



Transformer-based AI for Sentiment Analysis in Marketing

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Abstract

Previous research has found that sentiment analysis is the focus of Artificial Intelligence (AI). Nevertheless, a limited number of studies exist on advanced AI applications. First, this study contributes to this limited literature. It is argued that Transformer Architecture has initiated a new phase in AI and sentiment analysis. We contribute to this argument by providing evidence that transformer-based AI provides better performance and capabilities. We do so by systematically reviewing and analyzing the applications of Transformer-based models for sentiment analysis. The focus of this paper lies in the broader marketing field. In addition, marketing is one of the most essential fields in business. The choice of marketing in examining Transformer-based sentiment analysis constitutes a novelty. Using the PRISMA methodology we reviewed 481 papers. Only eight papers fulfill the criteria. It is a somewhat surprising finding that so few papers have applications of Transformer-based AI for sentiment analysis in marketing. Most papers follow older AI methods (i.e., Recurrent Neural Networks, Convolutional Neural Networks, etc.). This leaves a gap in this area, and we examine novel trends and directions for future research.

CCS Concepts

• **Computing methodologies**; • **Artificial intelligence**; • **Natural Language Processing**; • **Natural Language generation**; • **Information systems**; • **Information retrieval**; • **Retrieval tasks and goals**: Sentiment analysis;

Keywords

Machine learning, neural networks, applied computing, transformer-based models, performance, applications, consumer products, language models

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1 Introduction

AI and Machine Learning (ML) applications are widely used in marketing. In the domain of advertising, part of marketing, it is found that, in most of the studies, sentiment analysis is the focus

[1]. However, only a limited number of advanced AI techniques are used [1]. Our paper builds upon and expands on these findings. It contributes to this limited literature on advanced AI techniques by reviewing and analyzing transformer-based models.

Our study follows a similar methodological path to the previous related work of [1]. It focuses on advanced AI and sentiment analysis. It argues that the transformer-based architecture and models constitute the latest advancements in AI and Natural Language Processing (NLP). These technological advancements increase performance and enable novel applications and capabilities. The paper expands the scope of previous studies and examines the applications of transformer-based AI in the broader field of marketing. The choice of marketing constitutes a novelty. Previous literature has focused on specific aspects of marketing, such as advertising [1]. Marketing is one of the most essential fields in business. In addition, sentiment analysis is widely used in marketing.

Sentiment analysis is:

“[...] the computational study of people’s opinions, sentiments, emotions, and attitudes towards entities such as products, services, issues, events, topics, and their attributes. The entities can be products, services, organizations, individuals, events, issues, or topics.”

[2]

The wide applicability of sentiment analysis has contributed to its popularity. Sentiment analysis lies at the intersection of linguistics and computer science. It is a common tool in social media analysis carried out by business, marketing, and political analysts, and it is a growing field [3]. Interest in sentiment analysis has grown as online text volume and value continuously increase [4]. As [5] argues, in the digital world, media is used for every work with data created across social networks increasing; thus, there is an ‘eruption of interest’ to analyze sentiment.

The term *sentiment analysis* appeared in the early 2000s, and since then, it has substantially evolved and can be considered an active research field of NLP [2]. According to [6], NLP pertains to a field within computer science, specifically AI, focused on enabling computers to comprehend written and spoken language akin to human capabilities. In this sense, it merges computational linguistics with the rule-based modeling of human language. Therefore, it is part of the broader AI field. Language-based AI has advanced by leaps and bounds. The most significant progress has been in transformer-based models. They enable more advanced and innovative tasks, transforming how we work and impacting businesses and society [7]. We argue that the transformer-based architectures and models constitute the latest advancements in AI and NLP. However, despite the unprecedented impact of transformer-based AI, the literature on sentiment analysis needs to adequately capture these advancements. There are significant reviews of AI in marketing,



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for example [8]. Nevertheless, there is a noticeable gap in reviews focusing on AI-driven sentiment analysis in the marketing domain.

