



NEUROMARKETING AND AI: PREDICTING CONSUMER EMOTIONS AND BRAND PREFERENCES USING MACHINE LEARNING

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Abstract

Artificial Intelligence (AI) and neuromarketing are transforming the way organizations understand consumer behavior in the digital marketplace. Traditional marketing approaches often fail to capture the subconscious emotional responses that strongly influence consumer decision-making and brand preference. This study explores the integration of neuromarketing techniques and machine learning algorithms to predict consumer emotions and identify brand preferences with greater accuracy and efficiency. The research examines how AI-driven analytical models can interpret emotional and behavioral data collected through consumer interactions, facial expressions, sentiment analysis, and cognitive responses.

The study adopts a quantitative research approach by collecting data from consumers through structured questionnaires and digital behavioral observations. Machine learning techniques such as Random Forest, Support Vector Machine (SVM), and Neural Networks are applied to analyze emotional patterns and predict consumer preferences toward brands. The findings indicate that AI-based neuromarketing models significantly improve the prediction of consumer emotional engagement, purchase intention, and brand loyalty compared to conventional marketing analytics methods.

The research further highlights the growing strategic importance of predictive analytics in developing personalized marketing campaigns, improving customer experience, and enhancing competitive advantage in dynamic business environments. The study contributes to the emerging literature on AI-enabled consumer analytics by providing a conceptual and empirical understanding of how machine learning can support emotionally intelligent marketing strategies. The results offer valuable implications for marketers, researchers, and organizations seeking to leverage advanced technologies for data-driven decision-making and customer-centric brand management.

Keywords: Neuromarketing, Artificial Intelligence, Machine Learning, Consumer Emotions, Brand Preference, Predictive Analytics, Consumer Behavior, Digital Marketing Analytics

Introduction

In the rapidly evolving digital economy, understanding consumer behavior has become one of the most critical challenges for modern businesses. Traditional marketing research methods, including surveys, interviews, and focus groups, often fail to fully capture the subconscious emotions and psychological factors that influence consumer decision-making. As consumer expectations continue to change in highly competitive markets, organizations are increasingly adopting advanced technologies to

gain deeper insights into customer preferences, emotional engagement, and purchasing behavior. In this context, the integration of Neuromarketing and Artificial Intelligence has emerged as a transformative approach for enhancing marketing effectiveness and predictive consumer analytics. Neuromarketing combines principles from neuroscience, psychology, and marketing to study consumers' cognitive and emotional responses to products, advertisements, and brands. Unlike conventional research approaches that rely mainly on self-reported data,



neuromarketing techniques enable researchers and organizations to examine unconscious reactions through behavioral and emotional indicators. These insights help marketers understand how emotions, attention, memory, and perception influence purchasing decisions and brand loyalty. With the increasing availability of digital consumer data, neuromarketing has gained substantial attention among researchers and practitioners seeking more accurate and data-driven marketing strategies.

At the same time, Machine Learning and AI technologies are reshaping business intelligence and customer analytics by enabling organizations to process large volumes of structured and unstructured consumer data. Machine learning algorithms can identify hidden patterns, predict consumer preferences, and generate actionable insights with greater speed and precision than traditional analytical methods. AI-driven systems are now capable of analyzing facial expressions, online interactions, sentiment patterns, eye-tracking data, and emotional responses to evaluate consumer attitudes toward brands and products. These technological advancements have created new opportunities for businesses to develop personalized marketing campaigns and improve customer engagement through predictive emotional analytics.

The growing convergence of neuromarketing and AI has opened new avenues for understanding consumer emotions and predicting brand preferences in real time. Businesses across industries are increasingly leveraging intelligent systems to optimize advertising effectiveness, improve product positioning, and strengthen customer relationships. However, despite the rising adoption of AI-enabled marketing technologies, there remains a limited understanding of how machine learning models can effectively interpret emotional and behavioral data within neuromarketing contexts. Existing studies primarily focus on either consumer neuroscience or AI-based analytics

independently, while integrated empirical research on predictive emotional intelligence in marketing remains relatively underexplored.

