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Design and Implementation of an Intelligent Unified Social Media Monitoring Framework: A Multimodal Generative AI Framework

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ABSTRACT

With the increasing popularity of social media, however, there's an absolute lack of preference for the creation of the personalised version, something that is very hard to create efficiently across media (multimodal channels) in the same style. Often dealing with urgent problems within this context, automatic creation of texts with correct mastery of their stylistic features adapted to the various cultures of platforms, this study complements the urgent problem mentioned above. This proposed research is novel in the sense that it introduces a novel "Multimodal Generative Framework (MMGF)" to facilitate the synchronised text-image-video generation process while providing adaptivity, adaptable style variation, and modulation based on LLM, diffusion model and reinforcement learning. This method

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includes a style embedding process (dynamic approach) to guarantee consistency across several modalities, and a reward-based optimisation process to optimise content against participation associated with the platform, measured by metrics. The system runs on the AWS cloud platform, and is tested with multiple large-scale experiments with over one million labelled posts from Instagram, TikTok and Twitter. The results show an improvement of 15 times the production speed in relation to the creation done manually and a style preservation accuracy of 89% for both modalities. 83% of all content that is generated is deemed suitable for direct publishing in user studies, whereas the traditional way of generating content in the pipeline seems poor. The effort would encompass not only the general technical aspects of modularisation, but also basic practical aspects, which would decrease the barriers for small content creators. The features are also shared with the research community, which helps to initiate valuable discussions on ethical issues related to synthetic media on the open-source SocialGen-AI platform. The functions are also made available to the research community, enabling informed conversations around the ethical implications of synthetic media on the open-source SocialGen-AI platform. The results set a new standard for AI-assisted content brands on both a local and cultural level.

The system is based on a dual-layer prompting approach: it normalises the user intent with a large instruction following model, and generates Text, Image, Video materials using both Imagen and Phenaki. The perception module, which is based on the YOLOv8, ensures quality assurance by segmenting and editing the images as well as detecting errors, while human-in-the-loop systems will correct errors like fabrications and inconsistencies in terms of styling the images. To predict engagement, we tested a few regression techniques with the public Instagram Reach Analysis Data, which are available on Kaggle, including the following: Impressions, reach, likes, comments, shares, and profile visits. The tests performed indicated that the data were linear, as Linear Regression had the highest accuracy (R2 = 99.96 %). The other classifiers gave good results: Random Forest: R2 value 89.72, Neural Networks: R2 value 90.06 and KNN: satisfactory results - R2 value 72.82, Decision Tree: poor results - R2 value 44.34. The comparison of the actual engagements with the projected engagements is reinforced with the charts. This all-in-one solution will save time in creating content and planning, and deliver reliable engagement predictions that will turn into a valuable, scalable and brand-safe answer for businesses and small companies.

Keywords: Multimodal Generation, Style Control, Social Media Automation, Generative AI, Content Personalisation

INTRODUCTION

Social media has drastically changed the way knowledge is being shared, collaborated and communicated around the world in the past two decades. The conventional media are often unidirectional and information is sent only in one direction (from the provider to the viewers), while social media are interactive and participatory, real-time media. Users are not just content consumers, users are content producers, users are content distributors, and users are active conversationalists; they can break down the socio-economic, cultural and geographical barriers [1]. Now social media is no longer only a platform for personal communication; it's a platform to get your business out there, to learn, to mobilise for politics, to learn to entertain and to connect around the world. In this section, the methodological trade-offs, limitations of the data sets, and challenges with the interpretability

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of multimodal generative AI are discussed. It gathers comparative views for generative families and highlights regions of well-defined impacts and trade-offs in terms of speed, fidelity, robustness and scalability [2]. The section both emphasises where things are going well as well as the systemic shortcomings regarding bias, computational cost, black-box behaviours from the integration of GANs, Diffusion Models, contrastive pretraining, MLLMs and specialised audio, video, and XR pipelines. Finally, it gives technique-specific recommendations which serve as a practically useful reference for the researchers and the practitioners to see whether the model is suitable for the application and whether the model is fair, explainable and robust to the domain.

