A Bibliometric Analysis on Neuromarketing: Insights into Consumer Purchase Decisions and Emotional Branding on Scopus Database (2004–2025)

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Abstract. This study provides a comprehensive bibliometric analysis of neuromarketing research published between 2004 and 2025, specifically emphasizing consumer purchase decisions and emotional branding. Neuromarketing, a multidisciplinary field integrating neuroscience, psychology, and marketing, has experienced rapid growth in academic and practical applications. Using Scopus as the primary data source, 1,291 documents were retrieved and analyzed through bibliometric tools, namely R-Biblioshiny and VoS Viewer. The analysis reveals a consistent upward trend in publication output, driven by increasing interest in understanding consumer behavior through neurophysiological methods such as EEG and fMRI. Dominant themes include artificial intelligence, decision-making processes, and emotional engagement. The results identify the most influential authors, institutions, and countries contributing to the field, while visual mapping techniques reveal collaboration networks and thematic clusters. This study also uncovers emerging research directions and highlights underrepresented regions in global neuromarketing discourse. The findings offer valuable insights for academics and practitioners by outlining current research patterns, methodological developments, and strategic gaps. In particular, future research should address ethical concerns, data privacy, and the need for culturally sensitive applications to ensure the responsible advancement of neuromarketing as a field. This paper contributes to the ongoing academic dialogue by providing a structured overview of the evolution and trajectory of neuromarketing research over the past two decades.

Keywords: Neuromarketing, Consumer Behavior, Emotional Branding, EEG, Bibliometric Analysis, Artificial Intelligence, Cross-cultural Marketing

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1 Introduction

Neuromarketing has gained increasing scholarly attention as a multidisciplinary approach that combines neuroscience, psychology, and marketing to understand consumer behavior better. The term was first introduced by Smidts [1], who emphasized the potential of neuroscientific tools in examining the cognitive mechanisms behind purchasing decisions. Since its inception, the field has evolved with the adoption of advanced techniques such as functional magnetic resonance imaging (fMRI) and electroencephalography (EEG), allowing researchers to access subconscious consumer responses [2].

Subsequent studies have demonstrated the predictive power of neuromarketing tools. Ariely and Berns [3] showed that brain activity patterns offer more accurate predictions of consumer preferences than conventional self-reporting methods. Plassmann et al. [4] further revealed that emotional responses play a critical role in brand perception and consumer choices. These findings highlight the unique contributions of neuromarketing in uncovering the affective dimensions of consumer decision-making.

However, the field is not without controversy. Morin [5] raised concerns about the ethical implications of using neuroscientific data in marketing, particularly regarding consumer autonomy and manipulation. Reimann et al. [6] advocated for an integrated approach that blends traditional marketing principles with neuroscientific insights, while Khushaba et al. [7] introduced machine learning to improve the interpretability of neurophysiological signals in consumer research.

Despite its rapid growth, neuromarketing research still lacks comprehensive reviews that map its evolution, thematic trends, and geographic spread. In response to this gap, this study conducts a bibliometric analysis using data from the Scopus database (2004–2025). The aim is to identify influential authors, institutions, methods, and emerging topics, thereby providing a systematic overview of neuromarketing's development and future research directions.

2 Methods

This study applies a bibliometric analysis to systematically explore the scientific development of neuromarketing, with specific attention to consumer decision-making and emotional branding. Bibliometric methods enable the quantification of academic output, identification of influential publications and authors, and visualization of thematic trends within a field [1], [2]. Data was retrieved from the Scopus database for the period 2004 to 2025. Scopus was selected due to its broad coverage and indexing of peer-reviewed literature, making it a reliable source for bibliometric studies [3]. The search was performed using the keyword "neuromarketing" applied to the title, abstract, and keyword fields, following a strategy used in prior bibliometric research [4].

The initial search yielded 1,291 documents, which included journal articles, conference papers, and book chapters. Editorials and non-academic materials were excluded based on inclusion criteria consistent with previous studies [5]. Metadata collected from

these records included document types, author affiliations, keywords, and citation counts.

Data cleaning and standardization were conducted using OpenRefine to ensure consistency in author names and institutional details [6]. Bibliometric analysis was then performed using the Biblioshiny interface of the R Bibliometrix package, which provided insights into publication trends, citation metrics, and keyword co-occurrence networks [1].

VoS Viewer was used to generate maps of author collaboration, institutional networks, and keyword clusters to visualize the structure and evolution of research in neuromarketing. These tools support the identification of research hotspots and the thematic progression of the field over time [7].

The search interface on the Scopus database used to retrieve literature related to the term "neuromarketing". The search was conducted within the fields of article title, abstract, and keywords, ensuring a comprehensive capture of relevant documents. A total of 1,291 documents were identified, reflecting the growing scholarly attention toward neuromarketing research. The use of a broad search scope enhances the robustness of bibliometric analysis by including a wide range of conceptual and methodological contributions. This increasing volume of publications underscores neuromarketing's emergence as a significant interdisciplinary field that integrates neuroscience, psychology, and marketing. The result also affirms the presence of a strong body of peer-reviewed studies, confirming the scientific legitimacy and relevance of neuromarketing in contemporary consumer behavior research.