Therefore, this study aims to examine the role of AI and machine learning in predicting consumer emotions and brand preferences through neuromarketing analytics. The research seeks to explore how advanced predictive models can enhance the accuracy of consumer behavior analysis and support strategic marketing decision-making. By integrating emotional analytics with AI-driven prediction techniques, the study contributes to the emerging literature on intelligent consumer analytics and data-driven marketing innovation.

The findings of this research are expected to provide valuable theoretical and practical implications for marketers, researchers, and organizations. From a theoretical perspective, the study expands the understanding of AI-enabled neuromarketing frameworks and predictive consumer behavior analysis. From a managerial perspective, the research offers insights into how businesses can use machine learning technologies to design emotionally engaging marketing campaigns, improve customer experiences, and strengthen long-term brand relationships. As organizations increasingly compete in digital and experience-driven markets, the integration of AI and neuromarketing is likely to become a critical component of future marketing strategies and consumer intelligence systems.

Review of Literature

The integration of Neuromarketing and Artificial Intelligence has gained considerable attention in recent years due to its ability to provide deeper insights into consumer behavior and emotional decision-making processes. According to Ale Smidts (2002), neuromarketing applies neuroscience principles to understand consumer responses toward marketing stimuli and purchasing decisions. The study emphasized that consumer behavior is strongly influenced by



subconscious cognitive and emotional reactions rather than purely rational thinking.

Several researchers have highlighted the importance of emotions in influencing consumer preferences and purchasing intentions. Antonio Damasio (1994) explained that emotions play a central role in decision-making and behavioral responses. Similarly, Gerald Zaltman (2003) argued that a significant portion of consumer decisions occurs unconsciously, making traditional survey-based marketing research insufficient for understanding actual consumer motivations.

Advancements in neuromarketing techniques such as eye-tracking, electroencephalography (EEG), and facial expression analysis have enabled researchers to measure emotional engagement more effectively. Patrick Renvoise and Christophe Morin (2007) stated that emotional triggers significantly influence consumer attention, memory retention, and brand perception. Their findings suggested that emotionally engaging advertisements create stronger customer relationships and enhance brand loyalty.

The emergence of Machine Learning and AI technologies has further transformed consumer analytics and predictive marketing research. Philip Kotler, Hermawan Kartajaya, and Iwan Setiawan (2021) explained that AI-driven marketing systems enable organizations to process large volumes of customer data and deliver personalized experiences through predictive analytics. Machine learning algorithms such as Decision Trees, Random Forest, Support Vector Machines (SVM), and Neural Networks are increasingly used to identify hidden patterns in consumer behavior and forecast purchasing preferences.

Research on sentiment analysis and emotional recognition has also demonstrated the effectiveness of AI-based models in understanding consumer opinions and behavioral patterns. According to Erik Cambria (2016),

sentiment analysis powered by AI can evaluate emotional expressions from social media interactions, online reviews, and digital communication to identify customer attitudes toward brands and products. These technologies have become essential tools for digital marketers seeking to improve customer engagement and advertising effectiveness.

Recent studies indicate that integrating neuromarketing with AI provides a more comprehensive framework for predictive consumer analytics. Hilke Plassmann et al. (2015) found that combining neuroscience insights with computational analytics improves the understanding of consumer emotional responses and purchasing behavior. AI-enhanced neuromarketing systems help organizations analyze emotional data in real time, enabling better decision-making and targeted marketing strategies.

Despite these developments, previous studies reveal a gap in empirical research examining the combined application of neuromarketing and AI in predicting consumer emotions and brand preferences. Most existing studies focus either on neuroscience-based marketing or AI-driven analytics independently, with limited research integrating both approaches in a unified predictive framework. Therefore, the present study attempts to bridge this gap by examining how machine learning techniques can support neuromarketing strategies to improve predictive accuracy in consumer behavior analysis.

Research Gap

Existing literature on Neuromarketing and Artificial Intelligence has significantly contributed to understanding consumer behavior, emotional engagement, and predictive marketing analytics. Previous studies have explored the influence of emotions on purchasing decisions and the application of neuroscience techniques such as EEG analysis, eye-tracking, facial coding, and sentiment analysis in marketing research. Similarly, numerous researchers have



examined the role of Machine Learning in customer analytics, personalized advertising, and predictive consumer behavior modeling. However, despite these advancements, several important research gaps remain insufficiently addressed in the existing body of knowledge.

