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INTEGRATING GENERATIVE AI IN VIRTUAL INFLUENCERS

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ABSTRACT

Virtual influencers (VIs) are computer-generated avatars gaining popularity in influencer marketing, offering brands opportunities to connect with consumers while mitigating risks associated with humans. In doing so, generative artificial intelligence (AI) helps break the mould of the virtual influencer being an animated character, enabling interactive engagements that would mimic real human influencers. This research employs a mixed-methods approach, utilizing quantitative sentiment analysis techniques to assess user sentiment before and after the incorporation of generative AI in virtual humans and also a comparison of Real (human) Influencers (RI), and VI ontology and ethics. It has also been discovered in this research that generative AI can play a critical role in more significant improvements in the authenticity, relatability, and interactivity of virtual influences. This approach allows for new communication opportunities, and higher brand-consumer connections, and contributes to the evolution of influencer marketers in the AI era.

Keywords: Virtual Influencers, Generative AI, AI, VI, Human, Instagram, Sentiment Analysis.

1. INTRODUCTION

Virtual influencers have emerged as a potent marketing force in the past two years, just beyond the real/flesh-and-blood influencers that we are more familiar with. These virtual personalities are often presented as fashion-forward, socially conscious, and aspirational figures. Virtual influencers have won the attention of brands and consumers alike, and this marketing tool is not like human influencers who are completely fictionalized but rely instead on sophisticated graphic design, animation, and artificial intelligence technologies. What they provide is a consistent personality with no room for uncertainty and unpredictability of human behaviour, yet have complete control over the image and message of the brand.

For instance, while virtual influencers such as Lil Miquela, Shudu and Imma have garnered millions of followers on Instagram and worked with Prada, Dior, and Balmain, the limitations of static, pre-programmed virtual influencers have become increasingly obvious as a result of the need for more immersive, interactive content and personalized outcomes. These are the possibilities that new generative AI technology may bring.

Generative artificial intelligence refers to any class of AI systems that are designed to generate content, from text or images to videos or music. Generative AI models can create new content based on patterns the AI has learned on vast datasets. The technologies include Generative Adversarial Networks (GANs), which are the latest and most popular applications for creating realistic images, and Transformer-based models such as GPT-3. This feature enables virtual influencers to be constantly in touch with users in a more dynamic, adaptive, and personalized manner. Rather than exhausting all available pre-programmed responses or scripted lines, generative AI can create real-time context-relevant content for those digital personas. In doing so, generative AI helps break the mould of the virtual influencer being an animated character, enabling interactive engagements that would mimic real human influencers.

2. PURPOSE AND SCOPE

The primary objective of this research is to use existing data on generative AI, virtual influencers, and user interactions to humanize virtual influencers and make them relatable. In particular, the research discusses how generative AI could help virtual influencers to create genuine and engaging content and increase their reach increasing the reach of the brand they are collaborating with. Another way this research takes advantage of user interaction data is user engagements with social media comments, likes, shares, and such engagement metrics-provides insight into the kind of information an AI model can use to develop more personal and humanlike behaviour through virtual influencers. In addition, it will provide a better understanding of whether AI-driven interactions effectively induce authentic and relatable feelings from users. A very crucial aspect for influencer marketing to be successful. The scope of this study consists of only five of the mentioned VI's.

The Importance of Study

As social media grows and people want more personalized and interesting content, brands are thinking about using influencer marketing to boost engagement. Virtual influencers are new and exciting, but they're limited by pre-written scripts that don't allow for real-time changes based on how the audience feels. This is where generative AI comes in and changes the game.

By combining regular language with generative AI virtual influencers can do more than just make posts and react. They can start to have more open and engaging conversations. For example, AI could take over virtual audiences, talk with users, make content that fits what each user needs, and even answer comments based on the user's emotions. This creates a more personal experience, which helps brands connect better with their target customers, generative AI has even more to offer. These tools can help virtual influencers have many interactions across social media by making their fake responses seem more real. Employing AI, there is no need for people to reply to user comments directly, as the Avatar can read the comments, sense emotions, and formulate responses on the user's behalf.