The bibliometric search conducted on the Scopus database using the keyword "neuromarketing". A total of 1,291 documents were retrieved, including both articles and reviews spanning diverse research topics. Examples include studies on neuro-signaling techniques in advertisement endorsements and neuromarketing applications in online consumer behavior demonstrating the breadth of the field's relevance across various marketing contexts.

The diversity of publication types and subject matter confirms the interdisciplinary nature of neuromarketing, combining elements of neuroscience, behavioral science, and marketing analytics. These early search results underscore the need for structured data cleaning and analysis to ensure accurate bibliometric mapping. Therefore, the dataset was refined using OpenRefine to standardize author names, affiliations, and eliminate duplicates. Subsequent bibliometric analysis was performed using R-Biblioshiny, enabling the extraction of key metrics such as publication trends, citation impact, and keyword co-occurrence. VoS Viewer was utilized to visualize the scientific landscape through collaboration networks, thematic clusters, and geographic distribution of research activity.

3 Results and Discussion

The bibliometric analysis indicates a consistent upward trajectory in neuromarketing publications between 2004 and 2025. A total of 1,293 documents were identified, orig-

inating from 685 distinct sources, including journals, books, and conference proceedings. This growing volume of literature reflects sustained scholarly interest in neuromarketing, particularly in themes related to consumer decision-making and emotional branding.

The annual growth rate of publications stands at 12.56%, underscoring the expansion and increasing relevance of the field within the broader context of marketing and behavioral sciences. Citation analysis reveals that, on average, each document received 16.08 citations, which suggests a considerable academic impact. Moreover, the dataset includes 54,873 total references, demonstrating the richness and depth of scholarly dialogue supporting the evolution of neuromarketing research.

Table 1. Main Information

Description	Results
Main Information About Data	
Timespan	2004–2025
Sources (Journals, Books, etc.)	685
Documents	1293
Annual Growth Rate (%)	12,56
Document Average Age	5,29
Average citations per doc	16,08
References	54.873
Document Contents	
Keywords Plus (ID)	2997
Author's Keywords (DE)	2565
Authors	
Authors	3086
Authors of single-authored docs	169
Authors Collaboration	
Single-authored docs	192
Co-Authors per Doc	3,33
International co-authorships (%)	20,88
Document Types	
Article	692
Book	20
Book chapter	198
Conference paper	259
Conference review	15
Data paper	2

Source : Author's Work

Table 1 presents the core bibliometric indicators derived from the Scopus dataset related to neuromarketing research between 2004 and 2025. The analysis includes a total of 1,293 documents extracted from 685 distinct sources, reflecting a broad and

interdisciplinary scholarly engagement. The publication activity demonstrates an annual growth rate of 12.56%, indicating sustained and increasing interest in the field across the two-decade span.

The average citation per document is 16.08, suggesting that neuromarketing studies exert a strong academic influence, particularly within the domains of marketing, consumer psychology, and neuroscience. The reference count of 54,873 further supports the notion that neuromarketing research is embedded in a rich intellectual tradition and extensive citation network.

Keyword analysis reveals 2,997 terms categorized as Keywords Plus (ID) and 2,565 author-generated keywords (DE), indicating a wide conceptual spread within the field. A total of 3,086 authors contributed to the dataset, with 192 documents written by a single author and an average of 3.33 co-authors per document. The proportion of international co-authorships (20.88%) signifies the global nature of neuromarketing collaboration.

In terms of document types, the majority are journal articles (692), followed by conference papers (259), book chapters (198), and books (20). This distribution illustrates the diverse academic channels through which neuromarketing research is disseminated, spanning peer-reviewed journals, academic conferences, and edited volumes.

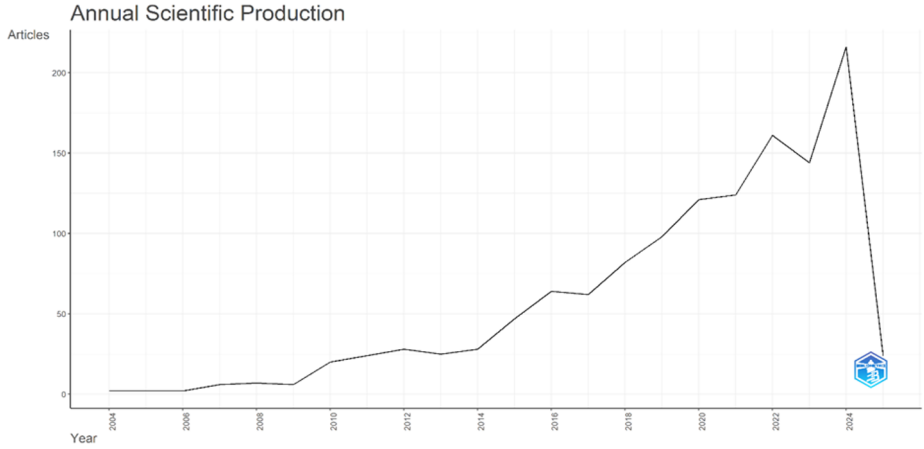

Fig. 1 Annual Scientific Production in Neuromarketing (2004–2025)
Source : Author's Work

Figure 1 presents the annual scientific production related to neuromarketing, as indexed in the Scopus database from 2004 to 2025. The graph displays a notable upward trend, particularly beginning in 2010 and accelerating significantly after 2018. This rise indicates increased scholarly engagement, driven by the proliferation of neuroscience-based tools such as EEG and fMRI, as well as the growing application of neuromarketing in digital and consumer research.

