

AI-Powered Customer Segmentation and Hyper-Personalization for Decision Making in Digital Marketing Campaigns

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Abstract: The rapid expansion of digital platforms has fundamentally transformed the way organizations understand, communicate with, and create value for customers. Conventional market segmentation approaches based primarily on demographic, geographic, and broad behavioral characteristics are increasingly insufficient for digital environments in which customer interests, preferences, purchasing intentions, and interactions change continuously. Artificial intelligence (AI), machine learning (ML), predictive analytics, and customer data platforms provide new possibilities for identifying dynamic customer segments and delivering personalized marketing experiences at scale. This study examines the role of AI-powered customer segmentation and hyper-personalization in improving decision making in digital marketing campaigns. A conceptual framework is proposed that integrates customer data acquisition, AI-based segmentation, predictive customer analytics, personalization engines, campaign decision systems, and continuous performance optimization. The framework demonstrates how clustering algorithms, classification models, recommendation systems, natural language processing, propensity models, and real-time behavioral analytics can transform heterogeneous customer information into actionable marketing decisions. Particular attention is given to the application of AI for predicting customer preferences, purchase probability, churn risk, customer lifetime value, channel preference, and content responsiveness. The study further discusses challenges involving customer privacy, algorithmic bias, data quality, model transparency, over-personalization, and regulatory compliance. It concludes that AI-supported segmentation should not merely automate marketing activities but should function as an intelligent decision-support architecture in which data, algorithms, marketers, and customers interact continuously. The proposed framework offers a foundation for developing more responsive, customer-centered, ethical, and performance-oriented digital marketing campaigns.

Keywords: Artificial Intelligence, Customer Segmentation, Hyper-Personalization, Digital Marketing, Machine Learning, Customer Analytics, Predictive Analytics, Marketing Decision Making



1. Introduction

Digital marketing has evolved from broad online advertising into a highly data-intensive environment in which organizations interact with customers through websites, search engines, social networks, mobile applications, e-commerce platforms, email, digital advertisements, and numerous other touchpoints. Each interaction can create information about consumer preferences, search behavior, purchase patterns, product interests, engagement, and responses to marketing communications. Consequently, the ability to transform large and diverse customer datasets into meaningful marketing decisions has become increasingly important. Traditional customer segmentation normally divides markets according to relatively stable variables such as age, income, gender, occupation, geography, lifestyle, purchasing behavior, or product preferences. Although such approaches continue to provide strategic value, they may not adequately capture the dynamic nature of customers in digital environments. A consumer who belongs to a particular demographic segment may demonstrate significantly different intentions depending on the device used, recent browsing history, stage in the purchase journey, previous purchases, interaction with promotional messages, and immediate situational context.

Artificial intelligence provides marketers with mechanisms for analyzing customer information at a scale and speed difficult to achieve through conventional analytical processes. Davenport et al. argue that AI has the capacity to transform both marketing strategies and customer behavior by supporting increasingly sophisticated analytical and decision-making functions [1]. AI can therefore shift customer segmentation from a relatively static exercise performed periodically toward a continuous process in which segments are revised as new behavioral information becomes available. Machine learning algorithms can identify patterns within large customer datasets without requiring every segment to be predetermined manually. Clustering techniques can discover groups of consumers who display similar behavioral patterns, while classification algorithms can assign customers to defined categories. Predictive models can estimate future purchase probability, customer lifetime value, response probability, churn risk, and product preference. Recommendation systems can subsequently determine which product, service, message, content item, or offer may be most relevant to a particular consumer. These developments have contributed to the transition from conventional personalization toward hyper-personalization. Traditional personalization may involve relatively simple modifications such as inserting a customer's name into an email or recommending products according to previous purchases. Hyper-personalization combines behavioral data, contextual information, predictive analytics, and AI algorithms to determine what should be communicated to an individual customer, through which channel, at what time, and under what circumstances.

2. Literature Review

The application of artificial intelligence in marketing has received increasing scholarly attention, particularly in relation to customer analytics, segmentation, personalization, predictive decision making, and digital customer experience.