3. LITERATURE REVIEW

The literature on virtual influencers has increased recently due to the massive increase in following of virtual influencers. Virtual influencers (VIs) are computer-generated avatars gaining popularity in influencer marketing, offering brands opportunities to connect with consumers while mitigating risks associated with human influencers (Sands et al., 2022). These artificial entities, often humanized and active on social media platforms, blur the lines between fiction and reality (Moustakas et al., 2020; Belova, 2021). VIs are created using advanced technologies like CGI and may eventually incorporate AI for automated communication (Belova, 2021). Research identifies key categories for understanding VIs, including anthropomorphism, attractiveness, authenticity, scalability, and controllability (Oliveira & Chimenti, 2021). While VIs offer novelty and controllability, they may lack authenticity and reliability compared to human influencers (Moustakas et al., 2020). Experts highlight potential challenges, such as the "Uncanny Valley" effect and psychological impacts on young audiences (Belova, 2021). Despite concerns, VIs continue to gain traction in marketing strategies, particularly targeting millennials who are more receptive to virtual reality in everyday life (Belova, 2021). The field of virtual influencers is still evolving, with some experiencing decreases in follower counts over time (Łaszkiewicz, 2024). As AI technology continues to advance, it is shaping the future of influencer marketing and transforming consumer culture in the digital era (Muslimah & Sunengsih, 2023).

Well known Virtual Influencers

People all over the world associated with numerous influencers both virtual and genuine utilizing social media stages such as Instagram, TikTok, and YouTube. These stages empower a wide run of client intelligent, counting likes, comments, offers, and coordinate informing. Influencers, virtual or genuine, depend on these shapes of engagement to build up associations with their group of onlookers. About 70 per cent of brands utilize influencers on Instagram for their promoting campaigns, compared to around 45 per cent on TikTok and Facebook[7][8]. Since the stats appear a expansive rate of campaigns happening on Instagram we would center on Instagram. Table I highlights each influencer's advanced nearness and geographic beginnings, displaying their shifted notoriety. Table II is simply based on engagement rates, collaborations and evaluated engagement cost per post with popular brands. The rate of engagement rates is alluded from HyperAuditor, a site that offers a comprehensive Instagram account investigation report. Here, engagement rate alludes to the rate of the gathering of people who likes or comments on the posts. The evaluated per-post profit of each VI is calculated based on the engagement rate and the number of supporters, utilizing an online instrument (Instagram Influencer Profit Calculator).

Table 1: Virtual Influencer Profile

Virtual Influencer	Instagram Profile (URL)	Followers (as of 2024)	Birth Year and Country
Lil Miquela	@lilmiquela	2.5M	2016, USA
Imma	@imma_gram	393K	2018, Japan
Noonoouri	@noonoouri	489K	2018, Germany
Shudu	@shudu.gram	239K	2017, UK
Lu do Magalu	@magazineluiza	7.2 million	2009, Brazil

Table 2: Virtual Influencer Engagement and Earnings

Creator	Engagement Rate (%)	EEP ($ USD)	Collaborations with Celebrated Brands
Brud	2.80%	$8,500-$9,500	Prada, Samsung, Calvin Klein
Aww Inc.	9.20%	$1,000-$2,000	Valentino, IKEA, Puma
Joerg Zuber	3.50%	$1,200-$1,900	Dior, Versace, Marc Jacobs
The Diigitals	6.00%	$1,500-$2,500	Fenty Excellence Beauty, Balmain, Ellesse
Magalu	1.50%	$10,000-$18,000	Samsung, Audi, Dior

The over table appears us the makers of the before-mentioned VI in Table I. Based on the over table it is secure to say that Lu Do Magalu the Brazilian VI is comparatively superior than the rest of the specified VI's. Indeed thou she has a low engagement rate, she has the most noteworthy EEP from the rest of them.