The main contribution of this paper is to fill this gap in the literature. Following [1], we have conducted a systematic review of transformer-based models for sentiment analysis in the broader field of marketing. To fulfill this objective, the study formulates the following research questions (RQ):

RQ1: In which industries is Transformer-based sentiment analysis applied to?

RQ2: Which segments of marketing use Transformer-based AI for sentiment analysis?

RQ3: Which Transformer models are used for sentiment analysis in each segment of marketing?

The structure of the paper is outlined as follows: Section 2 provides a succinct definition of sentiment analysis and its significance in marketing. It also briefly accounts for the historical evolution of AI and Transformer architecture. Section 3 presents studies on the relationship among artificial intelligence, sentiment analysis and marketing. Section 4 details the methodology, including sampling methods and data collection techniques. The findings of the data analysis are presented in Section 5. Section 6 offers a discussion on the study's primary findings, implications, and limitations. Finally, Section 7 concludes.

2 Literature

2.1 Sentiment analysis

Sentiment analysis, also known as opinion mining, is:

“[...] the computational study of people's opinions, sentiments, emotions, and attitudes towards entities such as products, services, issues, events, topics, and attributes. The entities can be products, services, organizations, individuals, events, issues, or topics.” [2]

It is the process of analyzing and determining, under a scale of polarity (i.e., positive, neutral, or negative) [9-10], the reviewer's subjectivity, in other words, the sentiment or emotional tone portrayed in a text using computer techniques. Nowadays, the increasing volume of text accessible online and across digital platforms requires the analysis and comprehension of sentiments. Given this, sentiment analysis uses models and algorithms that are made to analyze and categorize text according to predetermined sentiment categories, as opposed to only depending on human interpretation. In essence, the main goal of sentiment analysis is to automate the process of analyzing text for sentiment.

With initially focusing on analyzing movies, books, and consumer products [11-14], sentiment analysis proves to be a potent tool for marketing research. By understanding the sentiment of online content, such as customer reviews, social media posts, and comments towards products, brands, or services, marketers can extract valuable insights into consumer preferences, identify trends, and adjust their market strategies to meet customer needs and preferences better.

2.2 Brief History and Evolution of Transformer-based AI

A significant milestone in the development of AI was the introduction of the Transformer architecture, which relies solely on attention mechanisms and dispenses entirely with the need for recurrence and convolutions [15]. Unlike previous deep learning technologies, the Transformer Architecture does not use sequence-aligned Recurrent Neural Networks (RNNs) or convolution. This departure marked a breakthrough, making Transformer a prominent deep learning model that has been widely adopted in various fields, including Convolutional Neural Networks (CNNs) and NLP, as well as life and other sciences [16]. Transformer serves as the backbone for many state-of-the-art models, such as GPT-3: it addresses the limitations of earlier models, like RNNs, improving the performance of a wide range of NLP tasks [16] and, consequently, sentiment analysis.

2.3 Transformer-based models for sentiment analysis

One of the prominent areas of interest within the expansive landscape of Transformer-based AI is sentiment analysis. Various specialized Transformer language models focus on sentiment analysis. For instance, BERT has introduced a novel post-training approach that enhances the performance in sentiment analysis that is highly effective [17]. Domain-oriented language model (DomBERT) for aspect-based sentiment analysis also demonstrates promising results [18]. According to [19], SentiBERT, another variant of BERT, effectively captures compositional sentiment semantics and achieves competitive performance in phrase-level sentiment classification. It outperforms baseline approaches in tasks like capturing negation, contrastive relations, and modeling compositional sentiment semantics. Another notable example is the Sentix model, a sentiment-aware pre-training language model for cross-domain sentiment analysis [20], which builds on BERT by incorporating four new sentiment-aware pretraining tasks [21].