Wedel and Kamakura (2000) provided one of the important methodological foundations for market segmentation. Their work explained how heterogeneous markets can be divided into meaningful customer groups through statistical and analytical techniques. Although their study predates the widespread use of artificial intelligence in marketing, it established the conceptual basis upon which modern AI-driven segmentation methods have been developed.

Verhoef et al. (2009) examined customer experience creation and emphasized that customer responses are influenced by multiple interactions across different stages of the customer relationship. Their work suggested that firms should understand customer behavior across several touchpoints rather than evaluating individual transactions in isolation. This perspective is particularly relevant to AI-based segmentation because contemporary systems combine information from websites, mobile applications, social media, customer service, and purchasing activities.

Lambrecht and Tucker (2013) investigated personalized online advertising and retargeting. Their study demonstrated that highly specific advertising is not always equally effective across all stages of the consumer decision process. They found that the effectiveness of personalization depends on the customer's level of product awareness and purchase intention. This suggests that AI-driven personalization should consider customer context rather than merely increasing the amount of individualized advertising.

Aguirre et al. (2015) examined the relationship between personalization, customer information collection, and trust. Their research identified the personalization paradox, in which customers may appreciate relevant personalized advertising while simultaneously becoming concerned about the amount of personal information collected by organizations. Their findings are significant for AI-powered hyper-personalization because sophisticated algorithms depend heavily on customer data. Consequently, transparency and trust-building mechanisms are necessary components of personalized digital marketing.

Kannan and Li (2017) developed a broad framework for digital marketing and emphasized the importance of digital technologies, customer touchpoints, marketing analytics, and value creation. They argued that digital marketing should be understood as an interconnected process involving customer acquisition, interaction, conversion, retention, and engagement. Their framework provides an important basis for integrating AI-powered customer segmentation with campaign decision making.

Lemon and Verhoef (2016) studied customer experience throughout the complete customer journey. They explained that customers interact with firms through multiple stages, including pre-purchase, purchase, and post-purchase experiences. Their work indicates that customer segmentation should not necessarily remain static because customer needs and intentions change during the journey. AI-based dynamic segmentation can address this problem by continuously updating customer classifications according to new behavioral information.

Matz et al. (2017) investigated psychologically targeted digital advertising and demonstrated that marketing messages tailored to psychological characteristics can influence customer responses. Their findings showed the potential of behavioral and psychological information in creating more relevant digital communication. This study provides evidence that personalization can move beyond demographic variables toward more detailed behavioral and individual-level characteristics.

Huang and Rust (2018) examined the role of artificial intelligence in service environments. They explained that AI technologies can perform mechanical, analytical, and increasingly interactive tasks. Their study indicated that AI may transform customer service and customer relationship activities by improving prediction, automation, and personalization. This work provides an important foundation for understanding AI as an integral part of customer-facing marketing systems.

Haenlein and Kaplan (2019) discussed the evolution of artificial intelligence and its implications for business. They emphasized that advances in machine learning, computing power, and data availability have accelerated organizational adoption of AI. Their discussion is relevant to digital marketing because customer segmentation and personalization increasingly depend on automated learning systems capable of processing large datasets.

Kaplan and Haenlein (2019) further explored the interpretations and business implications of artificial intelligence. They highlighted the growing ability of AI systems to learn from information, recognize patterns, and support organizational decision making. These capabilities are directly applicable to customer segmentation, campaign optimization, and personalized communication.

Bleier, Harmeling, and Palmatier (2019) examined how organizations can create effective online customer experiences. Their research demonstrated that personalization effectiveness depends on factors such as timing, design, and relevance. They emphasized that technological personalization must create genuine customer value. This finding is significant because AI-based systems may generate highly personalized messages, but such messages will only be effective when customers perceive them as useful and appropriate.

Kumar et al. (2019) studied the role of artificial intelligence in personalized engagement marketing. Their work emphasized the potential of AI to support customer engagement by combining customer information, predictive analytics, and personalized communication. The authors suggested that AI can help firms identify valuable customers and determine more appropriate methods of interaction, thereby strengthening customer relationships.

Davenport et al. (2020) examined how artificial intelligence is expected to transform the future of marketing. They argued that AI can influence customer behavior, marketing strategies, product decisions, pricing, communication, and customer management. Their study emphasized that AI should be regarded as a strategic marketing capability rather than merely an automation tool. This perspective strongly supports the use of AI for customer segmentation and marketing decision making.