$$s(t) = (x * w)(t) = \sum_{a=-\infty}^{\infty} x(a)w(t - a) \quad \text{Eq (1)}$$

W stands for the kernel filter, x stands for the input signal, t stands for time and s is the output signal. The convolution process with two-dimensional input data is described by Equation (2).

$$S(i,j) = (I * K)(i,j) = \sum_m a \sum_n I(i,j) * K(i-m, j-n) \quad \text{Eq (2)}$$

The variables iii and jjj are the spatial position in the output matrix following the convolution operation. In this process, the centre of the filter is matched with the corresponding image area, so as to achieve the best feature extraction effect [3, 4]. Moreover, the proposed framework uses the cross-entropy loss as the optimisation objective, which is shown in Equation (3).

$$S(i,j) = (I * K)(i,j) = \sum_m a \sum_n I(i + m, j + n) * K(m,n) \quad \text{Eq (3)}$$

As time goes on, managing social media has evolved into a challenge for organisations, with issues such as varying standards for content, inadequate posting frequency, and high workloads. The present study presents a Generative AI solution for creating social media content in multiple formats and modelling user engagement, called the Social Media Automator [5].

Image and Video Families (GANs vs. Diffusion vs Text-to-Image/Video)

Problems: Preserving good "feel" and sharpness are important when success is defined by applications where speed and sharpness are valued, like mobile synthesis, interactive art tools etc., which are considered "low latency" [6]. Diffusion Models are used for distribution matching, diversity and human preference and are appropriate for production systems requiring realism (such as medical image augmentation, creative design). Text-to-image/video extensions provide powerful semantic alignment, which is important in interactive prompt-driven workflows [7, 8].

Limitations: GANs are not scalable due to fragile training and mode collapse. Although high quality, diffusion and text-to-video have significant inference costs, and lack temporal consistency and identity preservation for longer sequences [9]. This decreases their utility for deployment in a real-time or low-resource setting. The diffusion-based models are always best looking, more varied and require more computation time and are slower. This is especially apparent, where the diffusion techniques possess high image quality, FID [10], IS [11], CLIPScore [12] while the efficiency-related dimensions (LPR, LY, LSC) are comparatively low for the diffusion techniques compared to the GAN-based techniques [13].

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ReLu

$$f(x) = \begin{cases} 0, x < 0 \\ x, x \geq 0 \end{cases}, f(x)' = \begin{cases} 0, x < 0 \\ x, x \geq 0 \end{cases} \quad \text{Eq (4)}$$

Cross-Modal Retrieval and Alignment (Cross-Modal Pretraining, Fusion, Embeddings)

Advantages: retrieval and zero-shot transfer work very well using contrastive pretraining (CLIP-like) and have good robustness under heterogeneous multimodal datasets. Embedding-based method learns a meaningful, interpretable shared latent space for industrial search and recommendation [14].

Bias: These methods have biases in large-scale web corpora and are vulnerable to domain shift (e.g., medical to legal data). Although fusion strategies can enhance performance, the computation is expensive and they are often brittle when no large-scale pretraining is used [15]. Specialised Understanding Models are not taught in every subject area. Not all subjects have Specialised Understanding Models. Weaknesses: MLLMs are not very good at instruction following, open vocabulary QA, and tool augmented reasoning, which is why they are not very useful in general-purpose assistants and document understanding [16].

Sigmoid

$$\text{f(x)} = \frac{1}{1+e^{-2}}, f'(x) = f(x)(1 - f(x)) \quad \text{Eq (5)}$$

Challenges: Do not all use expert reasoning (e.g., STEM diagrams, charts) and do not have a lack of hallucination. This is the case in specific, narrow and structured domains: specialised captioning or VQA pipelines tend to perform better than MLLMs in these domains, indicating that the extent and reliability of the models' capabilities may be a trade-off [17].

