

Natural Language Processing in Marketing

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Abstract: Natural language processing (NLP) is a branch of artificial intelligence that empowers computers to comprehend, interpret, and generate human language. It involves teaching machines to understand the complexities of human language, including its semantics, syntax, and context. Drawing from disciplines like data science and computational linguistics, NLP empowers computers to comprehend and interact with human language. In marketing, NLP has emerged as a transformative technology, enabling businesses to extract actionable insights from vast quantities of unstructured data, ranging from social media conversations and customer reviews to emails and support tickets. NLP allows marketers to move beyond traditional quantitative analysis to understand the nuances of human communication. It analyses customer communications, social media posts, and feedback to extract insights about preferences, sentiment, and intent. This paper will explore the transformative role of NLP in modern marketing.

Keywords: *Natural Language Processing (Nlp), Computational Linguistics, Marketing*

I. INTRODUCTION

The increasing importance and proliferation of text data provide a unique opportunity and novel lens to study human communication across a myriad of business and marketing applications. The availability of and ability to extract meaningful information from unstructured data (e.g., image, video, voice, and text) continues to rise and has attracted much interest in the marketing community. For more than a decade, NLP has enabled various marketing applications across diverse contexts [1]. NLP acts as a bridge, transforming hard data into actionable, human-understandable insights. It is reshaping marketing, offering insights and efficiency that grant a competitive edge. This leap in data analytics and customer understanding requires that marketing leaders integrate AI and NLP into their strategies to stay ahead.

Natural language processing (NLP) enables computers to understand, interpret, and respond to human language in a meaningful way. It combines computational linguistics with machine learning to process human language data. It has a wide range of applications, including machine translation, speech recognition, sentiment analysis, information extraction, topic modeling, named entity recognition, text classification, and text summarization. This technology transforms how businesses personalize content, automate responses, and predict customer behavior across all digital touchpoints. For marketing professionals, NLP matters because it processes vast amounts of unstructured text data that would be impossible to analyze manually. NLP extracts these insights automatically, enabling data-driven decisions about messaging, product development, and improvements to the customer experience [2].

II. FUNDAMENTALS OF NLP

Natural language processing is a subfield of artificial intelligence that empowers computers to understand, interpret, and generate human language. It is a technique where machine can become more human and thereby making human to communicate with the machine easily. NLP seeks to make software intelligent enough to process a natural language as humans. For example, imagine a machine that takes instructions by voice.

NLP analysis generally consists of the following three levels [3]:

- *Syntax*, the study of sentence structure. Syntax deals with the formation of a sentence from individual words. Syntax alone suggests the proper interpretation of “Jimmy loves Lucy.”
- *Semantics*, the study of context-independent meaning. This derives the meaning of a sentence based on the meanings of the words/phrases. For example, semantics determines whether the word “bank” refers to a river bank or to a financial institution.
- *Pragmatics*, the study of context-dependent meaning. Pragmatics deals with how meaning changes in the presence of a specific context and how the contexts affect the meaning of the sentences. This level is concerned with the purposeful use of language in situations.

As a foundational pillar of modern artificial intelligence, NLP encompasses a wide array of tasks, including speech recognition, text classification, natural language understanding (NLU), and natural language generation (NLG). NLP encompasses a wide range of tasks, such as information retrieval (IR), named entity recognition (NER), relation extraction, text classification, topic modeling, semantic textual similarity, machine translation, and question answering (QA). Figure 1 shows how NLP transforms raw acoustic data into meaningful interactions [4], while Figure 2 shows different components of NLP [5].



Figure 1: A representation of NLP [4].