Libai et al. (2020) investigated the influence of AI on customer relationship management. Their study explained how artificial intelligence could affect customer acquisition, development, retention, and relationship management. They also identified potential challenges associated with automated customer interactions. Their findings suggest that AI-driven segmentation can enhance customer relationship strategies when combined with appropriate managerial control.

Rust (2020) examined the future direction of marketing and emphasized the increasing importance of analytics, automation, and technology-driven decision making. He suggested that marketing is moving toward greater reliance on customer-level data and predictive models. This development creates a strong foundation for AI-powered segmentation and personalized marketing decisions.

Huang and Rust (2021) proposed a strategic framework for artificial intelligence in marketing. They classified AI capabilities into mechanical AI, thinking AI, and feeling AI. Mechanical AI supports repetitive marketing activities, thinking AI supports analytical decision making, and feeling AI contributes to understanding customer emotions and interactions. Their framework specifically connects AI with segmentation, targeting, positioning, and marketing action, making it highly relevant to the present study.

Verhoef et al. (2021) examined digital transformation and highlighted how organizations are increasingly redesigning business processes around digital technologies and customer information. Their study emphasized that digital transformation affects customer interaction, organizational structure, and value creation. AI-powered segmentation can be considered part of this broader transformation because it enables firms to convert customer data into continuous marketing intelligence.

More recent developments have also expanded the possibilities of personalization through generative artificial intelligence. Emerging studies during 2023–2025 have increasingly examined the use of generative AI for creating marketing content, conversational customer interactions, personalized recommendations, and automated campaign materials. Generative AI has the potential to complement predictive segmentation by producing individualized text, advertisements, product descriptions, email messages, and promotional content based on customer characteristics. The existing literature clearly demonstrates that artificial intelligence has substantially improved customer analytics, prediction, targeting, and personalization. Earlier research primarily focused on conventional market segmentation and customer experience, while studies published after 2018 increasingly examine machine learning, predictive analytics, and AI-supported marketing decision making. More recent research focuses on hyper-personalization, generative AI, real-time customer intelligence, and automated marketing systems.

However, an important research gap remains. Much of the existing literature examines customer segmentation, predictive analytics, recommendation systems, customer experience, and personalization as separate functions. Comparatively fewer studies present an integrated framework connecting customer data acquisition, AI-powered dynamic segmentation, predictive customer analytics, hyper-personalization, campaign decision making, real-time execution, and continuous feedback within a single digital marketing architecture. The present study addresses this gap by proposing an integrated AI-powered customer segmentation and hyper-personalization framework for improving decision making in digital marketing campaigns.

3. Contribution of the Study

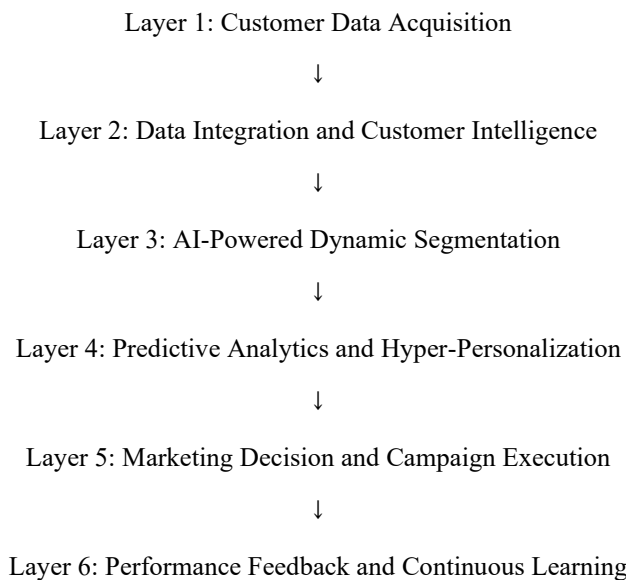
The major contributions of the present study are:

1. To examine the role of artificial intelligence and machine learning in contemporary customer segmentation.
2. To analyze the transition from conventional personalization toward data-driven hyper-personalization.
3. To identify the principal AI techniques that can support digital marketing decision making.
4. To propose an integrated AI-powered customer segmentation and hyper-personalization framework.
5. To explain how predictive models can support decisions relating to customer targeting, campaign timing, content, offers, channels, and customer retention.
6. To integrate continuous customer feedback and campaign performance measurement into the decision framework.
7. To examine privacy, transparency, bias, data quality, and ethical challenges associated with AI-driven personalization.
8. To provide directions for future research involving generative AI, explainable AI, federated learning, real-time customer intelligence, and autonomous marketing systems.