The data reveals that publication output peaked in 2024, suggesting a culmination of accumulated interest and research activity in the field. The sudden drop observed in 2025 may be attributed to the partial availability of data for the current year or delays in indexing and publication cycles, rather than a decline in research interest. Such a pattern is common in real-time bibliometric datasets.

Overall, the figure reflects the expanding legitimacy of neuromarketing as a multidisciplinary research area. The continued increase in scholarly output affirms its relevance for advancing our understanding of consumer behavior through neurophysiological and affective dimensions.

Table 2. Most Top 10 Relevant Sources

Description	Results
Main Information About Data	
Timespan	2004–2025
Sources (Journals, Books, etc.)	685
Documents	1293
Annual Growth Rate (%)	12,56
Document Average Age	5,29
Average citations per doc	16,08
References	54.873
Document Contents	
Keywords Plus (ID)	2997

Source : Author's Work

Table 2 provides a synthesis of key bibliometric indicators related to source distribution in neuromarketing publications indexed in Scopus from 2004 to 2025. The dataset encompasses 1,293 documents published across 685 distinct sources, including journals, books, and conference proceedings. This breadth of publication venues highlights the interdisciplinary engagement with neuromarketing from both the marketing science and cognitive neuroscience communities.

The field demonstrates an annual publication growth rate of 12.56%, with an average document age of 5.29 years, reflecting its dynamic and evolving nature. With an average of 16.08 citations per document and a total of 54,873 references analyzed, the data underscores the academic significance and research impact of neuromarketing studies.

Additionally, the presence of 2,997 Keywords Plus entries reinforces the thematic richness and conceptual diversity within literature. The high volume of scholarly references and frequent citations further affirm that neuromarketing has transitioned from an emerging niche to an established field that substantially contributes to the broader understanding of consumer behavior and strategic branding.

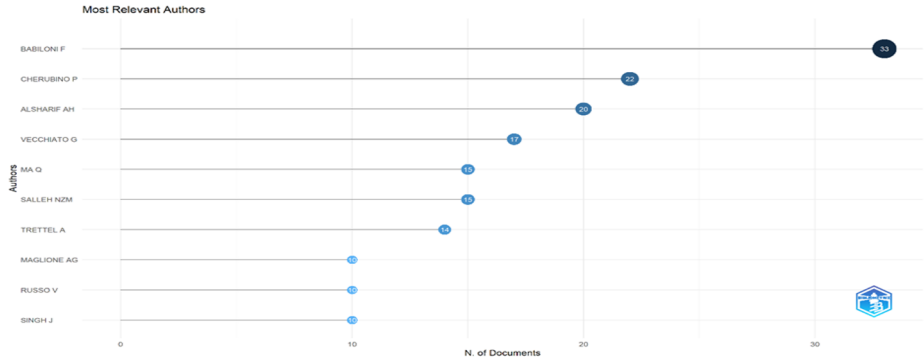

Fig. 2. Most Relevant Authors in Neuromarketing Literature
Source : Author's Work

Figure 2 displays the most prolific contributors to neuromarketing research based on document output indexed in the Scopus database. The leading author, Babiloni F., stands out with 33 publications, followed by Cherubino P. (22 documents) and Alsharif AH. (20 documents). These authors have played a pivotal role in advancing the field, particularly in brain imaging, consumer decision-making, and neurophysiological analysis of marketing stimuli.

The distribution of documents among the top 10 authors suggests a healthy and collaborative research environment rather than dominance by a single group. Scholars such as Vecchiato G., Ma Q., and Salleh NZM also contribute significantly, reinforcing the interdisciplinary nature of neuromarketing. Notably, the emergence of newer contributors like Trettel A., Russo V., and Singh J. signals the entry of fresh perspectives and novel methodological approaches into the discourse.

This diverse authorship landscape underscores neuromarketing's progression from a niche discipline into a more mature and institutionalized research domain. The sustained contributions from established and emerging scholars will likely continue shaping the field's development in response to evolving marketing technologies and consumer behavior paradigms.