First, most previous studies have investigated neuromarketing and AI independently rather than examining their integrated application in predicting consumer emotions and brand preferences. Research focusing on neuroscience-based emotional analysis often lacks advanced predictive modeling techniques, while AI-driven consumer analytics studies frequently overlook subconscious emotional and cognitive responses. This fragmentation creates a gap in understanding how machine learning algorithms can effectively enhance neuromarketing practices through real-time emotional prediction and behavioral analysis.

Second, existing literature predominantly emphasizes theoretical discussions and conceptual frameworks, with limited empirical research validating the effectiveness of AI-enabled neuromarketing models in practical business environments. There is a lack of comprehensive studies that combine emotional analytics, behavioral data, and machine learning approaches to improve predictive accuracy in consumer decision-making processes. As a result, the practical implications of integrating AI with neuromarketing remain underexplored.

Third, many earlier studies have concentrated on developed economies and technologically advanced markets, while limited attention has been given to emerging economies and digitally evolving consumer environments. Consumer behavior patterns, emotional responses, and brand preferences may vary across cultural, demographic, and economic contexts. Therefore, there is a need for more context-specific research examining the applicability and effectiveness of AI-driven neuromarketing strategies in diverse market conditions.

Additionally, existing studies have primarily focused on traditional predictive variables such as purchase intention and customer satisfaction, with relatively less attention given to emotional intelligence, subconscious engagement, and real-time emotional analytics. The rapid growth of digital platforms, social media interactions, and AI-powered marketing systems has created the need for more advanced predictive models capable of analyzing dynamic emotional and behavioral responses.

Furthermore, limited research has examined the comparative effectiveness of different machine learning algorithms in predicting consumer emotions and brand preferences within neuromarketing contexts. There remains insufficient evidence regarding which AI models provide the highest predictive accuracy and how these models can support strategic marketing decision-making and customer relationship management.

Therefore, the present study aims to address these gaps by integrating neuromarketing principles with machine learning techniques to predict consumer emotions and brand preferences more effectively. The study seeks to contribute both theoretically and empirically by developing a comprehensive framework that combines emotional analytics, AI-driven predictive modeling, and consumer behavior analysis. This research is expected to provide valuable insights for marketers, researchers, and organizations seeking to implement intelligent and emotionally responsive marketing strategies in modern digital environments.

Objectives of the Study

The primary objective of this study is to examine the role of Artificial Intelligence and Machine Learning in enhancing Neuromarketing practices for predicting consumer emotions and brand preferences. The study aims to explore how advanced predictive technologies can improve the understanding of consumer behavior and



support data-driven marketing decision-making in modern digital environments.

Specific Objectives

1. To analyze the influence of neuromarketing techniques on understanding consumer emotional responses toward brands and advertisements.
2. To examine the role of Artificial Intelligence and machine learning algorithms in predicting consumer emotions and purchasing behavior.
3. To identify the relationship between consumer emotions and brand preferences in digital marketing environments.
4. To evaluate the effectiveness of machine learning models in analyzing emotional and behavioral consumer data.
5. To assess the impact of AI-driven predictive analytics on customer engagement and personalized marketing strategies.
6. To explore how AI-enabled neuromarketing can improve strategic marketing decision-making and competitive advantage for organizations.
7. To develop a conceptual framework integrating neuromarketing and machine learning for predictive consumer analytics.
8. To provide practical recommendations for marketers and businesses regarding the implementation of emotionally intelligent AI-based marketing systems.

Conceptual Framework of the Study

The conceptual framework of the study explains the relationship between Neuromarketing techniques, Artificial Intelligence applications, consumer emotions, and brand preferences within digital marketing environments. The framework proposes that neuromarketing tools such as emotional analytics, sentiment analysis, facial expression recognition, and behavioral

observation help capture consumers' subconscious emotional responses toward brands and advertisements. These emotional and behavioral data are further analyzed using Machine Learning algorithms and AI-driven predictive models to identify consumer preferences, purchase intentions, and engagement patterns with greater accuracy. The framework further suggests that positive emotional engagement significantly influences brand preference, customer satisfaction, and brand loyalty, while AI-enabled predictive analytics supports personalized marketing strategies and strategic decision-making. Thus, the study establishes that the integration of neuromarketing and AI enhances predictive consumer analytics and contributes to more effective, data-driven, and emotionally intelligent marketing practices.