An extensive examination of various Generative Pre-Trained Transformer (GPT) methodologies on sentiment analysis is presented by [22]. They compare GPT variants with previous methods and find that GPT approaches exhibit better predictive performance and superiority, and better capabilities in dealing with advanced tasks in sentiment analysis. This reveals that not only the performance metrics are better, but also GPT, enable advanced tasks. The comparison with previous technology models, such as lexicon-based approaches and Long Short-Term Memory (LSTM), highlights the superiority of GPT models and, in general, the better performance of Transformer-based models.

3 Marketing, artificial intelligence and sentiment analysis

3.1 Systematic Literature Reviews on AI and Marketing

AI is the latest disruptive technology and can have immense transformation potential in marketing [23]. They argue that a systematic literature review highlights the importance of AI in marketing and identifies future research directions. They review 1582 published

papers written between 1982 and 2020. A limitation of this study is the time period since transformer AI models and advanced applications were invented in the last few years of this period. [23] find that both academicians and practitioners believe that AI is the future and that AI in marketing has gained momentum because of its practical applications. They discuss the use of AI in areas of marketing, such as strategy and planning, product management as well as pricing management, place management, and promotion management. Our paper follows [23] and conducts a systematic literature review while comparatively categorizes the areas of marketing. [23] classified the research domain into five different clusters. One of these clusters is consumer sentiment and word of mouth in online platforms. They find that sentiment analysis in marketing is the leading trending topic and direction for future research. These findings further justify our choice of sentiment analysis in marketing. We expand on these findings and suggest further research directions.

[24] argue that contemporary marketing has begun to experiment with AI and explore marketing as an emergent stream of research. They perform a systematic literature review that identifies 221 papers and evaluates 57 qualifying publications from 2015 till 2020. Therefore, the same limitations as before concerning the time period and the inclusion of transformer-based models apply. They discuss sentiment analysis in the context of integrated digital marketing and market research. They also suggest that AI provides better understanding and deciphering of consumer emotions and sentiments which are some of the potential areas for future researchers.

[25] provided an integrated view of AI in marketing, extending the scope to consumer research and psychology. They argue that while ‘AI is experiencing exponential growth in adoption by marketing managers and consumers’, no study covers AI in the closely related fields of marketing, consumer research, and psychology. Therefore, they produced a systematic literature review covering articles published from 1966 till June 2021 to find that most of the publications (more than half) on the topic is from 2017 to June 2021. As in previous studies, they categorize the themes into eight clusters, among them, social media and text mining, and social media content analytics are more related to sentiment analysis.

Finally, [26] provide a comprehensive review of AI in marketing, on the lines of a systematic literature review, and find uses of artificial intelligence in strategy and planning, product management, place management, promotion management, and pricing management.

Therefore, we argue that there is not a systematic literature review that examines AI, specifically sentiment analysis and the latest advancement in transformer-based models in marketing. We contribute to the existing literature by providing a novel systematic literature review and innovative future directions.

3.2 Literature reviews on AI and Marketing

There are additional reviews on AI in marketing. Nevertheless, they only constitute systematic literature reviews with some of the benefits and limitations this might have. Although it is beyond the purpose of this paper, it is worth briefly mentioning some critical studies that are related to our paper. [27] argue that there is a

growing interest in AI in marketing researchers and practitioners and provide a review of 164 articles published in Web of Science and SCOPUS-indexed journals. Their study provided an in-depth overview of studies at the intersection between marketing and AI but did not focus on any specific sub-field of marketing. However, it suggests that future studies could conduct a more focused analysis of specific areas and sub-fields of marketing and AI. We reply to this call by providing a systematic literature review focusing on sentiment analysis’ AI subfield.

[28] also recognize that AI has massive potential in marketing and is employed in marketing campaigns in various industries, such as finance, healthcare government and many more. They find that the primary marketing segments in AI applications are strategy and planning, product management, promotion management, and pricing management. This categorization essentially facilitates our analysis and coincides with our findings.

3.3 AI and sentiment analysis

Since sentiment analysis has a protagonist role in our paper, examining some critical literature on sentiment analysis would be beneficial. Therefore, we present some reviews on the topic that cover numerous aspects.