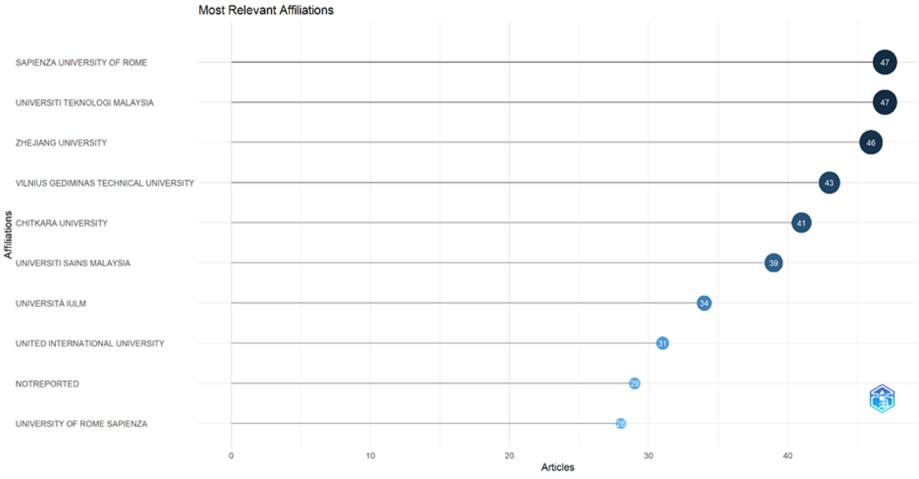

Fig. 3. Most Relevant Affiliations in Neuromarketing Publications
Source : Author's Work

Figure 3 presents the top institutional affiliations contributing to neuromarketing research as indexed in Scopus from 2004 to 2025. Leading the list are Sapienza University of Rome and Universiti Teknologi Malaysia, each with 47 publications, followed closely by Zhejiang University (46 documents) and Vilnius Gediminas Technical University (43 documents). These institutions represent the major academic centers advancing neuromarketing studies globally.

The presence of universities from Italy, Malaysia, China, Lithuania, and India reflects the international scope and cross-disciplinary engagement within the field. Universities such as Chitkara University and Universiti Sains Malaysia further demonstrate the increasing scholarly output from Southeast Asia. At the same time, institutions like Università IULM and United International University highlight Southern and South Asian contributions.

Notably, the appearance of "Not Reported" as an affiliation category indicates either metadata inconsistencies or institutional anonymity in certain Scopus entries, which is a common occurrence in large bibliometric datasets.

The geographic and institutional diversity among the most relevant affiliations affirms neuromarketing's collaborative and expanding nature. It also suggests that research in this area is not confined to traditional marketing or neuroscience hubs but is being developed in parallel with a wide range of global academic institutions.

Table 3. Country Scientific Production in Neuromarketing Research

Country	Freq
Italy	410
Spain	390
India	352
Usa	306
China	254
Malaysia	175
Turkey	169
Uk	129
Germany	123
Japan	118

Source : Author's Work

Table 3 illustrates the geographic distribution of neuromarketing publications from 2004 to 2025, with darker shades indicating higher scientific output. The accompanying table presents the top 10 contributing countries based on document frequency. Italy leads with 410 publications, followed by Spain (390), India (352), the United States (306), and China (254). This reflects a broad international engagement and the rising global relevance of neuromarketing as an interdisciplinary research field.

European countries, notably Italy, Spain, and Germany, dominate the landscape, likely due to strong institutional support, long-standing research networks in consumer neuroscience, and established funding mechanisms. Meanwhile, India and China show notable contributions from Asia, highlighting the field's rapid growth in emerging markets with expansive digital consumer bases.

The presence of Malaysia and Turkey further signals the increasing participation of Southeast Asian and Middle Eastern regions in neuromarketing discourse. The United States, although ranked fourth, continues to play a central role due to its concentration of neuromarketing laboratories, private sector initiatives, and academic programs.

This global distribution underscores the significance of cross-national collaborations and the need for culturally responsive research frameworks. Future studies are encouraged to explore how socio-economic, cultural, and regulatory factors shape neuromarketing's adoption and ethical boundaries across regions.

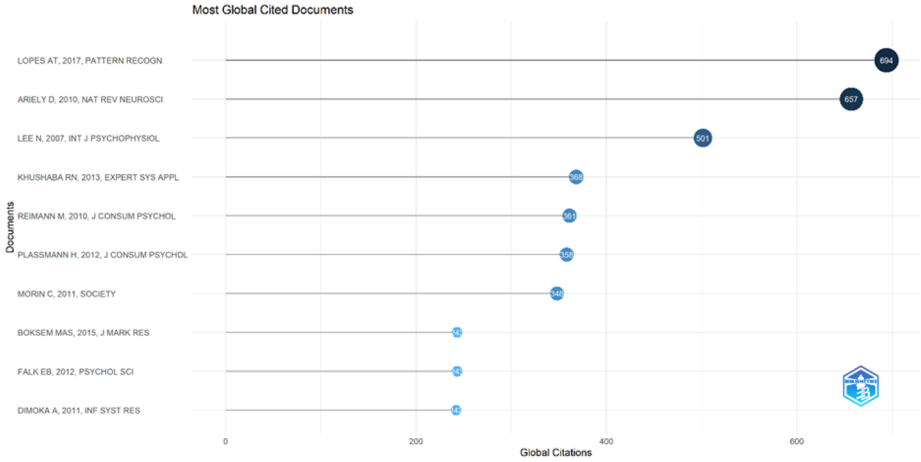

Fig. 4. Most Globally Cited Documents in Neuromarketing Research

Source : Author's Work

Figure 4 illustrates the top 10 most globally cited publications in the field of neuromarketing, reflecting the intellectual foundations and methodological evolution of the discipline. The highest-cited work is by Lopes et al. (2017) in Pattern Recognition with 694 citations, emphasizing the integration of artificial intelligence and pattern recognition in analyzing consumer behavior. This indicates a pivotal shift toward computational approaches in neuromarketing.

