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Abstract

In the digital era, emerging technologies such as Vision Pro are crucial for businesses due to their transformative potential across various industries. As an amalgamation of augmented reality (AR), virtual reality (VR), computer vision, and machine learning, Vision Pro technology represents a frontier in the intersection of human-computer interaction, offering innovative solutions and opening up new avenues for value creation in business. Considering the primary stages of this technology, this study aims to explore the spectrum of reactions in Vision Pro, presenting a sentiment analysis of the 'VisionPro' subreddit, a community dedicated to discussing vision technologies. Through sentiment analysis, we could discern patterns that suggest the factors driving positive and negative reactions within the community. This paper sheds light on the specific sentiments prevalent in the 'VisionPro' subreddit and demonstrates the applicability of sentiment analysis in understanding community dynamics in technology-focused online forums. The findings contribute to the broader discourse on public sentiment towards emerging technologies, offering implications for developers, researchers, and enthusiasts engaged in vision technology.

Keywords: *Vision Pro, Sentiment Analysis, RedditExtractoR, Augmented Reality, Virtual Reality*

Introduction

In recent years, Virtual Reality (VR), Augmented Reality (AR), and Extended Reality (XR) have emerged as transformative forces in technology, redefining how people interact with digital environments and the world around us (Fast-Berglund *et al.*, 2018; Jiang *et al.*, 2023). VR immerses users in a wholly digital environment, creating an entirely computer-generated simulation of the natural world or a fantasy landscape. On the other hand, AR overlays digital information onto the physical world, enhancing reality with computer-generated perceptions that coexist with our natural environment. XR, a broader category encompassing VR, AR, and everything in between, represents the full spectrum of these immersive technologies, pushing the boundaries of digital and physical realities (Prahani *et al.*, 2022).

Harvesting the power of those advancements, Apple introduced Apple Vision Pro, a cutting-edge device that redefines how users engage with augmented reality experiences (Apple Inc., 2024). Apple has been actively involved in patents for augmented reality (AR) and virtual reality (VR) technology (Perry, 2020). In this direction, Perry (2020) emphasises the potential for Apple's vision processing technology in the AR and VR market, which is projected to grow significantly in the following years. Since its introduction on February 2, 2024, Apple's Vision Pro (AVP), a revolutionary spatial computer that seamlessly blends digital content with the physical world, has gained much attention from tech enthusiasts and Apple's loyal customers. Additionally, social media has been overwhelmed with user-generated content (UGC) from users reviewing the product.

Although AR/VR/XR headsets are not new, Vision Pro has rekindled the world's interest in this technology. Deciphering the pulse of VisionPro, especially in the first months of its release, becomes critical for understanding future directions of technology that can be utilised, especially in a product that uses such innovative technologies. To better understand AVP's community feedback, opinions, appraisals, emotions, or attitudes towards Apple Vision Pro, sentiment analysis

was conducted in the r/VisionPro community on the Reddit platform. By the time the data were collected, the community had 65k members and was ranked in the 2% top communities in Reddit.

Utilising the RedditExtractoR package within R Studio, we extracted a substantial dataset comprising 991 posts along with their comments to gauge the community's reactions, ranging from positive to negative sentiments. Our methodology involved pre-processing the data for natural language processing (NLP) tasks and employing sentiment analysis techniques to classify and quantify the sentiments expressed in the subreddit's discourse. The analysis revealed significant insights into the community's perceptions, concerns, and enthusiasm regarding vision technologies, highlighting trends and shifts in sentiment over time.

The sentiment analysis conducted on the VisionPro subreddit contributes valuable insights into the prevailing sentiments and perceptions within the AR and VR enthusiast community. By uncovering the predominance of positive sentiment and identifying areas of concern through negative sentiments, the study offers actionable data for businesses across various functions. Marketing teams can leverage the positive sentiment to strengthen brand positivity in external communications, while product development teams can utilize feedback from negative sentiments to drive innovation and improvement efforts. Additionally, strategic planning and CSR initiatives can align with community expectations, fostering stronger connections and resonance with consumers. Overall, this study highlights the significance of sentiment analysis in understanding user sentiment and guiding strategic decisions, ultimately enhancing engagement, satisfaction, and strategic alignment within the AR/VR market.

Background literature

AR/VR/XR Devices

The arrival and evolution of Augmented Reality (AR), Virtual Reality (VR), and Extended Reality (XR) devices have catalyzed a paradigm shift in how we perceive and interact with digital information, bridging the gap between the virtual and physical worlds (Jiang *et al.*, 2023). These technologies, each distinct in their immersive capabilities, offer a spectrum of experiences ranging from the overlay of digital content onto the real world (AR) to fully immersive environments (VR), and a blend of both (XR) (Fast-Berglund *et al.*, 2018). The proliferation of these devices has not only expanded the frontiers of entertainment and gaming but also revolutionized various sectors, including education, healthcare, and manufacturing. By enabling immersive learning environments, facilitating remote surgeries, and enhancing design and prototyping processes, AR/VR/XR technologies are reshaping the contours of reality and human experience (Prahani *et al.*, 2022).