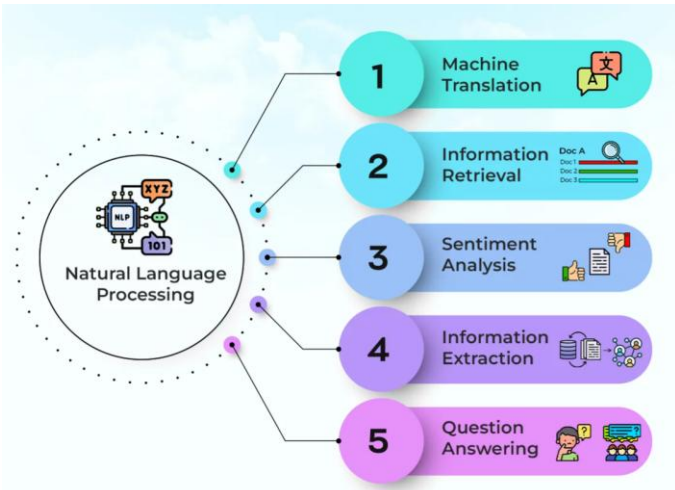


Figure 2: Different components of NLP [5].

Recently, large language models (LLMs) have shown their ability in learning universal language representations, text understanding and generation. LLMs refer to a model with a large number of parameters, vast training data, and substantial compute, enabling it to capture complex language patterns. In LLM-based NLP, pre-processing is followed by prompt engineering, which guides LLMs to produce outputs that align with extraction requirements during inference without altering the model's parameters. Models like GPT are pushing the boundaries of language understanding, enabling nuanced and context-aware applications. The GPT (Generative Pretrained Transformer) is a large-scale language model developed by OpenAI that consists of multiple layers of transformer blocks, each with a self-attention mechanism and a forward neural network [6]. GPT-based systems can summarize complex reports or generate creative content like essays, making them versatile in both academic and professional environments. ChatGPT uses NLP techniques to understand prompts. When you enter a prompt, the chatbot comprehends it and provides relevant replies. Figure 3 shows how NLP works [7].

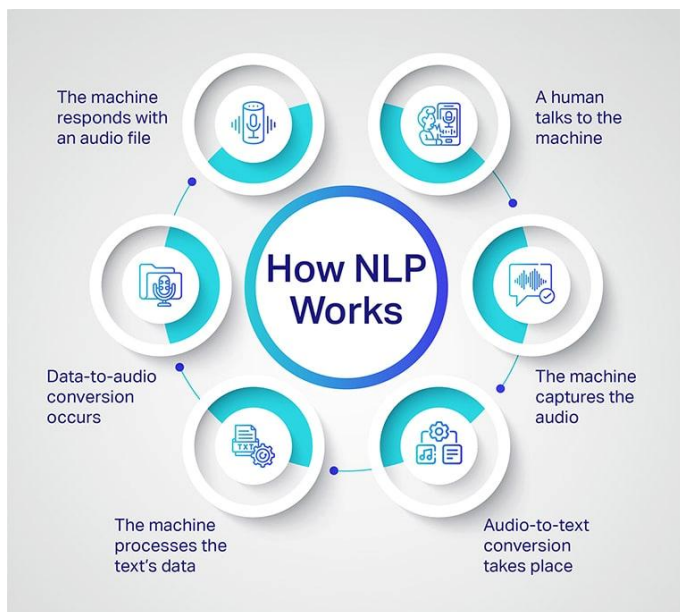


Figure 3: How NLP works [7].

III. NLP IN MARKETING

Natural language processing (NLP) has emerged as a pivotal technology in modern marketing. It is revolutionizing how marketers achieve their goals by enabling machines to comprehend, interpret, and generate human language. By

enabling machines to understand human language, NLP offers marketers unprecedented capabilities to enhance decision-making, optimize data analysis, and improve the accuracy of customer insights and trend predictions. NLP methods have been employed for established tasks in marketing, i.e., concept and topic extraction, relationship extraction, sentiment and writing style extraction, and delineated novel tasks enabled by recent technological advancements, i.e., text generation, text summarization, and multimodal representation learning [1]. Figure 4 shows how NLP aids marketers [8].



Figure 4: NLP aids marketers [8].

