1. Literature Review

Introduction

This study undertook a comprehensive review of pertinent literature spanning natural language processing, deep learning methodologies, as well as scholarly works concerning social media dynamics and branding strategies. This literature review delves into the nuanced dynamics of brand perception within the context of social media interactions. It specifically examines the utilization of NLP techniques to extract semantic insights from textual social media content, the application of pre-trained models for question answering and the implementation of time series analysis on the sentiment score to discern temporal patterns in social media engagement. Through this comprehensive scope, the review aims to offer a holistic understanding of the multifaceted relationship between social media discourse and brand perception.

1. Understanding the Role of Social Media in Brand Perception

A range of studies have highlighted the significant impact of social media on brand perception. (Rizwan Ali Khadim, B. Zafar, and M. Younis, 2014) and (L. V. Thang et al., 2016) both studies found that social media communication and engagement can positively influence consumer brand perceptions and purchase intentions. This is particularly true for technology-oriented brands. (Helal and Ozuem, 2021) and (Dwairi, Harb and Shehabat, 2020) further emphasize the role of social media in fostering brand-customer relationships and creating brand awareness, with e-WOM and user-generated content playing a key role in this process. (Ismail, Nguyen and Melewar, 2018) and (Ferreira and Zambaldi, 2019) delve into the impact of perceived social media marketing activities on brand and value consciousness, with (Ismail, Nguyen and Melewar, 2018) also highlighting the potential for social media to influence materialism and conspicuous consumption. Lastly, (Guida and Wilson, 2017) underscores the role of social media in shaping brand perceptions in the fashion industry, particularly through the development of brand-customer relationships.

Social media are online environments that are created and facilitated by computer-mediated technology. As a result, businesses can utilise these kinds of media as a powerful instrument for marketing and advertising to reach various client segments both locally and internationally and build brand awareness. There isn't much data on how social media platforms affect customers' development of brand awareness. Furthermore, not every business succeeds in this attempt. Thus, further study in this area is important. In response, this paper provides a useful chance to identify and investigate the critical elements that could contribute to the development of such behaviour and suggests a model for such phenomena. The study's findings demonstrated that consumer establishment of brand awareness is positively impacted by e-WOM, user-generated content, and product quality. The results contribute to understanding of the value-enhancing potential of social media campaigns and demonstrate how the perception of brands is influenced through this new communication channel .

This study partially addresses the drivers of brand corporate reputation attributable to branding in social media, in particular, the building of community engagement and two of its antecedents. They tested a theoretical framework with brand involvement and perceived homophily as the antecedents of social media community engagement and the relation of the latter with the corporate reputation (Van Doorn et al., 2010; Wirtz et al., 2013). Research suggests that creating a brand community or page on social media improves brand corporate reputation (Dijkmans, Kerkhof and Beukeboom, 2015) increases sales and returns on investments, and fosters positive word-of-mouth (Kumar et al., 2013).

This research investigates the impact of perceived social media marketing activities on brand- and value consciousness. It further examines the effect of social media usage on materialism, brand consciousness and conspicuous consumption, as examining materialism-centric behaviour is becoming important in a consumption-based economy. A self-administered questionnaire was developed and administered to a sample of 346 undergraduate students. Two different research models are tested and confirmed. The findings of this research indicated that perceived social media marketing activities have a significant effect on brand loyalty; brand consciousness and value consciousness mediate the relationship between perceived social media marketing activities and brand loyalty. Moreover, evidence supports the idea that the greater the use of social media, the greater the tendency towards materialism and conspicuous consumption. This study confirms the growing importance of perceived social media marketing activities in envisioning brand loyalty and provides insights into the impact of social media on materialism and conspicuous consumption (Ismail, Nguyen and Melewar, 2018).

The study of (Khan et al., 2023) says whether it is based on fact or fiction, a brand’s image is a crucial part of its overall marketing strategy. A brand image is an association formed in a consumer’s mind when they think of a specific brand. Overall, a brand’s image can be defined as a consumer’s impression or memory of a particular product or service. Social media influencers often send out more product messages to consumers than companies do. By using social media influencers to promote a product, consumers’ perceptions of it changed (Arora and Sanni, 2019). This was also in line with the findings of a study that found that the stronger the influencers’ brand images of a product, the stronger the perception. According to (Chakraborty and Bhat, 2018) social networking, influencers can help brands build positive brand perceptions because they are more effective at influencing consumers’ behaviours and purchase intentions.