[29] conduct a review of AI and sentiment analysis, arguing that AI has improved performance, particularly in sentiment analysis. A literature search using the PRISMA method from 2012 to 2022 in SCOPUS found 133 results, 43 of which were deemed significant to analyze AI sentiment analysis applications, approaches, and futures. They connect marketing to sentiment analysis and comment that in the future, improved sentiment categorization and the use of AI in marketing will increase.

[30] acknowledge that the field of sentiment analysis has experienced extensive research in the past decades. They conducted a tertiary study that follows the guidelines of systematic literature reviews and covers only secondary studies, eventually analyzing 112 sentiment analysis papers. They find that Long Short-Term Memory (LSTM) and CNN models are the most used in sentiment analysis. This is a very interesting finding, since it indicates that older models are used rather than the more advanced transformer-based models in sentiment analysis.

4 METHODOLOGY

Our study examines the applications of Generative AI in sentiment analysis within the marketing literature. The reporting of this systematic review adhered to the standards outlined in the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) Statement [31] [32] [33]. To achieve this, a research strategy was devised, incorporating predefined inclusion and exclusion criteria based on the checklist of the PRISMA Statement. The PRISMA Statement is:

“[...] an evidence-based set of recommendations designed primarily to encourage transparent and complete reporting systematic reviews [...] to aid authors with appropriate reporting of different knowledge synthesis methods [...] and to ensure that all aspects of this type of research are accurately and transparently reported.” [34]

Table 1: Research keywords

Category	Keywords
Artificial Intelligence	Artificial Intelligence, AI
Sentiment Analysis	Sentiment analysis, SA
Marketing	Marketing

Our study, using PRISMA and other methods, follows the methodology of other comparative studies, mainly [1] and [24]. We also used other comparative studies on systematic reviews [23] [25] [26] to check and verify the validity of our methodological approach. The study comes with some limitations and shortcomings. The main limitation concerns the use of keywords for the search. Specific words were used, and future research can expand the range or words used. Another shortcoming is the limited number of studies, only 8, that were found to be using transformer-based models. This was a surprising finding. We hope that future research in this area can expand on the use of transformer-based models and sentiment analysis applications in marketing.

4.1 Deciding on Keywords and Criteria

The domains of AI and sentiment analysis find practical applications in the realm of marketing. In our research process, we focused on these three categories, namely 'artificial intelligence', 'sentiment analysis', and 'marketing', choosing them as our specific keywords. This helped us establish search criteria to identify the most relevant publications, thereby providing valuable insights into the latest advancements and applications in the evolving field. To ensure thoroughness in our search process and capture a comprehensive range of results, we have identified and compiled spellings and synonyms for these keywords, as outlined in Table 1.

According to [4], the evolution of sentiment analysis can be organized into three overlapping phases, with the third one having begun in the past decade by applying Generative AI and deep learning to NLP. Similarly, [23] states that the evolution of sentiment analysis occurs in three pivotal phases: the lexicon-based era, the ML era, and Transformer model era. Our study focuses on the third era of Transformer models and Generative AI, with the introduction of Transformer models occurring in November 2017. Therefore, we selected January 2018 as the starting year, including more recent studies till April 2024, for the period of our systematic review.

The criteria in our research are summarized as follows:

- studies that are relevant to the keywords chosen,
- studies that are peer-reviewed,
- studies that are in English,
- studies that are published between January 2018 and April 2024.

Our keywords and criteria were used for a survey on the SCOPUS scientific database. Similar reviews are primarily based on SCOPUS [1] [8]. SCOPUS includes publications from ACM Digital Library and IEEE Xplore that are relevant to our purpose. Additionally, we searched independently ACM Digital Library, IEEE Xplore, and Google Scholar. The set of keywords was linked using Boolean operators and specific inclusion and exclusion criteria were applied. The initial screening process involved the following steps:

- We employed abstracts, titles, and keywords to search and evaluate publications based on the stated inclusion and exclusion criteria.
- Studies that are summary articles, patents, books, summary of conferences, keynotes, proposals, lecture notes, editorials, comments, tutorials, or review papers were excluded.
- Any studies that matched the search criteria but were not directly relevant to the topic in question were also removed.
- Any duplicate studies were removed.