In an increasingly digitized world, customer-centric marketing strategies have become paramount for businesses striving to gain a competitive advantage and cultivate brand loyalty. NLP has emerged as a transformative technology for processing and analyzing unstructured text data. It analyses customer communications across all touchpoints to build detailed behavioral profiles. It processes email responses, social media interactions, customer service chats, and website behavior to understand individual preferences, communication styles, and purchase motivations. Over the past decade, significant advancements in NLP techniques have empowered businesses to extract actionable insights from large-scale textual data [9].

IV. APPLICATIONS OF NLP MARKETING

Natural language processing is fundamentally reshaping the marketing landscape, offering unprecedented opportunities for businesses to understand their customers, personalize their outreach, and optimize their campaigns. From sentiment analysis and customer segmentation to programmatic advertising and SEO, NLP provides powerful tools for extracting value from the deluge of unstructured data. Common applications of NLP in marketing include [2,8-11]:

- **Sentiment Analysis:** Sentiment analysis is one of the most exciting applications of NLP marketing. It involves determining the emotional tone behind a piece of text, whether it is positive, negative, or neutral. This technology goes beyond simply counting positive or negative mentions of a brand or product; it delves into the nuances of human emotion expressed in text. NLP sentiment analysis enables your content marketing strategy. By analyzing vast amounts of unstructured data from social media, customer reviews, forums, and support interactions, NLP can gauge public sentiment and identify the underlying reasons behind customer feelings. Marketers leverage sentiment analysis to monitor brand reputation across diverse online platforms, including social media, forums, and customer review sites. By categorizing opinions, businesses can identify shifts in consumer perception in real-time, allowing for swift responses to emerging trends or potential crises. NLP-driven

sentiment analysis of customer feedback can reveal critical insights into product improvements or service deficiencies, allowing businesses to align their offerings more closely with customer expectations.

- *Customer Segmentation:* This is the process of categorizing customers based on shared characteristics. It has traditionally relied on structured data sources, such as demographic, geographic, and transactional data, to inform marketing strategies. NLP significantly enhances customer segmentation and personalization by providing a deeper understanding of individual customer preferences and behaviors. Traditional segmentation often relies on demographic data, but NLP allows marketers to analyze unstructured data—such as social media posts, chat logs, and email interactions—to create highly detailed customer profiles. By analyzing customer feedback, online interactions, and purchase histories, NLP algorithms can identify patterns and trends in consumer behavior that might otherwise remain hidden. This refined segmentation supports targeted marketing efforts that resonate on a personal level, enhancing customer engagement and loyalty. The application of NLP in customer segmentation has opened new possibilities for personalized marketing, enabling the identification of customer segments based not only on explicit behavioral patterns but also on implicit preferences and emotional responses conveyed through text.
- *Digital Marketing:* NLP innovations have a wide range of potential applications in digital marketing. These applications are generally aimed at improving each customer's individual experience and promoting a positive customer-business relationship. Personalized marketing, defined as the delivery of tailored messages and product offerings to individual consumers based on their unique behaviors and preferences, has witnessed significant advancements in recent years. As businesses seek to leverage data to enhance the customer experience and drive targeted marketing, the ability to accurately segment customers into meaningful and actionable groups becomes critically important.
- *Digital Advertising:* In the realm of digital advertising, NLP plays a crucial role in optimizing programmatic campaigns and enhancing search engine optimization (SEO) strategies. Contextual targeting allows advertisers to place ads based on the content of the webpage a user is currently viewing. NLP contributes to ad optimization by continuously analyzing campaign performance data and making real-time adjustments to ad copy and imagery to maximize engagement and conversion rates. In programmatic advertising, NLP helps in placing ads more effectively by understanding the context and sentiment of web pages, ensuring ads appear alongside relevant and brand-safe content. With the demise of third-party cookies, natural language processing for marketing plays an important role in the rise of contextual advertising. Advertisers can use NLP to scale campaigns and target consumers based on their interests.
- *Content Creation:* Content creation becomes more strategic with NLP analysis of customer conversations and competitor content. The technology identifies trending topics, common questions, and language

patterns that resonate with target audiences. This insight guides content planning, ensuring articles, videos, and social posts address real customer needs using familiar terminology. Content performance prediction becomes possible through language pattern analysis. NLP examines successful content to identify linguistic elements that drive engagement, such as specific phrases, emotional tones, or structural patterns. NLP can also assist in the creation of messaging and ad copy that is tailored to specific audience segments. It can automate the generation of product descriptions, blog posts, and even social media content, ensuring consistency and saving time.