The second most cited article by Ariely (2010) in Nature Reviews Neuroscience (657 citations) explores the use of neuroimaging to understand subconscious consumer decision-making, offering insights into emotional branding strategies. Lee (2007), with 501 citations, contributes to the understanding of psychophysiological signals (e.g., heart rate, EEG) in consumer engagement, establishing methodological standards for measuring affective responses.

Khushaba et al. (2013), with 368 citations, reinforce the role of machine learning in predictive consumer modeling, bridging neuroscience with intelligent marketing systems. Other significant contributions, including those by Reimann (2010), Plassmann (2012), and Morin (2011), offer critical perspectives on emotional decision-making, branding, and ethical implications.

These highly cited documents indirectly underline neuromarketing's interdisciplinary character, drawing from psychology, neuroscience, computer science, and marketing. As the field advances, future research should prioritize issues of data privacy, transparency, and cultural sensitivity. The continued integration of AI and neuroimaging technologies will further enhance the predictive precision of consumer insights, paving the way for more effective and ethically sound marketing strategies.

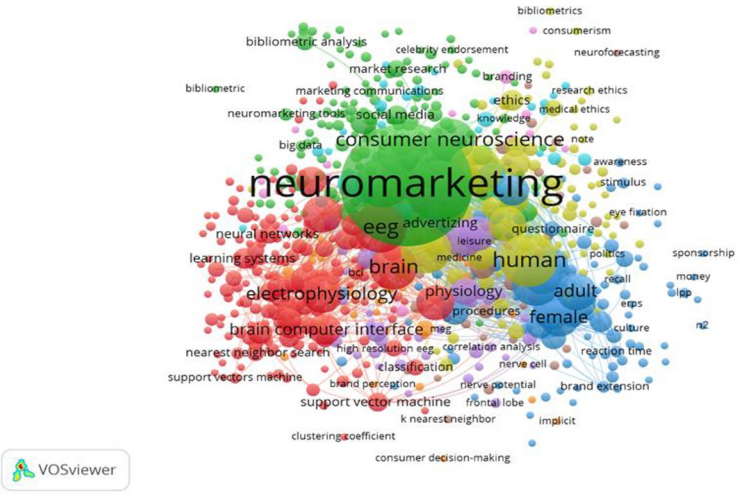

Fig. 5. Co-Occurrence Network of Keywords in Neuromarketing Research
Source : Author's Work

Figure 5 presents a co-occurrence network visualization generated using VOSviewer, depicting the most frequently appearing keywords in neuromarketing literature from 2004 to 2025. The size of each node reflects the frequency of keyword usage, while the lines connecting nodes indicate their co-occurrence strength. This mapping provides an overview of the thematic structure and conceptual density within the field.

The most dominant terms, neuromarketing, consumer neuroscience, and EEG, serve as central nodes, signifying the core focus of the discipline. Surrounding clusters reflect the interdisciplinary convergence of neuroscience, psychology, marketing, and data science. Notable keywords such as brain, electrophysiology, brain-computer interface, and neural networks emphasize the field's grounding in neurophysiological measurement and computational analysis.

Additional terms like advertising, brand perception, decision-making, and consumer behavior highlight the applied dimensions of neuromarketing in commercial contexts. The presence of AI-related terms such as support vector machine, classification, and big data illustrates the methodological shift toward machine learning and predictive analytics.

Color-coded clusters indicate distinct thematic groupings, suggesting specialization in areas such as biometric measurement (red), marketing communication (green), psychophysiological constructs (blue), and ethical or cognitive themes (yellow and purple). This visualization affirms that neuromarketing is not only multidisciplinary but also methodologically diverse, expanding into advanced modeling, emotion tracking, and sensory neuroscience.

Future research is encouraged to further investigate the ethical implications of these technologies, particularly regarding data privacy, algorithmic bias, and cross-cultural validity. As neuromarketing continues to intersect with artificial intelligence and behavioral sciences, it holds the potential to reshape both academic inquiry and strategic marketing practices.

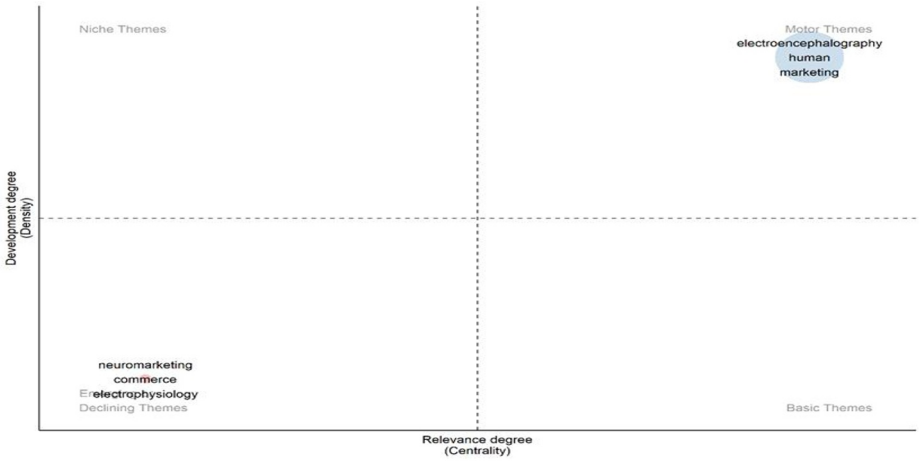

Fig. 6. Thematic Map of Neuromarketing Research

Figure 6 presents a thematic map based on keyword co-occurrence and clustering, generated using bibliometric mapping techniques. This map categorizes research themes into four quadrants according to their degree of development (density) and centrality (relevance) within the neuromarketing literature.