Text-to-Audio, ASR (Audio and Speech Families)

Weaknesses: Text-to-audio systems have a good degree of semantic alignment (CLAPScore) and they are quickly improving in fidelity; this allows them to be used in music recommendation, sound design, and accessibility. Models of low WER in controlled benchmarks are used in voice assistants and transcription pipelines, as ASR models [18].

Restrictions: Although the generation of audio is still genre-dependent and less well-reasoned than in shorter pieces, it still limits professional music production. ASR is not reliable without adaptation, and it fades in accented and noisy speech or when the speech is in a different domain [19].

Tanh:

$$\tan h\,(\text{x}) = \frac{2}{1+e^{-2x}} - 1, f'(x) = 1f(x)^2 \quad \text{Eq (6)}$$

The 3D/XR first approach will be compared to the Cross-Modal synthesis approach.

Challenge: The current techniques of Text-to-3D/XR are challenging for virtual assets, games, design and other applications, especially in light of the new Gaussian splatting and multi-view diffusion techniques [20]. The integration of image, text and audio with cross-modal synthesis families is more factual and more aligned and integrated creative workflows are possible. GAN-based models have low latency (suitable for real-time creative applications), are easy to train and generate quickly, but have stability problems during training and mode collapse at scale (reducing their diversity and robustness) [21]. Although Diffusion Models are more stable during training, they are more capable of representing the data distribution, and have greater fidelity, they come with a high computational cost and latency associated with the iterative sampling procedure, which is expensive for interactive

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systems. Large-scale text-to-image and text-to-video systems use powerful text encoders and transformer backbones, and require large amounts of paired data, with extensive filtering and complicated safety pipelines, which makes scaling and accessibility difficult [22, 23].

Clipped ReLU:

$$f(x) = \begin{cases} 0, x < 0 \\ x0 \leq \text{x} < \text{ceiling} \\ ceiling, \geq \text{ceiling} \end{cases} \qquad \text{Eq (7)}$$

With a variety of social media platforms out there, the one that is ruling the roost is Facebook for business and digital marketers. Instagram [24], Twitter (X) [25], LinkedIn [26], TikTok [27] and YouTube [28] all provide unequalled platforms to target different audiences, recognise products and services and boost brand loyalty. Now, there are billions of people globally who spend much of the day using these platforms and social media is an integral part of digital marketing [29]. What is demolished in traditional advertising – the taboo of one-way communication – is made possible through dialogue and contact between consumers and brands, to the extent that not only can consumers give a sincere feedback reaction, but these consumers can also participate in the decision-making process simultaneously [30].