4.2 Processing the database outcomes

These above techniques produced a total of 481 relevant studies. The entire text of relevant papers was then retrieved and examined in detail to re-evaluate the inclusion and exclusion criteria. The studies that did not match the above criteria were excluded.

We also used some additional exclusion criteria that serve the main scope of the papers. A key criterion was the use of Transformer architecture and models. While many papers matched the general AI criterion, most papers were excluded from the 'transformer' criterion. The primary purpose of this paper is to identify the transformer-based AI applications of sentiment analysis in marketing. Therefore, we further searched in the text for 'Transformer', 'BERT' and 'GPT', which can be considered the two most popular families of transformer-based AI models.

Some of the results were found in different databases and they were validated in this way. The results were also double-checked and reviewed to ensure that they match the criteria. Once again, any studies that matched the search criteria and additional criteria but were not directly relevant to the topic in question were also removed. This was, in some cases, challenging and can be further investigated in future research. For example, in a few papers, the keyword 'marketing' was found in the main text, but this mention was based on other studies, and the mention was theoretical. Thus, it was not directly related to marketing applications of Transformer AI. Therefore, these studies were also excluded since they do not fit the scope of this Systematic Review.

Eventually, eight studies were identified from the database procedure. They were organized in chronological order and presented based on the features related to the research questions. The key attributes of the chosen studies are reported in the Appendix. We adhered to the PRISMA framework to ensure the thorough identification of relevant studies and the subsequent selection of eligible ones. The insights gleaned from the review process capture sentiment analysis in AI transformer-based models applied in marketing, which will be reported and discussed in Sections 4 and 5, respectively.

5 results

Our research identified 481 primary studies using the above systematic review methodology. The studies were distributed both in journals and conferences, indicating that the authors did not favor a single type of publication. We read the paper and did not limit it to titles, abstracts, and keywords to better understand the context in which the keywords were utilized.

Out of the 481, only eight studies were eventually included based on the aforementioned criteria and steps. Most of the studies did

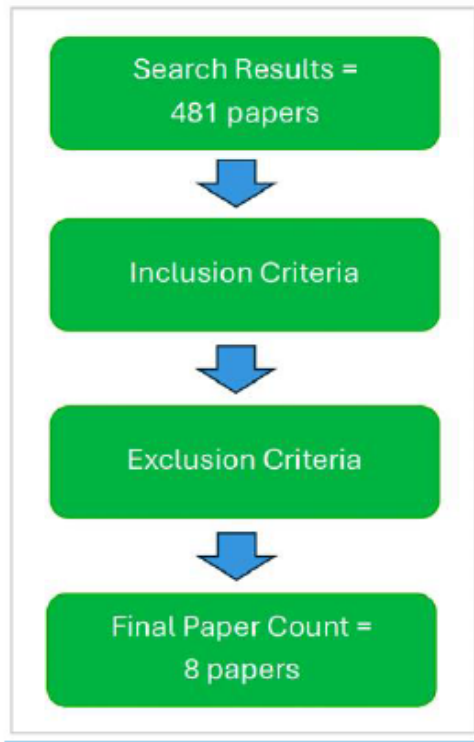


Figure 1: Literature search process

not meet the transformer-based AI model criterion. This is because they instead used previous AI methods, like CNN, LSTM network, and, in general, RNN. They also used ML algorithms and other NPL methods, such as Word2Vec. For this reason, most of the studies were excluded. Few studies briefly mentioned transformer-based models, usually BERT, but they did not mention it in the context of marketing or sentiment analysis and thus, were excluded too.

5.1 Applications in industry

Focusing on RQ1, we found diverse industries to which Transformer-based sentiment analysis is applied. More specifically, e-commerce [35] [36] and social media [37] [38] were the primary industries. In addition, insurance [39], electronics [40], and even film industries [41] appear. Interestingly, [42] is unique in that it covered a wide variety of industries. Some broad, like technology, electronics, and accessories.