The Motor Themes quadrant, representing high development and relevance, includes keywords such as electroencephalography, human, and marketing. These terms signify the core areas of neuromarketing that are both methodologically robust and central to the field's intellectual structure. Their presence reflects the sustained interest in neurophysiological tools and behavioral analysis in consumer research.

In contrast, the Declining Themes quadrant, characterized by low density and low centrality, includes terms such as neuromarketing, commerce, and electrophysiology. This placement suggests that while these terms are foundational, they may be giving way to more specific or technologically advanced concepts, such as machine learning, brain-computer interfaces, or emotional analytics.

Interestingly, the Basic Themes quadrant is unoccupied, indicating that the foundational topics of neuromarketing have become well integrated into broader research agendas. The Niche Themes quadrant also shows limited activity, implying that highly specialized areas may be underexplored or currently disconnected from the field's mainstream dialogue.

This thematic landscape highlights a shift in research priorities from general conceptual discussions to more focused, technologically sophisticated investigations. Future neuromarketing studies are encouraged to bridge emerging niche topics with motor themes to enhance conceptual integration and methodological innovation, particularly in commercial applications and ethical frameworks.

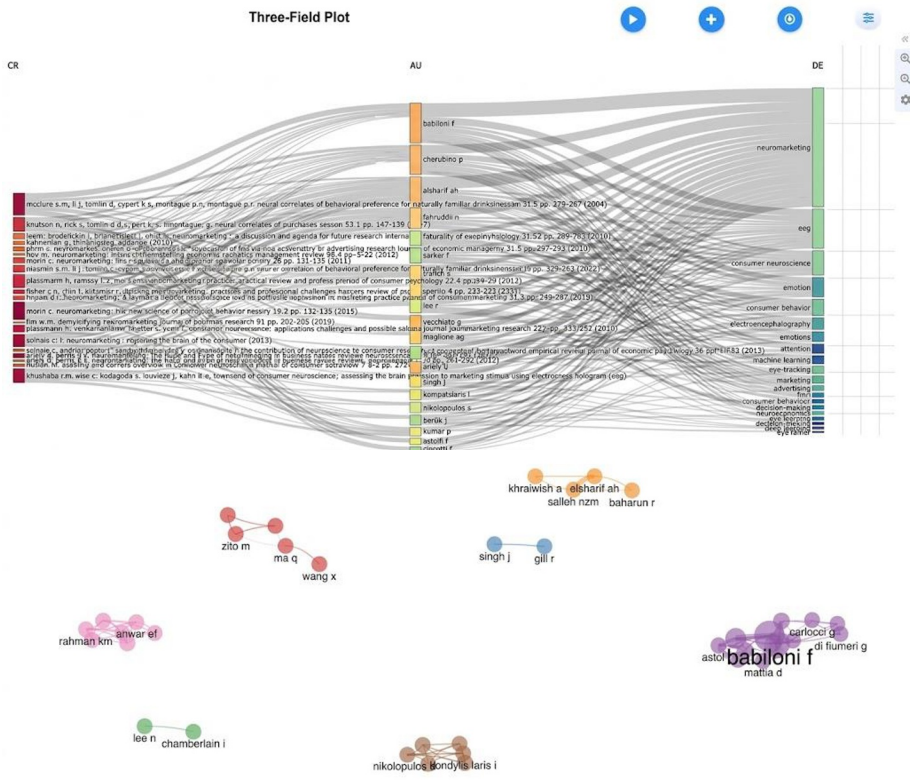

Fig. 7. Author Collaboration Network in Neuromarketing Research

Figure 7 visualizes the collaboration network among authors in the neuromarketing research domain, generated using bibliometric mapping tools. Each node represents an author, while the links between them indicate co-authorship relationships. The clustering and color differentiation reflect distinct research groups or institutional collaborations.

The most prominent node is Babiloni F., whose extensive co-authorship connections with scholars such as Mattia D., Astolfi L., and Di Flumeri G. indicate a central and sustained contribution to the field. This cluster reflects a strong and active European research network with a focus on EEG, neurophysiological measurements, and applied neuromarketing experiments.

Other visible clusters include authors such as Ma Q., Zito M., and Wang X., likely representing Asia-based collaborations that emphasize decision neuroscience and brain–computer interface applications. Similarly, Alsharif AH, Khrawish A., and Salleh HZM form a distinct cluster reflecting active research from the Middle East and Southeast Asia.