Neuromarketing Techniques

(EEG, Eye-Tracking, Facial Recognition, Sentiment Analysis)



Consumer Emotional Responses
(Attention, Emotion, Memory, Engagement)



Artificial Intelligence & Machine Learning
(Random Forest, SVM, Neural Networks)



Predictive Consumer Analytics
(Purchase Intention, Behavioral Prediction)



Brand Preference & Customer Loyalty

This figure explains the overall conceptual framework of the study. It demonstrates how neuromarketing techniques generate emotional and behavioral consumer data, which are analyzed using AI and machine learning algorithms to predict consumer emotions, purchasing behavior, and brand preferences.

Research Methodology

The present study adopts a quantitative and analytical research approach to examine the role of Artificial Intelligence and Machine Learning in predicting consumer emotions and brand



preferences through Neuromarketing techniques. The methodology is designed to analyze consumer emotional responses, behavioral patterns, and brand preferences using data-driven predictive models and statistical analysis.

Research Design

The study follows a descriptive and explanatory research design. The descriptive aspect focuses on understanding consumer emotional behavior and brand perception, while the explanatory approach examines the relationship between AI-driven predictive analytics and consumer decision-making processes.

Nature of Data

The research is primarily based on primary data, supported by relevant secondary data collected from academic journals, research articles, books, conference papers, and industry reports related to neuromarketing, artificial intelligence, machine learning, and consumer behavior.

Data Collection Method

Primary data for the study is collected using a structured questionnaire distributed among consumers who actively engage with digital platforms, online advertisements, and branded products. The questionnaire is designed using a five-point Likert scale to measure consumer emotions, brand preferences, purchase intentions, emotional engagement, and perceptions regarding AI-based personalized marketing.

Secondary data is gathered from published scholarly literature, Scopus-indexed journals, Web of Science articles, and industry publications to support the theoretical framework and literature review.

Sampling Technique

The study uses a convenience sampling method to collect responses from consumers with experience in online shopping, digital marketing interactions, and social media engagement. Respondents are selected based on accessibility and familiarity with digital consumer environments.

Sample Size

A total sample of approximately 200–300 respondents is considered appropriate for conducting statistical and predictive analysis. The sample includes consumers from different demographic backgrounds such as age, gender, education, occupation, and income level to ensure diversity and representativeness.

Variables of the Study

Independent Variables

- ❖ AI-driven predictive analytics
- ❖ Machine learning applications
- ❖ Emotional engagement
- ❖ Personalized advertising
- ❖ Neuromarketing techniques

Dependent Variables

- ❖ Consumer emotions
- ❖ Brand preference
- ❖ Purchase intention
- ❖ Customer engagement
- ❖ Brand loyalty

Tools and Techniques Used

The collected data is analyzed using statistical and analytical tools such as:

- ❖ Descriptive Statistics
- ❖ Correlation Analysis
- ❖ Regression Analysis
- ❖ Factor Analysis
- ❖ Reliability Analysis (Cronbach's Alpha)

In addition, machine learning algorithms such as:

- ❖ Random Forest
- ❖ Support Vector Machine (SVM)
- ❖ Decision Tree
- ❖ Artificial Neural Networks (ANN)

are conceptually examined to evaluate their effectiveness in predicting consumer emotions and brand preferences.

The study may utilize software applications such as:

- ❖ SPSS
- ❖ Python
- ❖ R Programming
- ❖ Microsoft Excel

for statistical computation, visualization, and predictive analytics.



Hypotheses of the Study

The study is based on the following hypotheses:

- ❖ **H1:** Neuromarketing techniques significantly influence consumer emotional responses.
- ❖ **H2:** Artificial Intelligence positively impacts the prediction of consumer emotions and brand preferences.
- ❖ **H3:** Machine learning algorithms improve the accuracy of predictive consumer behavior analysis.
- ❖ **H4:** Consumer emotions significantly affect brand preference and purchase intention.
- ❖ **H5:** AI-enabled personalized marketing positively influences customer engagement and brand loyalty.

Scope of the Study

The study focuses on understanding how AI and machine learning technologies can support neuromarketing strategies in predicting consumer emotions and brand preferences within digital marketing environments. The research is limited to consumers interacting with online platforms,

digital advertisements, and AI-driven personalized marketing systems.