The development of AR/VR/XR devices is underpinned by significant advancements in hardware and software engineering, including the miniaturization of components, improvements in display technologies, and the development of sophisticated tracking and spatial recognition systems (Doerner *et al.*, 2022). These technical advancements have made it possible to create more lightweight, ergonomic, and powerful devices, thereby enhancing user experience and expanding their applicability in everyday life. Moreover, as these technologies evolve, they are becoming increasingly integrated with artificial intelligence, machine learning, and cloud computing, opening new avenues for personalized and context-aware experiences. The convergence of these cutting-edge technologies within AR/VR/XR devices not only signifies a leap towards more immersive digital interactions but also poses new challenges and opportunities for innovation, privacy, and ethical considerations in the digital age (Nikolaidis, 2022).

Apple Vision Pro

Already, since its announcement, the academic community has embraced Apple Vision Pro (AVP) by conceptually exploring its uses in several industries and academic fields. Our initial research in the most commonly known database indexes (Google Scholar, Scopus, Web of Science, PsycINFO) revealed an increasing body of literature, concerning AVP, specifically in the general academic field of health. Such research has been conducted in the field of ophthalmology (Jonnakuti and Frankfort, 2023; Masalkhi *et al.*, 2023) with (Waisberg *et al.*, 2024a) addressing AVP as a mean that can enhance visual acuity and hence, improve individuals quality of life, surgery (Olexa *et al.*, 2024; Waisberg *et al.*, 2024b), medicine (Waisberg *et al.*, 2024c), medical education (Armstrong *et al.*, 2024; Waisberg *et al.*, 2024d) and psychological research and therapy (Zhang *et al.*, 2023). Besides healthcare, a significant number of references to AVP in the bibliography comes from the field of consumer behaviour. Several research have referred on AVP as a technology that will impact consumer behavior and society in several ways (van Oosterum, 2023; Rauschnabel *et al.*, 2024).

Methodology

A sentiment analysis was conducted to address this paper's research question. A sentiment analysis, as a methodological approach in the field of text mining, involves the computational processing of opinions, sentiments and subjectivity of text (Medhat *et al.*, 2014). Sentiment analysis proves to be an invaluable tool for businesses, particularly in the process of new product development and planning (Ng *et al.*, 2021). Although the first publication analysing public opinion was

published in 1940, computer-based sentiment analysis began in the 1990's (Bordoloi and Biswas, 2023). Since then, a wide array of methods and techniques have been developed to enhance the field's knowledge base and perform more accurately within the context of the data collection. The procedure consisted of two phases. The first phase involved data collection and the second, data analysis.

In phase A - data collection phase - the RedditExtractoR package (Rivera and Rivera, 2019) within R Studio (Version 2022.12.0+353) was used. The search was performed on February 21, 2024. RedditExtractoR has become a standard tool for extracting post text, comment text and metadata from this platform, widely used by researchers despite its relatively recent emergence (Alvarez and Wolfe, 2024; Smith *et al.*, 2021; Yadav *et al.*, 2022). 991 posts were extracted and conducted the main database that was used in the phase. In phase B, the selected data were analysed with the "State of Change Management", a custom version of ChatGPT (OpenAI, 2023) for sentiment analysis, running on Python and utilizing several Python libraries such as, Pandas, Matplotlib and Seaborn for data visualization, TextBlob for sentiment analysis, WordCloud, NTLK (Natural Language Toolkit) and Python-docx for Microsoft Word (.docx) documents creation and manipulation.

Results

Sentiment Summary

The overall sentiment for both titles and texts leans slightly positive on average, with titles showing a wider range of sentiments (from very negative to very positive) compared to the texts. Texts, on the other hand, tend to be more positive overall based on the mean sentiment score.

Table.1 Summary statistics for the sentiment scores

	Title	**Text**
Statistic	*Value*	*Value*
count	991.0000	806.0000
mean	0.0748	0.1403
std	0.2595	0.2086
min	-1.0000	-0.6667
25%	0.0000	0.0000
50%	0.0000	0.1279
75%	0.1364	0.2464
max	1.0000	1.0000

The sentiment analysis of the text content from the VisionPro database reveals the following insights:

- **Positive Sentiment:** Approximately 71% of the analyzed texts have a positive sentiment.
- **Negative Sentiment:** About 15% of the texts are categorized as negative.
- **Neutral Sentiment:** Roughly 14% of the texts are neutral.

The sentiment polarity scores range from -0.67 (most negative) to 1.00 (most positive), with a mean score of 0.14, indicating a generally positive sentiment across the dataset. The standard deviation is 0.21, suggesting some variation in sentiment across different texts.