Social media applications are consistent with similar findings [1], in which there is a significant number of AI applications and sentiment analysis. E-commerce applications can also be considered consistent with previous findings [1] since they can be related to classified and other ads. Nevertheless, it should be emphasized that there is a wide range of applications, in these limited number of studies, mainly expressed by [42]. Figure 2 displays the distribution of studies among industries.

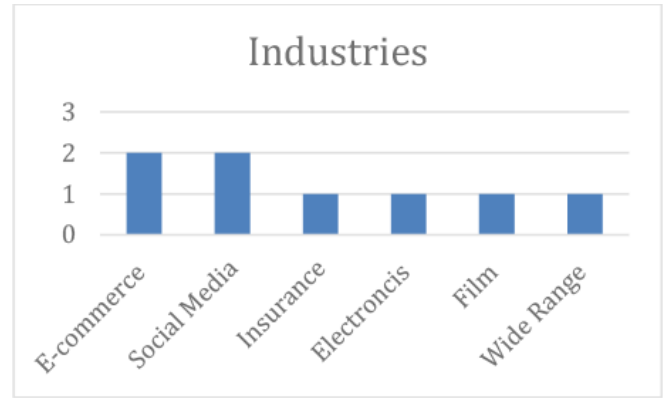


Figure 2: Industries

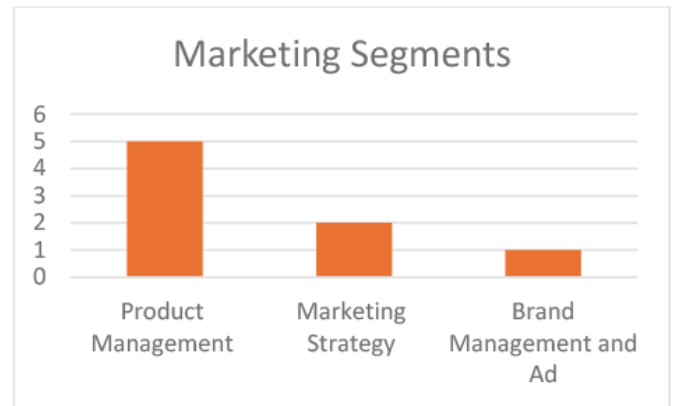


Figure 3: Marketing Segments

5.2 Segments of marketing

According to our search, the literature focuses on the application of AI in product management. More specifically, concerning RQ2 and the segments of marketing using Transformer-based AI for sentiment analysis, the review found that the applications on Product Management (reviews) dominate [35] [36] [40] [41] [42]. In contrast, Marketing strategy is also popular [38] [39]. However, we identified only a combined case of brand management and advertising in [37]. In Figure 3, these segments are presented.

Product management was expected to be the most popular category, given that it is related to e-commerce and social media applications that usually deal with product placement and reviews. While marketing strategy is a relatively popular segment, it can be argued that advanced AI, and in this case transformer-based AI, has not been extensively applied yet to the core of marketing and business strategy. This might reveal some limitations concerning the sophistication and maturity of advanced AI applications to more complex issues. Finally, it should be noted that these findings indicate that transformer models enable innovative applications of sentiment analysis to marketing.

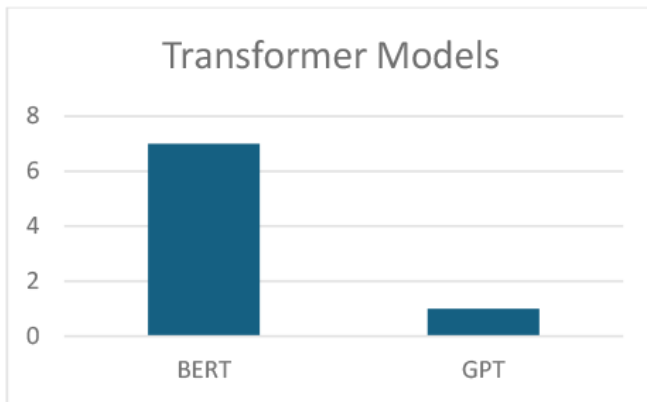


Figure 4: Transformer model ‘families’