However, as time passed, social networking sites evolved into a complex amalgamation of endless opportunities from the fields of artificial intelligence (Chin, Marcelin and Newsted, 2003), cognitive science, machine learning (Djafarova and Rushworth, 2017), deep learning, image processing (Dodoo, 2018), cryptography and network security (Freberg et al., 2011). Customers live in a digital world where almost everything is accessible via a single click or touch. From monstrously large desktop computers to small laptops, palmtops, and now smartphones, humans have advanced toward a century of endless opportunities. One such example is social networking markets, also known as electronic stores or e-commerce, which have drastically changed the way consumers shop now. They have not only transformed the product sales process as a whole but have also changed consumer purchasing habits.

Natural Language Processing is a branch of machine learning that deals with text and speech. Natural Language Processing is a way for computers to analyse, understand, and derive meaning from human language in a smart and useful way. By utilizing Natural Language Processing, developers can organize and structure knowledge to perform tasks such as automatic summarization, translation, named entity recognition, relationship extraction, sentiment analysis, speech recognition, and topic segmentation. NLP has gained much attention for representing and analysing human language computationally. It has spread its applications in various fields such as machine translation, email spam detection, information extraction, summarization, medical, and question answering etc. In understanding this computational representation of human language, it's essential to make a token distinction, where a token represents an instance of a sequence of characters grouped as a useful semantic unit for processing, while a type encompasses all tokens containing the same character sequence (Rizwan Ali Khadim, B. Zafar, and M. Younis, 2014).

The study of (Liu et al., 2020), aimed to understand the mental health disparities faced by the transgender community, researchers analysed social media posts to categorize sentiment and build machine learning models. This analysis of social media data has the potential to improve our understanding of the transgender community's well-being and inform interventions to support them.

The methods and difficulties of sentiment analysis are described by (Khan et al., 2016). The biggest obstacle in this field is the dearth of dependable and effective software and resources. Additionally, they suggest enhancing language understanding to enhance knowledge extraction. It covers a wide range of business and social science disciplines. Analysing sentiment is a more recent marketing technique. They employed machine learning to find a solution. They contest that NLP is qualified to respond to any of its queries. Negation is predicated on NLU issues, such as word sense disambiguation, co-reference resolution, and domain awareness. Since sentiment analysis solely examines sentiment, it is a limited NLP topic. With complex network analysis, you can arrange text at random.

Semantic analysis is an essential feature of the Natural Language Processing (NLP) approach. It indicates, in the appropriate format, the context of a sentence or paragraph. Semantics is about language significance study. The vocabulary used conveys the importance of the subject because of the interrelationship between linguistic classes.

Researchers (Wong, Damjakob and Hu, 2021) argue that current success metrics for natural language processing models, particularly transformers, don't fully assess their ability to grasp complex relationships and understand text holistically. Studies show these models often rely on memorization or shallow reasoning on datasets like SQUAD or RuleTakers, excelling at tasks requiring simple phrase matching. This proposal explores modifying the transformer's attention mechanism to a sparser structure, aiming to improve performance on difficult reasoning tasks, generalizability, and learning efficiency. They utilized pretrained transformer models, namely BERT, to measure baseline performance. They evaluated their models using the CLUTRR codebase and test for generalizability by applying their models to noisy CLUTRR and other variants. These are a standard BERT model with added Feed-Forward architecture, BERT with an added transformer structure and 3 versions of BERT with added regularized transformers. They fine-tuned BERT models to the reasoning task and enhanced them by requiring sparsity for the Graph Network implied by the transformer encoding. The researchers posited that this could be achieved by including regularization terms in the loss function, pruning pre-trained models, or using specialized versions of multiheaded attention. Apart from the effect of sparsity, they were also curious about the combination result of transformers and pre-trained models. They have successfully introduced the distributional regularization attention model, which is the first attention model to directly restrict graph connections across attention heads by a penalization method. They’re also saying that despite robust performance gains in the presence of noise variables, regularized BERT models improve performance for long-relation tasks, highlighting a need for further research to enhance logical reasoning in NLP and NLU models.

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| **Author(s)** | **Year** | **Applications** | **Data Analytics Techniques** |
| Liu Y., Wang Y.,  Zhao Y., Li Z. | 2020 | Mental health disparities in the transgender community using social media sentiment analysis | Kappa Score, Bag-of-Words, TF-IDF, Naïve Bayes, Random Forest, SVM, Logistic Regression, K-Nearest Neighbour, CNN, LSTM |
| Justin Wong, Dominik Damjakob, Xinyu Hu. | 2021 | Transformers for Textual Reasoning and Question Answering | BERT with Feed-Forward architecture,  BERT additional transformer structure,  BERT with regularized transformers (3 versions). |
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