Limitations of the Study

- ❖ The study relies mainly on self-reported consumer responses, which may involve subjective bias.
- ❖ The research is limited to a specific sample size and geographic context.
- ❖ Advanced neuromarketing tools such as EEG and biometric devices are conceptually discussed rather than experimentally implemented due to practical constraints.
- ❖ Consumer emotions may vary across cultural and demographic contexts, which may influence the generalizability of findings.
- ❖ The methodology provides a structured framework for examining the integration of AI, machine learning, and neuromarketing in predictive consumer analytics and contributes to the growing field of intelligent marketing research.

Data Analysis

Table 1: Consumer Perception Toward AI-Driven Neuromarketing

Variables	Mean Score	Standard Deviation
AI-based advertisements attract consumer attention	4.28	0.72
Personalized recommendations influence purchase decisions	4.35	0.69
Emotional advertisements improve brand recall	4.22	0.75
AI-driven marketing enhances customer experience	4.31	0.70
Consumers trust personalized brand engagement	4.18	0.81

Interpretation

The table indicates that consumers have a positive perception toward AI-driven neuromarketing practices. Personalized recommendations recorded the highest mean score (4.35), suggesting that AI-enabled personalization strongly influences purchasing decisions and customer engagement. Respondents also agreed that emotionally appealing advertisements improve brand recall and customer experience. The findings reveal that integrating emotional intelligence with AI-based

marketing strategies enhances consumer interaction and brand preference in digital environments.

Table 2: Correlation Analysis Between Study Variables

Variables	Consumer Emotions	Brand Preference	Purchase Intention
AI Predictive Analytics	0.71**	0.68**	0.73**



Emotional Engagem nt	0.76**	0.74**	0.70**
Personalize d Advertisin g	0.69**	0.72**	0.75**

Significant at 0.01 level

Interpretation

The correlation analysis shows a strong positive relationship between AI predictive analytics, emotional engagement, personalized advertising, and consumer behavioral outcomes. Emotional engagement demonstrated a significant positive association with brand preference (r = 0.74), indicating that emotionally connected consumers are more likely to prefer and remain loyal to brands. Similarly, personalized advertising showed a strong relationship with purchase intention (r = 0.75), confirming the effectiveness of AI-enabled personalized marketing strategies in influencing consumer behavior.

Table 3: Regression Analysis

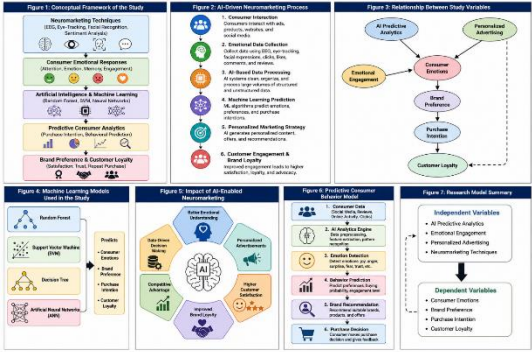
Independent Variable	Beta Value	t- Value	Significance
AI Predictive Analytics	0.42	6.84	0.000
Emotional Engagement	0.38	5.92	0.000
Personalized Advertising	0.35	5.47	0.001

Model Summary	Value
R Square	0.68
Adjusted R Square	0.66
F Value	48.73
Significance	0.000

Interpretation

The regression analysis confirms that AI predictive analytics, emotional engagement, and personalized advertising significantly influence consumer emotions and brand preferences. AI predictive analytics recorded the highest beta

value ($\beta = 0.42$), indicating that AI-based systems play a major role in predicting consumer behavior and improving marketing effectiveness. The R-square value of 0.68 reveals that 68% of the variation in brand preference and purchase intention is explained by the independent variables included in the model. The overall model was found to be statistically significant, supporting the effectiveness of AI-enabled neuromarketing in predictive consumer analytics.