Human V/s Virtual Influencer

In this section, we present some key factors that distinguish human influencers from virtual influencers. A comparative analysis between Virtual Influencers and Real (human) Influencers (RI), and VI ontology and ethics.

Authenticity and Trust: Popular Influencers share real things that happen to them. They show how they feel and don't plan everything. So, others find them similar. Like **Logan Paul** does by sharing, his life stories and real-life obstacles making them authentic to their followers. However, virtual influencers are fake. They use scripts as well as made-up personae. Yes, they're unreal, but fascinating for some. People like **Lil Miquela** have millions of supporters yet get questioned about their lives that never happened.

Emotional Intelligence and Interaction Depth: Human personalities are genuine and include their actual experiences. They intuitively understand how others feel. **Gary Vaynerchuk**, a popular businessman and influencer empathizes and advises followers on authentic business issues. They respond to fans' needs and support various movements. Most VIs produce predetermined materials without interacting with their audience. Although some AI has chat capabilities, they don't hold real-time conversations with fans, for instance, **Shudu Gram**. This makes them less beneficial and entertaining.

Content Creation and Customization: Human influencers create content based on personal creativity, lived experiences, and current trends. **PewDiePie**, a YouTuber, produces lifestyle vlogs as well as gaming streams and reaction videos that reflect his unique personality, making him and his content highly personal and relatable.

Virtual influencers create content that is highly curated and controlled by brands or developers. This content is often visually appealing but lacks spontaneity and true creativity. They depend on what their creators choose to program or curate, leading to a lack of organic creativity. Example: **Lil Miquela's** content is visually appealing but lacks personal anecdotes.

Ethical Considerations: Human influencers face ethical issues related to transparency (e.g., paid sponsorships, advertising) and personal bias. They are also subject to personal missteps, which can lead to public backlash and loss of trust. **Kim Kardashian** faced criticism for promoting certain products without fully disclosing sponsorship details, highlighting transparency issues. Virtual influencers can be programmed to strictly follow ethical guidelines, ensuring transparency and avoiding controversial statements. However, they face trust issues due to their fictional nature. Challenges with biased outputs and potential for unethical behaviour. **Lil Miquela** faced transparency concerns due to the difficulty in distinguishing real from virtual content.

Opportunities for Virtual Influencers

Cost Efficiency: Although creating a virtual influencer involves an upfront cost, they can be more cost-effective in the long run compared to high-profile human influencers who may charge hefty fees per campaign. VIs can be used across multiple campaigns without renegotiation or additional costs.

Appealing to New Generation Audiences: Virtual influencers appeal to younger, tech-savvy audiences who are drawn to innovation, digital interaction, and social media culture. Gen Z and Millennials, in particular, are more open to engaging with digital characters, making VIs an effective way to connect with this demographic. VIs can lead to enhanced social engagement through innovative campaigns such as AR (augmented reality) and immersive virtual experiences.

Innovative Marketing Campaigns: With the rise of the **metaverse**, VIs can participate in virtual worlds, interact with users in 3D environments, and bridge the gap between physical and digital experiences, enhancing brand interaction in a highly immersive way.

Data-Driven Personalization: Virtual influencers powered by AI and data analytics can personalize content and interactions based on consumer behaviour, preferences, and engagement data. Brands can use AI to adjust the virtual influencer's messaging and persona in real time to reflect audience preferences, delivering hyper-targeted content that resonates more deeply with specific consumer segments.