4. Proposed Research Framework

Although previous studies have examined artificial intelligence, customer segmentation, recommendation systems, personalization, customer experience, and predictive marketing separately, effective digital marketing requires these activities to operate as an interconnected system.

The proposed study therefore conceptualizes an AI-Powered Customer Segmentation and Hyper-Personalization Decision Framework containing six interconnected layers:



The system is surrounded by a **Responsible AI Governance Layer** dealing with privacy, consent, fairness, transparency, security, and human supervision.

5. Discussion

The application of artificial intelligence to customer segmentation represents a significant change in how marketers understand customers. Conventional segmentation generally assumes that customers can be placed within relatively stable groups. AI-based segmentation instead treats customer behavior as dynamic and allows membership to change as new information becomes available. For example, a consumer classified as a low-engagement customer during one period may suddenly demonstrate high purchase intent by repeatedly viewing a product, comparing specifications, reading customer reviews, placing the product in a shopping cart, or responding to promotional content. A dynamic segmentation model can recognize this behavioral transition and move the individual into a high-intent segment. The campaign system can subsequently modify communication strategy without waiting for a manually scheduled segmentation analysis.

Machine-learning clustering represents one of the most useful techniques for discovering customer groups. Algorithms such as K-means, hierarchical clustering, Gaussian mixture models, and density-based clustering can analyze multiple behavioral attributes simultaneously. Instead of segmenting consumers simply according to age or location, marketers can identify groups such as high-value loyal customers, price-sensitive frequent browsers, promotion-driven purchasers, high-potential new customers, dormant customers, and customers at risk of churn. AI can additionally combine behavioral segmentation with RFM analysis, which evaluates recency, frequency, and monetary value. However, AI extends conventional RFM models by incorporating variables such as session frequency, product-category interest, advertising interaction, email engagement, search behavior, return history, channel preference, customer service interaction, and predicted future value.

Predictive analytics then transforms segmentation from descriptive analysis into forward-looking marketing intelligence. Instead of asking only, “What has this customer done?” marketers can ask:

- What is this customer likely to purchase next?
- How likely is the customer to respond to this campaign?
- Is the customer likely to leave?
- Which communication channel is most appropriate?
- When should the message be delivered?
- Which offer is most likely to influence the purchase?
- What is the expected long-term value of this customer?

AI thus shifts digital marketing decisions from generalized assumptions toward probability-based predictions. Customer lifetime value prediction is particularly important because campaign decisions based solely on immediate transactions may encourage excessive expenditure on customers who generate limited long-term value. AI systems can estimate future revenue potential and allow marketers to prioritize acquisition, retention, and loyalty investments accordingly. Churn prediction represents another valuable application. Behavioral changes such as reduced purchase frequency, declining app usage, decreased email engagement, repeated customer-service complaints, or abandoned subscriptions may indicate that a customer is likely to discontinue a relationship. Classification models can identify these patterns and allow retention campaigns to be initiated before the customer leaves. Recommendation systems contribute directly to hyper-personalization. Collaborative filtering can identify relationships between customers who demonstrate similar behavior, while content-based approaches can recommend items similar to those previously viewed or purchased. Hybrid systems can combine both methods. More advanced recommendation architectures can incorporate contextual variables such as time, location, device, price sensitivity, product availability, customer journey stage, and recent interactions.

The resulting personalization can extend beyond product selection. AI may determine the appropriate advertising creative, subject line, call-to-action, promotional incentive, communication channel, landing page, timing, and sequence of messages for individual customers. However, more personalization does not automatically mean more effective marketing. Research on personalized advertising demonstrates that relevance must be balanced with

consumer perceptions and context [5]–[7]. Marketers therefore require algorithms capable of determining not only what information can be personalized but also what degree of personalization is appropriate.