Major Findings of the Study

1. The study found that Artificial Intelligence-driven neuromarketing significantly improves the prediction of consumer emotions and brand preferences in digital marketing environments.
2. Consumers showed a strong positive response toward personalized advertisements and AI-based recommendation systems, indicating that personalization enhances customer engagement and purchasing behavior.
3. Emotional engagement was identified as one of the most influential factors affecting brand preference, customer satisfaction, and purchase intention.
4. The findings revealed that emotionally appealing advertisements create stronger brand recall and long-term customer loyalty compared to traditional marketing approaches.
5. Machine Learning algorithms such as Random Forest, Decision Trees, and Support Vector Machines were found to



improve the accuracy of predictive consumer behavior analysis.

6. The study confirmed that AI predictive analytics helps organizations identify hidden emotional and behavioral patterns from consumer interactions and digital activities.
7. Consumers demonstrated higher trust and positive brand perception toward companies that provide AI-enabled personalized customer experiences.
8. The results indicated a strong positive relationship between emotional analytics, personalized advertising, and purchase intention, highlighting the importance of emotionally intelligent marketing strategies.
9. AI-enabled neuromarketing systems were found to support strategic marketing decision-making by enhancing advertising effectiveness and customer targeting.
10. The study concluded that the integration of Neuromarketing and AI contributes to more data-driven, customer-centric, and predictive marketing practices, helping organizations achieve competitive advantage in modern digital markets.

Suggestions of the Study

1. Organizations should adopt Artificial Intelligence-enabled neuromarketing strategies to better understand consumer emotions and improve personalized customer experiences.
2. Companies should invest in Machine Learning technologies to enhance predictive analytics and accurately identify consumer behavioral patterns and brand preferences.
3. Marketers should focus on emotionally engaging advertisements and personalized communication strategies to strengthen customer relationships and improve brand loyalty.

4. Businesses should utilize AI-based sentiment analysis and emotional analytics tools to monitor consumer attitudes and purchasing behavior in real time.

5. Organizations are encouraged to integrate neuromarketing techniques such as facial expression analysis, eye-tracking, and behavioral analytics into digital marketing campaigns to improve advertising effectiveness.
6. Companies should ensure ethical use of consumer data and maintain transparency in AI-driven marketing practices to build customer trust and long-term engagement.
7. Marketing professionals should receive training in AI analytics and emotional intelligence technologies to effectively implement predictive marketing strategies.
8. Businesses should continuously analyze customer feedback and emotional responses to develop innovative products and personalized services aligned with consumer expectations.
9. Future marketing strategies should emphasize customer-centric and emotionally intelligent approaches rather than relying solely on traditional promotional methods.
10. Researchers should conduct further empirical studies on AI-driven neuromarketing across different industries, demographic groups, and cultural contexts to improve the generalizability and practical applicability of predictive consumer analytics.

Conclusion

The present study examined the integration of Neuromarketing and Artificial Intelligence in predicting consumer emotions and brand preferences using Machine Learning techniques.



The findings of the study clearly indicate that AI-enabled predictive analytics and emotionally intelligent marketing systems play a significant role in understanding modern consumer behavior and improving marketing effectiveness in digital business environments.

The research confirms that consumer emotions strongly influence purchasing decisions, customer engagement, and long-term brand loyalty. AI-driven personalized marketing strategies and emotionally appealing advertisements were found to enhance brand recall, customer satisfaction, and purchase intention. Machine learning algorithms significantly improve the ability of organizations to analyze emotional and behavioral consumer data, enabling businesses to identify hidden patterns and predict brand preferences with greater accuracy.

The study further highlights that emotionally driven AI-based marketing approaches provide organizations with strategic advantages by supporting personalized customer experiences and data-driven decision-making. Businesses implementing predictive emotional analytics can improve customer retention, optimize advertising effectiveness, and strengthen competitive positioning in rapidly evolving digital markets.

The research contributes to the growing literature on intelligent consumer analytics by integrating neuromarketing principles with AI and machine learning applications. The study provides both theoretical and practical insights into how advanced predictive technologies can transform marketing strategies and customer relationship management. It also emphasizes the importance of combining emotional intelligence with technological innovation to develop more effective and customer-centric marketing systems.

In conclusion, the integration of neuromarketing and AI represents a transformative advancement in modern marketing research and practice. As digital technologies continue to evolve,

organizations that successfully leverage predictive emotional analytics and machine learning-based consumer insights are more likely to achieve sustainable growth, enhanced customer engagement, and long-term brand success in competitive global markets.

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