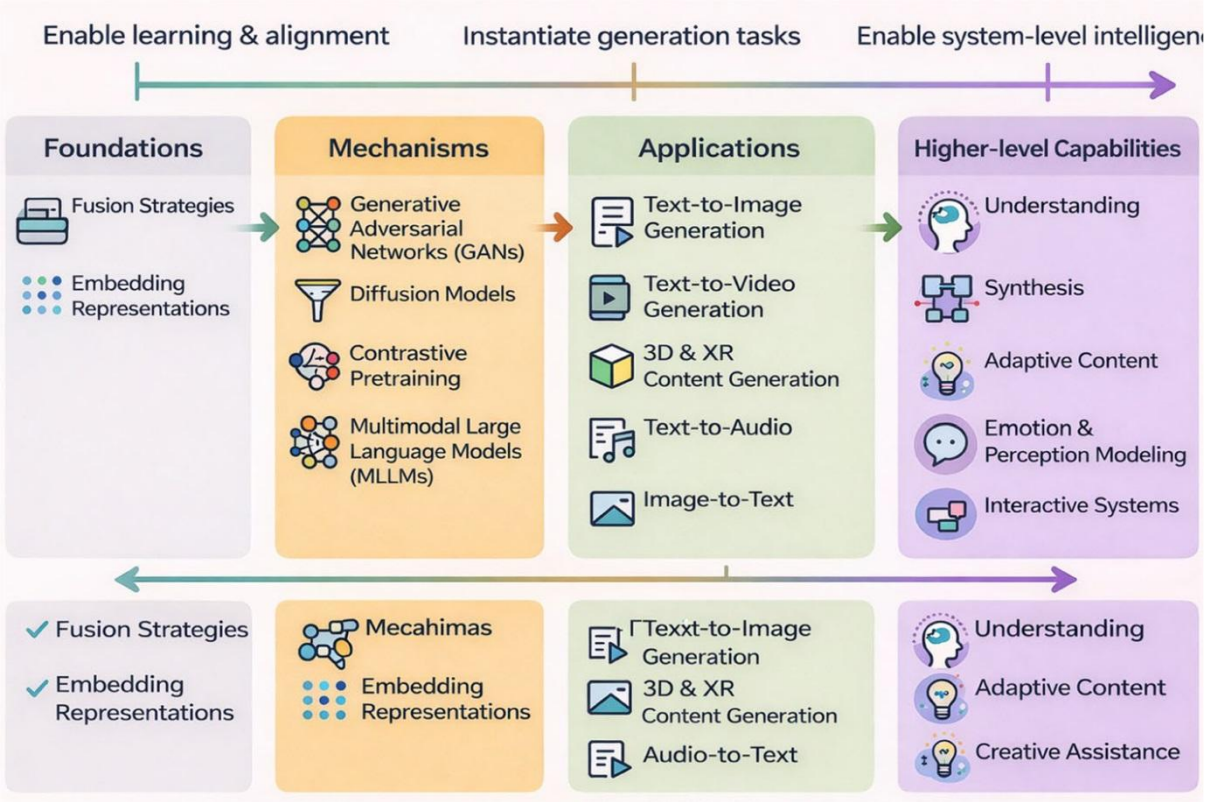

Figure 1 (a): Generic categories of generative AI Architectures for multimodal content

This engagement element sets social media apart in terms of how it affects consumers' perceptions, actions and their affinity with brands on a longer-term basis [31].

One of the most difficult aspects of the application is the disunited nature of social media, however, the benefits of social media are transformative. Each platform has its own customisation, audiences and content dynamics. Instagram's a visual story platform, LinkedIn's a professional networking site, Twitter (X) is the place for microblogging in real-time, and YouTube is a long-form video site. This means that marketers need to create and

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execute a strategy for each platform, which can be time-intensive, difficult to "synchronise," and resource-consuming. This disunity can result in a wide variety of branding issues, with no campaign posts and substandard management efforts [32, 33].

Besides, the amount of UGC is a major contributor to information overload. Millions of posts, comments, likes and shares are produced every second, resulting in a large volume of data that is generated raw [34].

Leaky ReLU:

$$f(x) = \begin{cases} 0, x < 0 \\ scale * x, x < 0 \end{cases} \quad \text{Eq (8)}$$

This information can be a gold mine of knowledge, but extracting actionable information from the unstructured data is not easy for organisations. Without proper business filtering and analytics, it's impossible to fully detail customer sentiment, determine engagement amounts, or evaluate the performance of a campaign; otherwise, businesses could end up without having access to the right information to effectively decipher their customers [35, 36]. There is limited knowledge about the raw data that could make it a strategic marketing tool akin to the power of social media. Researchers and practitioners have devoted more and more time to developing an integrated social media management system over the last ten years [37].

$$\text{Yi} = \frac{\text{Xi} - \mu\beta}{\sqrt{2\sigma^2\beta + \varepsilon}} \quad \text{Eq (9)}$$

These come with an array of platforms all on one dashboard, where one can create, schedule, and publish content to all platforms simultaneously. They also have the capability to incorporate analytics for a more thorough understanding of engagement, audience expansion, and campaign efficiency. Unified platforms not only simplify the processes but also eliminate manual processes and duplication, making them more efficient and consistent from one channel to another [38]. The capabilities of these systems have been further enhanced to encompass Artificial Intelligence, Machine Learning and automation. The analytical power behind AI algorithms can be used to tweak the time you post as well as to recommend trending keywords and hashtags, generate personalised content, and even draw opinions from customers on an even broader scope [39, 40].