- *Content Optimization:* NLP aids in the optimization of online content by analyzing current trends, competitor content, and search engine algorithms to recommend keywords and topics that are likely to attract and engage the target audience. For content marketers and SEO specialists, NLP is an invaluable tool for content optimization and search engine optimization (SEO). It moves beyond simplistic keyword matching to integrate semantic analysis, understanding the context and intent behind search queries. This allows for the recommendation of keywords and topics that are most likely to attract and engage the target audience. NLP tools can analyze current trends, competitor content, and search engine algorithms to suggest improvements that make content more relevant to user queries, thereby boosting SEO rankings and visibility. By understanding the semantic relationships between words and phrases, NLP helps create content that is not only optimized for search engines but also highly engaging and informative for readers.
- *Chatbots:* Most businesses have some kind of chatbot on their website. Chatbots can help with lead generation and sales in addition to customer service. The most common use of chatbots is sales. NLP is used by chatbots to provide prospects with the appropriate automated response. NLP-powered chatbots can handle customer queries in real-time, improving user experience and reducing response time. Chatbots powered by NLP handle customer enquiries more effectively by understanding the context and intent behind questions. They provide relevant answers, collect qualified leads, and escalate complex issues to human agents when appropriate. This automation improves the customer experience while reducing manual workload for marketing teams. The tone and sentiment of prospects' messages can be analyzed using NLP. It can determine the emotion of the text input and filter out high-quality leads for the sales team. Smart assistants like Alexa, developed by Amazon, or Siri by Apple are prime examples of how NLP is currently being leveraged by technology companies to provide an improved consumer experience. Ecommerce websites using chatbots see their average order value rise by about 20% within the first week.

V. BENEFITS

The integration of NLP into marketing strategies yields several significant benefits. NLP ensures consistent branding across all communication channels. Other benefits of NLP in marketing include [10,11]:

- *Automation:* Marketing automation platforms use NLP to trigger personalized campaigns based on customer communication patterns. Beyond insights, NLP drives significant automation and efficiency in marketing operations. This saves countless hours that would otherwise be spent on manual data review.
- *Increased Efficiency:* Manual data analysis can be incredibly time consuming, especially when dealing with unstructured data from varied sources, such as social media, customer reviews, and forums. NLP automates the extraction of relevant information, significantly reducing the time needed to gather and analyze data. This increased efficiency frees up marketing teams to focus on strategy and implementation rather than getting bogged down by data processing.
- *Enhanced Decision-making:* NLP technologies transform complex, voluminous datasets into clear, actionable insights that marketers can easily interpret and use. NLP converts data into straightforward narratives or summaries, allowing marketing teams to make informed decisions swiftly, and ensuring strategies respond to current market dynamics.
- *Improved Accuracy:* NLP's ability to process and analyze large datasets with an understanding of language nuances greatly enhances the accuracy of customer insights and trend predictions. NLP can also help navigate regional differences so marketers can make more informed decisions. This precision helps marketers tailor their approach more effectively, leading to better customer engagement, targeted marketing campaigns, and ultimately, improved return on investment (ROI) on marketing efforts.
- *Sentiment Analysis:* Extracting the sentiment of a text is among the most popular NLP tasks in marketing and has been employed across many different applications. Sentiment analysis is the "identification of positive or negative orientation of textual language." Closely related to sentiment analysis is the detection of different emotions (e.g., anger, joy, disgust).
- *Personalization:* Modern customers expect personalized interactions across multiple channels, and NLP makes this personalization scalable by understanding individual customers' language patterns and preferences. This enables hyper-personalized content delivery that resonates with each customer's specific interests and language patterns. For example, NLP can detect when customers use language suggesting they are researching competitors or expressing frustration with current solutions. This insight triggers personalized content designed to address specific concerns or highlight relevant product benefits. NLP also enables dynamic content personalization that adapts in real time.
- *Data Privacy:* Handling sensitive customer conversations and personal data requires strict adherence to privacy regulations and ethical guidelines.
- *Bias:* NLP models can inadvertently perpetuate or amplify biases present in their training data, leading to discriminatory or unfair marketing practices. Ensuring fairness and mitigating bias is a critical ongoing challenge.
- *Hallucinations:* Another notable challenge is the phenomenon of "hallucination," where models generate convincing, but inaccurate or fictional information. This underscores the importance of human oversight in the process, ensuring outputs align with factual accuracy and are contextually appropriate. Hallucinations occur when generative AI systems confidently produce distorted, inaccurate, or entirely false information. In the context of marketing, such inaccuracies can severely impact brand reputation, lead to misleading campaigns, and erode consumer trust. AI hallucinations can manifest in various forms, from generating incorrect product specifications to fabricating customer testimonials or misinterpreting market trends.
- *Integration:* The digital marketing landscape is inherently multimodal, encompassing text, images, videos, and audio. A significant challenge for NLP in marketing is effectively handling and integrating these diverse data types, a concept known as cross-modality. While NLP excels at processing textual data, extracting insights from a combination of text and other media presents considerable technical hurdles.
- *Complexity:* Anyone who has ventured into learning a foreign language understands the complexity, diversity, and occasional absurdity of language. Take English, for example, with its intricate web of syntax and semantics, numerous irregularities, and puzzling contradictions, making it a notoriously challenging language to master.
- *Accuracy:* One of the major growth restraints for the natural language processing industry players is related to achieving essential accuracy in cases where there are misused or misspelled words from the user's end. Such issues can have a drastic impact on the final text analysis and response.

VII. FUTURE OF NLP MARKETING

NLP applications in marketing continue to move from extracting single words, to combining words into topics, to relationship extraction. The future of NLP in marketing involves embedding-based approaches for novel tasks such as automated text generation and multimodal representation learning. Once word embeddings are constructed, one can look for relationships between words by calculating similarities between words such that words that appear in similar contexts tend to carry similar meanings.

The natural language processing (NLP) market is projected to grow at a significant rate due to growing use in customer service and data analysis, and the increasing volume of unstructured text data. The market is projected to grow owing to the rising applications of AI in the development of smart assistants that have become a common part of the everyday lives of the general population.

VI. CHALLENGES

Despite its numerous advantages, the application of NLP in marketing is not without its challenges. Challenges related to data privacy, bias, and contextual understanding persist. One of the primary challenges in marketing analytics is translating complex, often unstructured, data into actionable insights that are readily understandable by non-technical marketers. Other challenges of NLP in marketing include [10,11]:

CONCLUSION

Natural language processing is no longer a futuristic concept but a present-day imperative for marketers seeking a competitive edge. It has emerged as a transformative technology across various industries, with its application in marketing offering unprecedented opportunities for understanding consumer behavior, personalizing customer experiences, and automating communication. It has become a mature and indispensable tool for marketers. From deciphering complex customer emotions to personalizing every interaction and optimizing content for maximum reach, NLP provides the tools to transform raw data into actionable strategies. By embracing NLP, marketers can move towards more intelligent, efficient, and customer-centric strategies, ultimately driving greater engagement and business success.

Employing natural language processing techniques in marketing is no longer just an option, but a crucial step towards staying competitive in today's digital landscape. By incorporating NLP tools and strategies, businesses can not only streamline operations but also establish meaningful connections with their target audience. From smarter chatbots to content generation, NLP is reshaping how we build relationships with audiences. More information about the integration of NLP in marketing can be found in [12-15] and the following related journals:

- *Natural Language Processing Journal*
- *Journal of Emerging Technologies and Innovative Research*

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