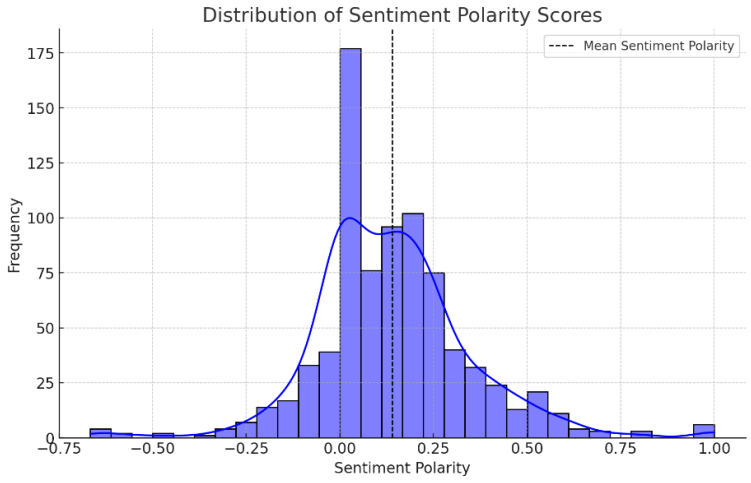

Figure.1 Distribution of Sentiment Polarity Scores

The visualizations provide a clear representation of the sentiment analysis results from the VisionPro posts:

The Sentiment Distribution pie chart shows a predominant presence of positive sentiments (71%) within the dataset, followed by negative (15%) and neutral (14%) sentiments. This indicates that the overall mood of the VisionPro community discussions leans towards positivity. The Distribution of Sentiment Polarity Scores histogram further illustrates this trend, with the bulk of posts scoring positively in terms of sentiment polarity. The mean sentiment polarity is marked by a dashed line, emphasizing the overall positive skew of sentiments in the dataset. These insights suggest that discussions within the VisionPro subreddit are generally positive, with a smaller proportion of negative sentiments. This positive sentiment dominance could be indicative of a supportive and enthusiastic community or reflect the nature of the topics discussed.

Key Example of Positive and Negative Sentiments

Positive Sentiment Example:
- Title: "The foreflight app (voyager) is awesome for planning flights!"
- Text: (This post did not contain text, but the title itself conveys a positive sentiment towards the Foreflight app.)
- Sentiment Score: Positive
- Negative Sentiment Example:
- Title: "Frame syncing with light flicker"
- Text: "I understand that the VP adjusts the cameras' frame rate to reduce flicker, but it's not working well in my case. The flicker is quite noticeable and distracting."
- Sentiment Score: Negative

Visual Representation of Sentiment Scores and Shifts

To visually represent these insights, diagrams showcasing sentiment trends, key phrases driving sentiment, and examples of sentiment shifts would be beneficial. These visual aids can further enhance the understanding of sentiment dynamics within the VisionPro community discussions.

Distribution of Word Count

- **Distribution of Word Count in Titles**: Most titles have a relatively low word count, with most falling below 10 words. This distribution reflects the concise nature of titles.
- **Distribution of Word Count in Texts**: The word count in texts varies more widely than in titles, with a significant number of texts containing upwards of 50 to 100 words and some extending even further. This indicates a broader range of content length in the text fields, from short comments to more detailed discussions.

These visualizations provide insights into the dataset's structure, highlighting the brevity of titles compared to the more variable length of text content.