$$\sigma\beta = \frac{1}{M}(\text{Xi} - \mu\beta)^2 \quad \text{Eq (10)}$$

Predictive analytics helps marketers while predictive analytics also helps marketers in better anticipating customer behaviours, AI-powered chatbots and virtual assistants help by providing customers with instantaneous information and making the response process automatic [41].

$$\mu\beta = \frac{1}{M} + \sum_{t=1}^{M} \text{Xi} \quad \text{Eq (11)}$$

The changes mentioned are indicative of a transition in the social media landscape beyond being merely a supportive entity to a robust business instrument best suited to provide its owner with a competitive edge in the digital economy [42].

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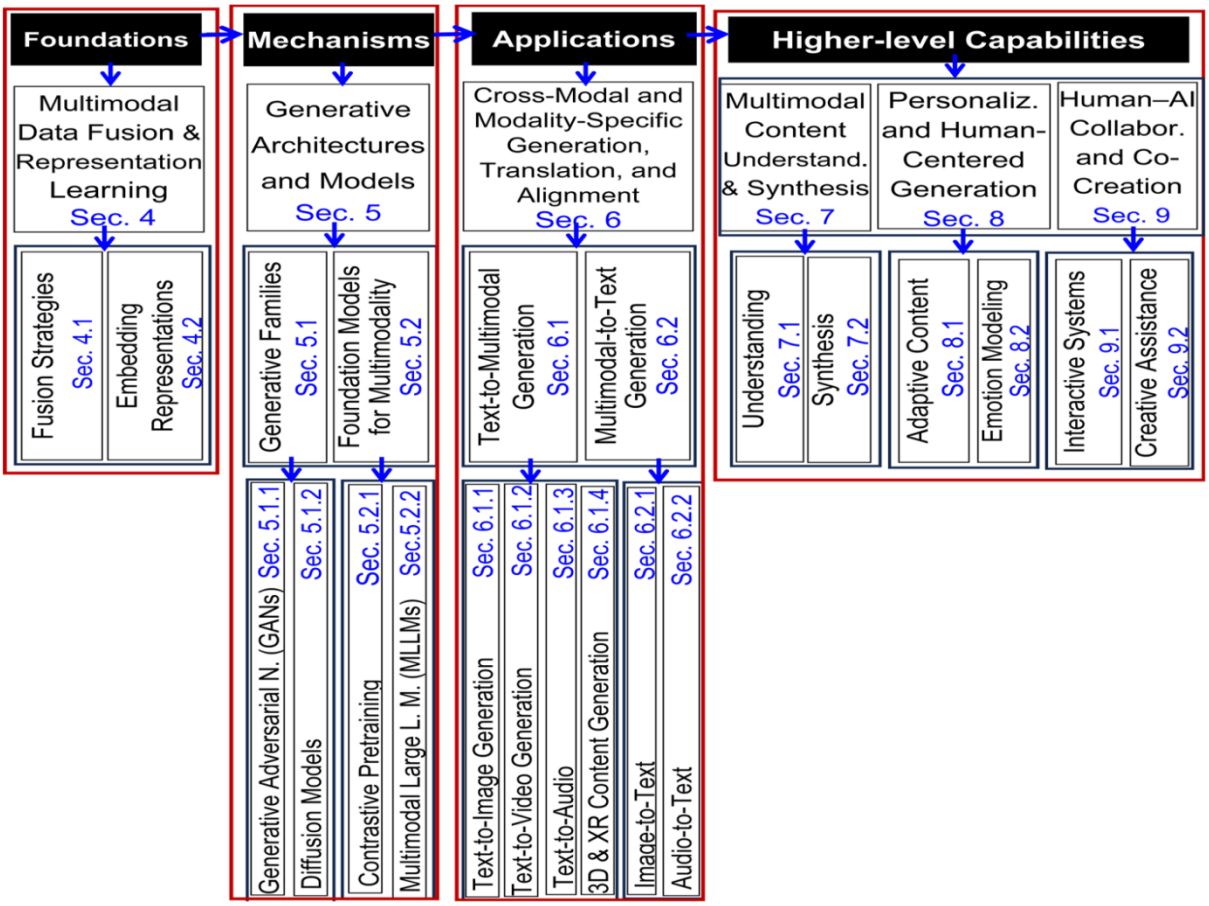