5.3 Transformer models in marketing

Regarding the Transformer models used for sentiment analysis in marketing, BERT models are prevalent [35] [36] [37] [38] [40] [41] [42]. There is only one application of GPT [38]. It is interesting to notice that while BERT models appeared relatively early, GPT modeling is just surfacing. In Figure 4, the prevalence of BERT family models is displayed. Future research can examine if this prevalence of BERT models will continue or if GPT and other models will become more popular.

An interesting finding is that not only were BERT models employed, but some specific BERT family models were also utilized. Notably, BERTopic was used twice [36] [39]. The study of [38] is BERT-based but uses additional methods, indicating that BERT can be altered, combined, and extended to other methods, providing more options and applicability. Future research can expand on using specific BERT models and their extensions to sentiment analysis.

6 discussion

The outcomes presented above offer several implications worth noting. This section presents the findings, managerial implications, contributions, limitations and future directions.

6.1 Key Findings

Despite the wide application of AI transformer-based models, a relatively small number of studies have used them for sentiment analysis in marketing for some years. Moreover, the first study was in 2020 [41], and since then, there has been little work on transformer models, despite a significant number of studies of transformer models in other topics and fields.

The limited use of transformer-based models in sentiment analysis in marketing instead comes as a surprise. Despite their substantial higher performance and innovative capabilities, AI transformer-based models are rarely used in sentiment analysis in marketing. We found that older methods, such as Neural Networks, were extensively used, but these studies were excluded from this study. Nevertheless, transformer-based models seem to have enabled novel applications of sentiment analysis in marketing. The initial search which produced 481 results included a substantial number of studies

using older and, therefore, less advanced AI methods than transformer architecture.

6.2 Managerial implications

This work has interest for academia as well as practice. Marketing is an applied field in business and sentiment analysis has been widely used. While transformer-based models provide advanced performance and enable new tasks, they seem not to be much researched and used in marketing. Our findings suggest that their applications are very limited. [29] argue that effective competitive research helps businesses outperform their competitors and sentiment analysis may be used. Managers should therefore use transformer-based models for sentiment analysis to improve performance of their companies.

6.3 Contributions

To the best of our knowledge, this is the first systematic review that examines AI transformer-based models and their application in sentiment analysis in marketing. Although sentiment analysis is an essential field in business and marketing, the application of AI transformer-based models remains limited. Only little attention has been paid to this area, which has significant potential. In our study, researchers can pinpoint essential areas needed for research and exploration.

The contributions can be summarized as follows: This study contributes to the limited literature on advanced AI applications. We further contribute to the argument, that transformer AI models are a new phase in sentiment analysis by providing evidence that transformer-based AI provides better performance and capabilities. Another contribution and main novelty are the choice of marketing in examining transformer-based sentiment analysis. Finally, we contribute to the literature and research by examining novel trends and directions for future research.

6.4 Limitations

This research included reviewed full-text publications to ensure only relevant studies were considered. We have focused our search and keywords on specific terms directly related to the topic in question. For this, this research adhered to a pre-established methodology, conducted a thorough search, and utilized multiple databases to minimize this risk. Despite significant mitigation efforts, some studies may have been overlooked. Therefore, we recognize that the risk of overlooked relevant publications and the possibility of articles being missed remains. Additional limitations and shortcomings concern the use of keywords for the search and future research can expand the range or words utilized.

6.5 Future Research Directions

Our findings suggest that there is a very limited number of transformer-based sentiment analysis in marketing. Moreover, these studies focus on product management, marketing strategy and brand management and advertising. Nevertheless, our literature review [35-42] provides more areas of marketing as pricing management and promotion management. Future research should cover these important segments of marketing, as well as expand to broader clusters and related topics [25].