Smaller but significant nodes such as Lee N., Chamberlain L., and Nikopoulou A. demonstrate more isolated collaborative patterns, possibly from institutions or research groups with specialized but less networked contributions.

This visualization underscores the importance of collaborative authorship in advancing neuromarketing as a multidisciplinary field. Stronger international partnerships—particularly between established European researchers and emerging scholars in Asia and the Global South—may further enrich the theoretical and methodological diversity of the field. Future research is

encouraged to foster cross-border collaborations to enhance innovation, data accessibility, and cultural inclusivity in neuromarketing applications.

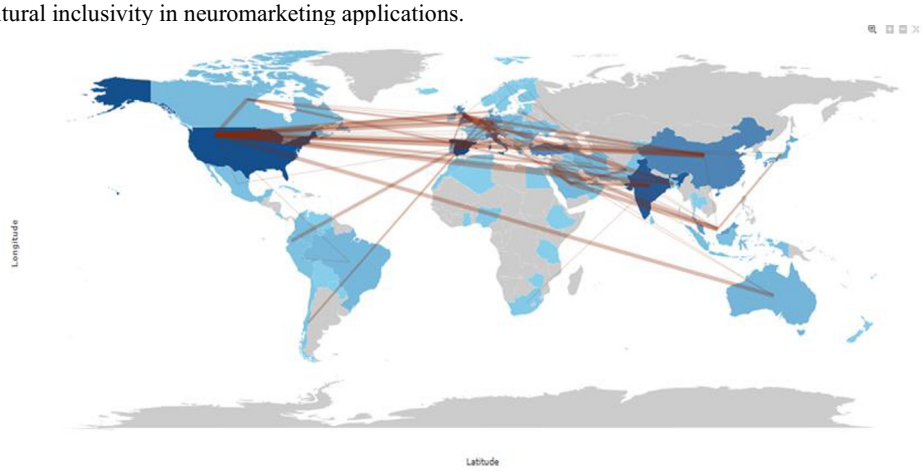

Fig. 8. Global Collaboration Map in Neuromarketing Research

Figure 8 displays the international collaboration network among countries involved in neuromarketing research, based on co-authorship affiliations. The thickness of the connecting lines represents the intensity of collaboration between countries, while the color gradient indicates research productivity, with darker shades signifying higher output.

The map highlights the United States, several European nations (notably Italy and Spain), and China as the most active collaboration hubs. These regions have established themselves as global leaders in neuromarketing research through sustained contributions in neuroimaging, consumer psychology, and applied marketing studies.

Strong collaborative ties are evident between North America and Western Europe, particularly between the U.S. and countries like Italy and Spain, reflecting historical academic exchange and shared research funding frameworks. Additionally, countries such as India, Malaysia, and Australia show increasing participation, signifying the rising relevance of neuromarketing in Asian and Pacific markets.

However, the map also reveals geographic imbalances, with limited representation from regions in Africa, parts of Latin America, and Central Asia. This suggests opportunities for future knowledge transfer and partnership development across underrepresented areas. Expanding the global research network would not only enhance scientific diversity but also improve the cultural applicability of neuromarketing findings in emerging consumer markets.

To further strengthen global collaboration, future initiatives could include joint international conferences, open-access data sharing platforms, and co-funded interdisciplinary research grants. These efforts would foster equitable knowledge exchange and capacity building, especially in low- and middle-income countries. Moreover, integrating local consumer behavior insights into global models could enhance the ecological validity of neuromarketing strategies and promote ethical, culturally aware marketing practices across diverse populations.

The findings of this bibliometric study reaffirm neuromarketing's growing prominence as a dynamic and interdisciplinary domain that bridges neuroscience, psychology, and marketing. The upward trajectory in annual publication output reflects an increasing scholarly and practical interest in understanding consumer behavior through

neurophysiological and computational approaches. The dataset's dominance of EEG and fMRI techniques underscores a paradigm shift from traditional self-reported measures toward more objective, biometric-driven insights into emotional engagement, attention, and decision-making processes.

Thematic mapping and keyword co-occurrence analysis indicate that neuromarketing research is maturing conceptually, with a strong emphasis on "consumer neuroscience," "emotional branding," and "neuroimaging." The emergence of machine learning and big data analytics as co-occurring themes further highlights the field's integration with artificial intelligence. This convergence enhances the predictive power of neuromarketing by enabling real-time, data-informed strategies tailored to individual consumer responses.

Author and institutional collaboration networks reveal that research activity is concentrated in several academic hubs, particularly in Europe, North America, and parts of Asia. Countries such as Italy, Spain, the United States, China, and India play leading roles in shaping the research landscape. However, the geographic analysis also reveals underrepresentation from Latin America, Africa, and certain parts of Southeast Asia, indicating an opportunity for more inclusive global collaboration. Expanding participation from these regions would enrich the field by incorporating diverse cultural and socioeconomic contexts into neuromarketing models, improving their applicability and external validity.