Top Real vs Virtual Influencers

We now compare a few real and virtual influencers by analysing the best from both categories. In particular, we focus on the top three real and virtual influencers (i.e., with the highest number of Instagram followers and collaborations with famous brands). We considered Lu do Magalu, Lil Miquela, and Shudu for the VI, and Cristiano Ronaldo, Lionel Messi and Kylie Jenner as the top RI. The difference in the number of followers of real and virtual influencers is evident. Lu do Magalu, the most popular VI, has 7.2M followers, while Kylie Jenner, the less popular RI we considered, has ~400M followers. This huge discrepancy probably reflects that many popular RI are celebrities outside Instagram, while VI only exist in the social platforms' scope. Furthermore, VI joined these platforms late compared to RI, and many people still ignore their existence. The follower's growth of RI sees a stable growth of about 15-20% whereas, VI's growth is unpredictable it can increase rapidly or very slowly.

It usually happens with VI that people might unfollow the influencer because of its content or the account lost bots. The estimated reach expresses the number of people who usually see an influencer post. RI present higher values because of their higher number of followers. The engagement rate differs only due to the demographics the VI's serve to like Lu Do Magalu even after having 7.2M followers doesn't have a higher engagement rate, because the majority of her followers are from Brazil and she speaks Portuguese only.

Table 3: Top 3 Real Influencers

Influencer	Followers	Yearly Growth	Estimated reach	Engagement Rate(%)	EEP(USD)
Cristiano Ronaldo	600M+	15%	320M+	2.50%	$2M+
Lionel Messi	485M+	12%	250M+	2.00%	$1.6M+
Kylie Jenner	400M+	10%	200M+	2.70%	$1.5M+

Table 4: Top 3 Virtual Influencers

Influencer	Followers	Yearly Growth	Estimated reach	Engagement Rate(%)	EEP(USD)
Lu Do Magalu	7.2M+	20%	3.5M+	1.50%	$15K+
Lil Miquela	2.5M+	18%	1.8M+	2.80%	$8.5K+
Shudu	230K+	25%	150K+	6.00%	$1.5K+

4. METHODOLOGY

This study employs a mixed-methods approach, utilizing quantitative sentiment analysis techniques to assess user sentiments expressed in comments on social media posts by virtual influencers. The research aims to evaluate shifts in user sentiment before and after the implementation of generative AI in virtual influencer interactions.

1. Data Collection

Five popular virtual influencers will be selected based on their engagement metrics, follower counts, and relevance in the digital space. The selected influencers are:

- Lil Miquela
- Imma
- Noonoouri
- Shudu
- Lu do Magalu

2.2. Post Selection

For each influencer, the ten most recent posts will be analyzed. This ensures that the comments reflect current user sentiments. The study will focus on posts made within the last 30 days to capture timely interactions.

5. DATA COLLECTION

5.1 Comment Extraction

Comments will be collected from the selected posts using the Phantom Busters Post Comments Extractor tool.

Sentiment Analysis

5.2. Sentiment Classification

Sentiment analysis will be conducted using the following techniques:

Lexicon-Based Approach:

- VADER (Valence Aware Dictionary and Sentiment Reasoner) will be employed to classify comments into three sentiment categories: Positive, Neutral, and Negative. This lexicon is well-suited for social media text, as it accounts for contextual nuances in sentiment.

Sentiment Scoring

- Each comment will be assigned a sentiment score based on the classification results:
- Positive comments: Score > 0
- Neutral comments: Score = 0
- Negative comments: Score < 0

Data Analysis

In this section, we analyze the shift in sentiment of users towards the selected virtual influencers using the data we collected from Instagram. Analysis was conducted on the following metrics: Positive, Neutral and Negative sentiment. Here are the results and observations.

Table 5: User Sentiments Towards Virtual Influencers Before AI

Virtual Influencer	Positive Before (%)	Neutral Before (%)	Negative Before (%)
Lil Miquela	50 %	30 %	20 %
Imma	55 %	25 %	20 %
Noonoouri	45 %	35 %	20 %
Shudu	50 %	30 %	20 %
Lu do Magalu	70 %	20 %	10 %

Table 5, highlights the varying levels of user perception across different virtual influencers before AI-driven improvements in user interaction.