5.1. Proposed AI-Powered Segmentation and Hyper-Personalization Model

The proposed framework consists of six operational layers supported by an overarching responsible AI mechanism.

Layer 1: Customer Data Acquisition

The first layer collects customer information from multiple digital and organizational sources, including:

- Customer Relationship Management systems
- E-commerce transactions
- Website browsing
- Mobile application activity
- Search behavior
- Social-media engagement
- Email interactions
- Advertisement impressions and clicks
- Customer service interactions
- Loyalty programmes
- Product reviews
- Campaign histories

The purpose is to establish a sufficiently comprehensive view of customer interactions without assuming that every available piece of information should necessarily be collected. Data minimization and legitimate customer consent should guide acquisition.

Layer 2: Data Integration and Customer Intelligence

Raw customer information may contain missing values, duplicate profiles, inconsistent identifiers, irrelevant information, and conflicting records. Therefore, the second layer performs data cleaning, integration, transformation, identity resolution, and feature engineering. Customer events across devices and channels can then be associated, where appropriately permitted, with a unified customer profile. Important analytical variables may include: purchase frequency; average order value; days since previous purchase; browsing intensity; campaign engagement; preferred product category; promotional sensitivity; channel preference; customer lifetime value; retention probability; purchase propensity. The resulting customer intelligence layer becomes the foundation for subsequent AI analysis.

Layer 3: AI-Powered Dynamic Segmentation

The third layer applies machine-learning algorithms to identify meaningful patterns among customers. Instead of relying exclusively on manually selected demographic categories, AI can derive behavioral segments such as:

AI-Identified Segment	Major Characteristics	Suggested Marketing Decision
High-Value Loyal Customers	Frequent purchases and high lifetime value	Loyalty rewards and exclusive benefits

High-Intent Prospects	Strong browsing and product interaction	Conversion-oriented offers
Price-Sensitive Customers	High promotion response	Targeted discount communication
Cross-Sell Candidates	Strong complementary product probability	Personalized product bundles
Churn-Risk Customers	Declining engagement	Retention campaigns
New High-Potential Customers	Early strong engagement	Onboarding and relationship building
Dormant Customers	Long period without activity	Re-engagement campaigns
Brand Advocates	High engagement and positive interaction	Referral and advocacy initiatives

Segments are not considered permanent. Customers move between them according to their evolving behavior. This produces dynamic segmentation, one of the central advantages of AI-powered marketing.

6. Conclusion and Future Work

The increasing complexity of digital consumer behavior has made conventional static segmentation progressively less sufficient for many data-rich marketing environments. Customers interact with brands through multiple channels, move rapidly between stages of the purchasing journey, and continuously generate behavioral information. Artificial intelligence provides an opportunity to transform these fragmented interactions into actionable customer intelligence.

This study has proposed an AI-powered customer segmentation and hyper-personalization framework for decision making in digital marketing campaigns. The model combines customer data acquisition, data integration, machine-learning segmentation, predictive analytics, personalized recommendation, campaign decision making, and continuous performance feedback. The central contribution of the proposed system is the integration of segmentation and decision making. Customer groups are not identified merely for reporting purposes. Instead, segment membership influences subsequent decisions concerning product recommendations, marketing messages, communication channels, timing, promotional offers, campaign expenditure, customer retention, and long-term relationship management.

AI consequently allows marketing systems to shift from:

Mass Marketing → Segment Marketing → Personalized Marketing → Predictive Hyper-Personalization.

The proposed architecture further emphasizes that customer segments should remain dynamic. Behavioral changes should update customer profiles, which should influence subsequent predictions and campaign actions. However, technological sophistication alone does not guarantee successful marketing. Over-personalization, inaccurate predictions, algorithmic bias, poor-quality data, insufficient transparency, and privacy violations can damage customer relationships. AI-driven marketing must therefore combine algorithmic capability with responsible data governance and meaningful human oversight. Future marketing systems are likely to become increasingly adaptive as predictive analytics, generative AI, real-time customer intelligence, and automated experimentation develop further. The most valuable systems, however, will not necessarily be those that generate the greatest number of personalized interactions. They will be those that identify when personalization genuinely creates value for both the customer and the organization.

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