Another critical consideration is the ethical dimension of neuromarketing practices. As the field evolves with increasing use of biometric and algorithmic tools, concerns surrounding consumer autonomy, informed consent, and data privacy have become more pronounced. Several of the most cited publications in the field emphasize the importance of ethical safeguards, especially in contexts where implicit neural responses are used to influence marketing strategies without consumers' conscious awareness. Therefore, future research must address the development of standardized ethical frameworks and regulatory guidelines to ensure responsible application of neuromarketing in both academic and commercial settings.

Moreover, the thematic map shows that while topics such as "electroencephalography" and "human" are well-developed motor themes, foundational concepts like "neuromarketing" and "electrophysiology" are currently situated in the declining cluster. This shift suggests that the field is moving toward more granular and technology-specific investigations. However, maintaining conceptual clarity and theoretical grounding remains essential to prevent fragmentation and to ensure that newer methodological innovations remain anchored in the core objectives of consumer research.

In summary, the expansion of neuromarketing research presents both opportunities and challenges. It enables more precise targeting and deeper understanding of consumer psychology, yet it also demands rigorous methodological, ethical, and cross-cultural scrutiny. Moving forward, interdisciplinary collaboration, technological innovation, and ethical sensitivity should remain at the forefront of neuromarketing research agendas to ensure its sustainable and responsible development.

4 Conclusion

This study presents a comprehensive bibliometric analysis of neuromarketing literature published between 2004 and 2025, offering insights into its conceptual development, thematic focus, and global research trends. The findings demonstrate that neuromarketing has transitioned from a nascent, exploratory field into a well-established domain that is increasingly integrated within mainstream marketing science. The sharp rise in publication volume, coupled with the widespread adoption of advanced methodologies such as electroencephalography (EEG), functional magnetic resonance imaging (fMRI), and machine learning, signifies a robust academic and practical interest in understanding the neural underpinnings of consumer decision-making.

The analysis also reveals a notable diversification in research contributors, both in terms of authorship and geographic distribution. Scholars from Europe, North America, and Asia have played pivotal roles in advancing the field, supported by interdisciplinary collaborations across marketing, neuroscience, psychology, and computer science. Despite this global growth, disparities in regional contributions persist, particularly from underrepresented areas such as Latin America, Africa, and certain parts of Southeast Asia. Addressing these gaps through inclusive research partnerships could enrich neuromarketing frameworks with culturally diverse perspectives and improve their global applicability.

Key thematic trends identified in this study, including emotional branding, consumer neuroscience, and AI-enhanced predictive modelling, highlight a shift toward more data-driven and cognitively grounded approaches to understanding consumer behavior. The integration of deep learning, neuroforecasting, and biometric analytics allows for greater accuracy in interpreting consumer preferences and engagement patterns. However, this advancement also brings ethical implications, particularly related to transparency, informed consent, and consumer autonomy.

Future research should thus prioritize the development of ethical and regulatory frameworks to govern the use of neurotechnologies in marketing. Ensuring that neuromarketing applications align with data protection standards and respect consumer rights is essential for maintaining public trust and long-term viability. Researchers are also encouraged to explore how neuromarketing techniques can be adapted for diverse socio-cultural contexts, particularly in emerging markets where consumer behavior may be shaped by distinct values, norms, and digital adoption patterns.

Looking ahead, the intersection of neuromarketing, artificial intelligence, and big data analytics is poised to transform the future of consumer research. As technologies become more accessible and sophisticated, neuromarketing will play a critical role in enabling businesses to design emotionally resonant and cognitively informed marketing strategies. By bridging biological responses with behavioral insights, neuromarketing can offer a deeper understanding of consumer experiences and unlock new dimensions of strategic decision-making.

Ultimately, sustained innovation, interdisciplinary collaboration, and ethical vigilance will be key to positioning neuromarketing as a responsible and impactful driver of marketing science in the digital era. Innovation must be rooted not only in technological advancement, such as real-time neural monitoring, emotion AI, and immersive

interfaces like virtual and augmented reality, but also in methodological rigor that integrates both qualitative and quantitative paradigms. Interdisciplinary collaboration across fields such as behavioral economics, computational neuroscience, data science, and cultural studies will enrich the explanatory power of neuromarketing and foster the development of models that are not only predictive but also explanatory and context-sensitive.

Equally important is establishing clear ethical standards and cross-border regulatory frameworks to address growing concerns over manipulation, data exploitation, and the transparency of neuro-based targeting practices. As consumers become more aware of how their subconscious responses are being analyzed and potentially influenced, building public trust will require academic and industry stakeholders to engage in proactive communication, digital literacy efforts, and participatory research approaches.

In the long term, the credibility and sustainability of neuromarketing will depend not only on its ability to generate business value but also on its contribution to consumer well-being, equitable access to technology, and the promotion of inclusive, culturally relevant marketing strategies. Thus, the future of neuromarketing lies not just in decoding how consumers think, but also in aligning that knowledge with ethical, human-centered, and globally responsible marketing practice.omarketing research has grown significantly over the past two decades, driven by interdisciplinary approaches and technological innovations. This bibliometric study reveals the dominance of themes such as emotional branding and AI integration. Ethical issues and regional disparities present opportunities for future inquiry. Expanding research into emerging economies and promoting global collaborations are essential steps in enhancing the applicability and integrity of neuromarketing.

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