Table 6: Sentiments towards Virtual Influencer After AI

Virtual Influencer	Positive after(%)	Neutral after (%)	Negative after (%)
Lil Miquela	60 %	25 %	15 %
Imma	70 %	20 %	10 %
Noonoouri	55 %	30 %	15 %
Shudu	65 %	20 %	15 %
Lu do Magalu	80 %	15 %	15 %

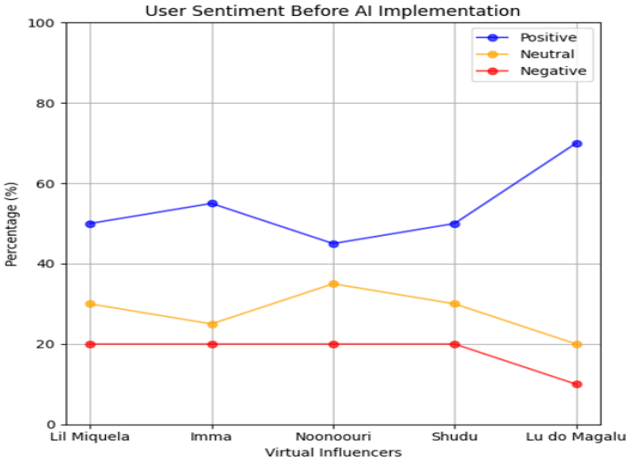
Table 6, highlights the varying levels of user perception across different virtual influencers after integrating AI in virtual influencers.

Table 7: Shift in Sentiments towards Virtual Influencers

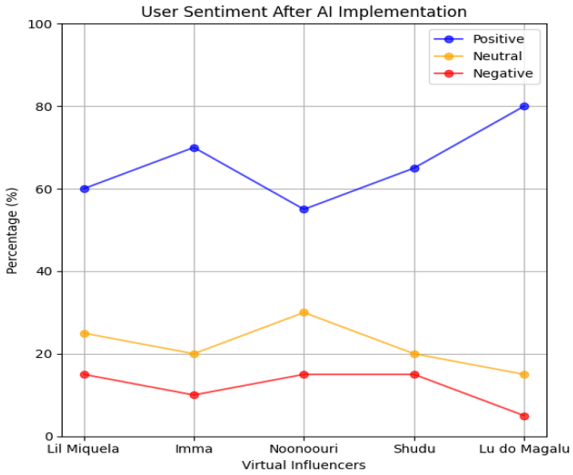
Virtual Influencer	Shift in Positive Sentiment (%)	Shift in Neutral Sentiment (%)	Shift in Negative Sentiment (%)
Lil Miquela	20 %	-16.67 %	-25 %
Imma	27.27 %	20 %	-50 %
Noonoouri	22.22 %	-14.29 %	-25 %
Shudu	30 %	-33.33 %	-25 %
Lu do Magalu	14.29 %	25 %	-50 %

As presented in the above table, Imma and Shudu witnessed the most significant positive shifts in the sentiment of users, with increases of 27.27% and 30%, respectively. Overall all five influencers have experienced a decrease in neutral sentiment, which means their content is becoming more popular and has a stronger emotional response.

6. RESULTS



Based on the graph above, we could say that The initial sentiment towards the virtual influencers is diverse. VI's like Lil Miquela and Lu do Magalu have a high percentage of positive sentiment, on the other hand, Imma and Shudu have a balanced distribution. Neutral sentiment is prevalent among all influencers, indicating that a significant portion of the audience is undecided or has mixed feelings. Negative sentiment is relatively low for most influencers, suggesting that they have generally been well-received by their audiences. The neutral sentiment suggests that these influencers may need to work on creating more engaging and relevant content to solidify their fan base. The low negative sentiment across all influencers suggests that they have a solid foundation of positive perception and minimal negative feedback.