In addition, future research could explore subfields of marketing, but also AI [27] and sentiment analysis [30] (for example, polarity). Our findings suggest that there are transformer-based models enabling novel applications of AI in marketing. Future research can expand on using specific transformer models, like BERT models. While in engineering literature there is a frequently comparison between the older models and transformer ones. In the literature, we examined that there is not any such comparison. Future research can examine and compare performances among AI models. This could consequently guide investment in marketing and have significant managerial implications.

7 conclusions

AI and Machine Learning applications are widely used in marketing. Previous work [1] found that most studies are concerned with sentiment analysis stating that only a limited number of advanced AI techniques are used. Our paper contributes to this limited literature. Following a similar methodology, the paper builds and expands upon [1] producing similar findings and confirming that there is only a limited number of advanced AI techniques. We found that while sentiment analysis is widely used in marketing, more advanced AI transformer architecture is only applied in very few studies. It also seems that transformer models enable innovative applications of sentiment analysis in marketing.

This paper is a thorough examination and systematic review of Transformer-based AI sentiment analysis in marketing. Initially, a search yielded 481 studies meeting the predefined inclusion and exclusion criteria, from which only eight were identified as primary studies. The full texts of these studies were meticulously evaluated, adhering rigorously to the PRISMA framework.

The review revealed that a relatively low number of studies characterizes the current body of literature on Transformer-based AI in marketing. It was found that the primary industries in which Transformer-based sentiment analysis is applied are e-commerce and social media. In addition, product management and marketing strategy are the most popular applications of Transformer-based models. Finally, most of the studies use BERT models for sentiment analysis in each segment of marketing.

This study is the first effort in the marketing domain, offering insights that may yield benefits for researchers and practitioners. This research field is still nascent and requires future research.

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APPENDIX

No	Authors	Title	Year	Industry	Segment	Tool	Reference
1	H. He, G. Zhou, S. Zhao	Exploring E-Commerce Product Experience Based on Fusion Sentiment Analysis Method	2022	E-commerce	Product Management (Reviews)	BERT	[35]
2	Y. An, D. Kim, J. Lee, H. Oh, J. -S. Lee and D. Jeong	Topic Modelling-Based Framework for Extracting Marketing Information From E-Commerce Reviews	2023	E-Commerce	Product Management (Reviews)	BERTopic	[36]
3	Y. Chen, Z. Zhang and Z. Xia	Sentiment Assessment of Brand Advertising on Gender Issues on Social Network: A Case Study of Femvertising on Sina Weibo in China	2021	Social media	Brand Management, Advertising	BERT	[37]
4	V.M. Ngo	Does ChatGPT change artificial intelligence-enabled marketing capability? Social media investigation of public sentiment and usage	2024	Social media	Marketing strategy	ChatGPT	[38]
5	C.G. Giancaterino	NLP and Insurance—Workshop Results at SwissText 2022	2022	Insurance	Marketing strategy	BERTopic	[39]
6	K. Park, S. Park and J. Joung	Contextual Meaning-Based Approach to Fine-Grained Online Product Review Analysis for Product Design	2023	Electronics (TV)	Product Management (Reviews)	BERT	[40]
7	C. Chen, X. Hu, H. Zhang, and Z. Shou	Fine grained sentiment analysis based on Bert	2020	Chinese film	Product Management (Reviews)	BERT	[41]
8	L. E. Ferro-Díez, N. M. Villegas, J. Díaz-Cely and S. G. Acosta	Geo-Spatial Market Segmentation & Characterization Exploiting User Generated Text Through Transformers & Density-Based Clustering	2021	Movies and TV/ Clothing, Shoes & Jewelry/ Music/ Technology, Electronics & Accessories/ Books/ Toys & Games/ Home & Kitchen/ Office & School Supplies/ Health & Personal Care/ Sports & Outdoors/ Food	Product Management (Reviews)	BERT based	[42]