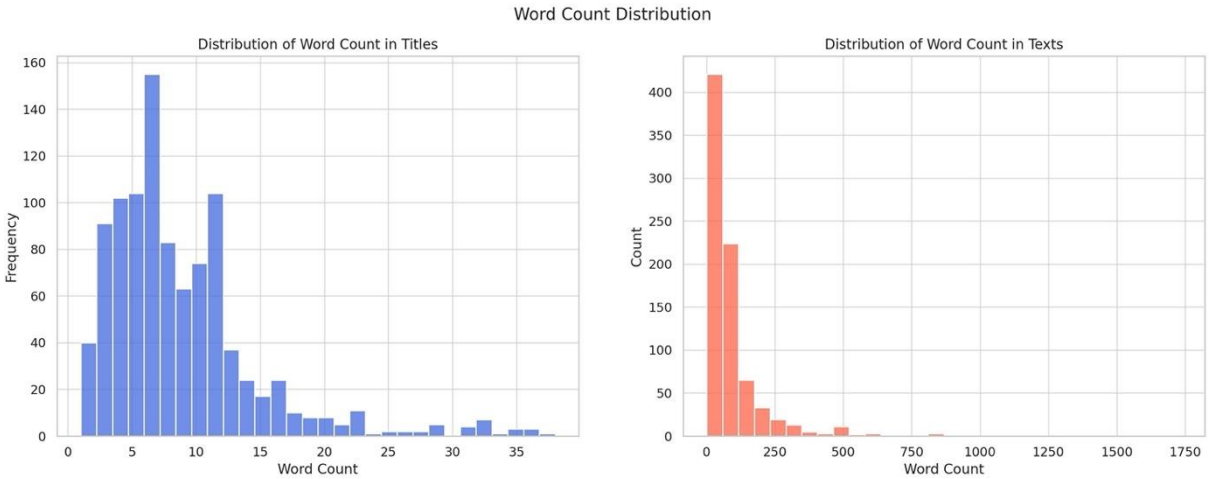

Figure.2 Word Count Distribution

Word Cloud

The Word Cloud visually represents the most frequently mentioned words in the VisionPro posts' text content. Larger words indicate higher frequency, highlighting the key topics and themes discussed within the community. This

visualization helps identify what is most important or concerning to the community members, providing valuable insights into the collective mindset and areas of interest or concern.

Figure.3 Word Cloud for text

Figure.3 Word Cloud for titles

Discussion

In this study, we conducted a sentiment analysis of text data extracted from the VisionPro subreddit to uncover the sentiments among its users and understand the community's general perception of related topics. Our methodology utilized natural language processing (NLP) and machine learning (ML) techniques to parse various posts with titles and textual content through the dataset. The analysis revealed a predominance of positive sentiment, with approximately 71% of the posts categorized as such, followed by 15% negative and 14% neutral sentiments. This distribution indicates a generally favourable view towards the topics discussed within the VisionPro community, reflecting an engaged and possibly satisfied user base. The sentiment polarity scores further supported these findings, showing a mean polarity score of 0.14, suggesting that the overall sentiment leans towards the positive end of the spectrum.

The predominance of positive sentiment towards Vision Pro found in this study aligns with the optimistic reception of innovative technologies noted by Rauschnabel et al. (2015), who found similar enthusiasm in communities discussing VR technology. This reflection points to a steady pattern where emerging tech innovations, particularly in augmented and virtual reality, receive enthusiastic feedback from communities focused on technology. On the other hand, the limited presence of negative sentiments in this study stands in contrast to Jin's et al. (2019) research found a greater prevalence of adverse reactions in broader social media debates about new technology products. This suggests that differences in community sentiment may be influenced by the specific platforms being analyzed. Furthermore, employing RedditExtractoR for methodology is consistent with Proferes et al. (2021) findings on its effectiveness in gathering detailed conversations within Reddit communities. Yet, this research's focus on just one platform for sentiment analysis deviates from the multi-platform strategies suggested by Dhaoui et al. (2017), suggesting a potential limitation in capturing the full spectrum of public opinion.

Given the fluid nature of public sentiment, particularly in the context of rapidly evolving technology, it's vital to study how opinions change through time. Tsou et al. (2013) emphasize the significance of conducting analyses over time in sentiment research, showing how changes in public attitudes correspond with technological developments and societal occurrences. Similarly, Thelwall et al. (2011) highlight the value of longitudinal sentiment analysis in mapping out the progression of public sentiments, providing insights into the factors that influence changes in community sentiment. Integrating a temporal dimension into our sentiment analysis could, as suggested by Kim et al. (2014), provide insights into how particular updates to Vision Pro, media reporting, or significant external occurrences could influence the evolution of community dialogues and sentiments as time progresses.

The implications shed light on the community's dynamics and provide valuable insights for various business functions. For instance, marketing and communications teams could leverage the high prevalence of positive sentiment to reinforce brand positivity in external communications and campaigns. As AR/VR/XR technology continues to advance, collateral opportunities arise for businesses in the context of Integrated Marketing Communication (Koukopoulos and Vrechopoulos, 2020). Similarly, product development teams can utilize the feedback encapsulated in negative sentiments to identify areas for improvement or innovation. Strategic planning can also benefit from understanding the underlying sentiments and aligning their strategies with the community's expectations and concerns. The sentiment analysis serves as a tool for measuring current perceptions, as well as a guide for future actions for relevant stakeholders.

Limitations

It's essential to acknowledge and mitigate possible biases from data sources, especially when they involve self-selecting groups like those on Reddit, to maintain the integrity of research outcomes. Olteanu et al. (2019) underline the difficulties presented by unrepresentative data in social media studies, stressing the importance for scholars to assess and reveal such biases carefully. The unique dynamics of Reddit, where communities are formed around specific interests, can lead to echo chambers that may not accurately reflect broader public opinion, as discussed by Barberá et al. (2015). Within this framework, our research recognizes the constraints due to the self-selected nature of the 'VisionPro' subreddit community and examines approaches to counteract these biases. This is done by employing strategies suggested by Massanari (2017), aimed at refining data gathering and analytical processes in specialized online groups.

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