions such as ethical considerations, algorithmic transparency, and consumer perceptions. This review bridges the gap between technical innovations and their practical applications in advertising strategy by combining empirical insights with thematic analysis. Furthermore, this study aligns with calls for interdisciplinary approaches to evaluating AI and ML marketing applications, as Malthouse and Copulsky (2022) highlighted. By addressing critical gaps in the literature, this research underscores the far-reaching implications of technological advancement

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