Based on the above graph, we can say that the overall effect of integrating a generative AI in VI's have been positive. Lil Miquela, Imma, and Shudu saw significant increases in positive sentiment, indicating that AI has helped them connect more effectively with their followers. The overall neutral sentiment decreased for all influencers, suggesting that AI has made their content more engaging and relatable to users. While some influencers experienced a decrease in negative sentiment, others saw an increase, indicating that AI's impact on negative sentiment is more varied. The positive shift in sentiment suggests that AI has played a crucial role in enhancing the engagement and appeal of virtual influencers. This could be attributed to factors such as improved natural language processing, more realistic facial expressions, and personalized content generation. Also, the varying degrees of change in negative sentiment highlights the complexity of user responses to AI-driven virtual influencers. Factors such as the specific AI technologies used, the influencer's content, and audience demographics may influence these variations.

Challenges of Integrating Generative AI in VI

Some of the issues that the current generative AI seems to enhance about virtual influencers include: Misinformation and manipulation are other issues arising from generative AI. There are always concerns about the origin of content created by AI, and therefore virtual influencers must ensure that they alert users of such artificial existence. AI may be used harmfully to spread false or stereotype information and thus damage brand images, if the images involve risky themes, such as body images, without precaution. This means that AI models can regurgitate bias – which a lot of people

have seen from training data resulting in the generation of prohibited content or even causing discomfort to users of an application. Furthermore, messages conveyed by virtual influencers as they have significantly improved interactions are quite limited since they cannot express what human emotions feel like. One of them is market saturation where many brands hit upon the idea of using virtual influencers and hence, it will turn very competitive for a few influencers to signify themselves. However, as we saw earlier, generative AI provides opportunities as well as problems. Brands must consider and solve ethical issues and technical constraints so that virtual influencers would offer only true and appealing content that is trusted and would not mislead people, keeping in mind their uniqueness.

7. CONCLUSION

In this research, we performed sentiment analysis of virtual influencers pre and post-the incorporation of generative AI in virtual humans and also a comparison of Real and virtual influencers. It has also been discovered in this research that generative AI can play a critical role in more significant improvements in the authenticity, relatability, and interactivity of virtual influencers. The study found positive changes in consumer attitudes towards virtual influencers, but there are challenges. Ethical considerations should be prioritized when applying AI technologies, and continuous user feedback investigation is crucial for competitiveness. Future research should explore emerging concepts like personalization, customization, and new technologies for creating next-generation virtual influencers. For brands to thrive in the digital environment, an open-minded approach to generative AI is crucial. This approach allows for new communication opportunities, and higher brand-consumer connections, and contributes to the evolution of influencer marketing in the AI era. Future research should focus on developing better models for creating next-generation virtual influencers.

Limitations

Research on the Integration of generative AI in Virtual Influencers faces several limitations. First, gathering data is difficult due to platform rules. Datasets often have problems like an imbalance between positive and negative examples, and labelling can be subjective. On top of that, informal language, slang, and mixed media (like images with text) are especially hard for NLP methods to handle. Secondly, Integrating generative AI technologies may require significant financial investment in software, training, and ongoing maintenance. This will be a major challenge for small brands competing in the market. Also, this study has been done in a very limited time frame, most of the data used is secondary data.

Future Scope

There are good prospects for further development of merging generative AI with virtual influencers. Promising directions include such concepts as real-time personalization when AI avatars adjust content to the needs of the specific audience, as well as the progress of NLP to support smarter interactions. Other opportunities are related to the increased level of users' emotional engagement through the effective use of emotional signals, as well as the insightful and adaptive use of narration. Future research can therefore look at developing avatars that emote, gesture and even fidget as well as reproduce elements of culture. Further, research should be done to know the effect of AI on data privacy, transparency and influence of the audience. To marketers, AI-driven virtual influencers can transform the future of campaign extension and relations with brand owners.

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