Figure 1 (b): Hierarchical taxonomy of Generative AI for Multimodal Content [43]

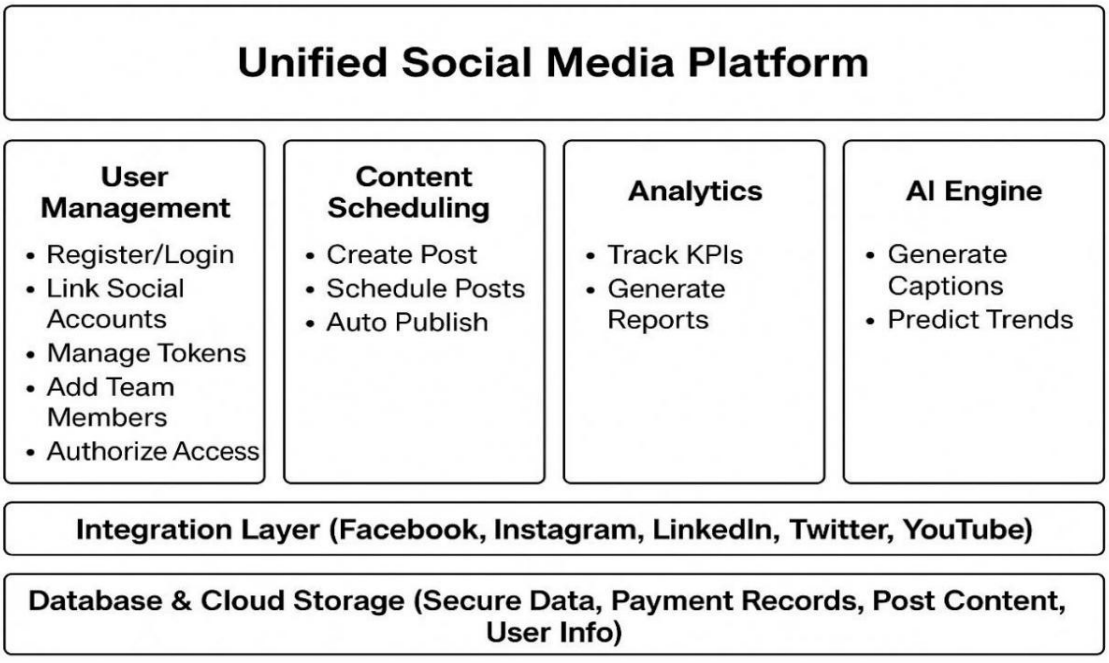

Figure 1 (c): Top-Level Functional Overview [44]

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The article underscores the opportunities for one-platform solutions to transform digital marketing, optimize processes and boost innovation while tracing the trends and challenges of the moment.

$S=w2\times h2\times d2$ Eq (12)

The insights will be valuable to marketers, small and medium businesses (SMEs), and researchers who want to gain insight into the potential benefits of integrated systems in improving efficiency, consistency, and engagement in today's highly competitive digital environment. Over the past 40 years a worldwide computer network, known as the internet, emerged [45]. The Current craze is social media – a group of purposes which are web-based and depend on group or social media interaction. Wider concepts or structures that relate to the use, creation and development of Web 2.0 tools. exchange of user-generated content and act as a new type of communication medium. Some of the most popular social media networks are: Facebook, Twitter and YouTube. Facebook had 845 users up until December 2011. According to Facebook, there are 483 million registered users of FaceBook and an average of 483 million active users on Facebook daily out of 1.4 billion people worldwide [46]. Currently, Twitter has more than 200 million users, and 100 million on the first year. YouTube is restricting its ability as it is removing bad content as well as ads.

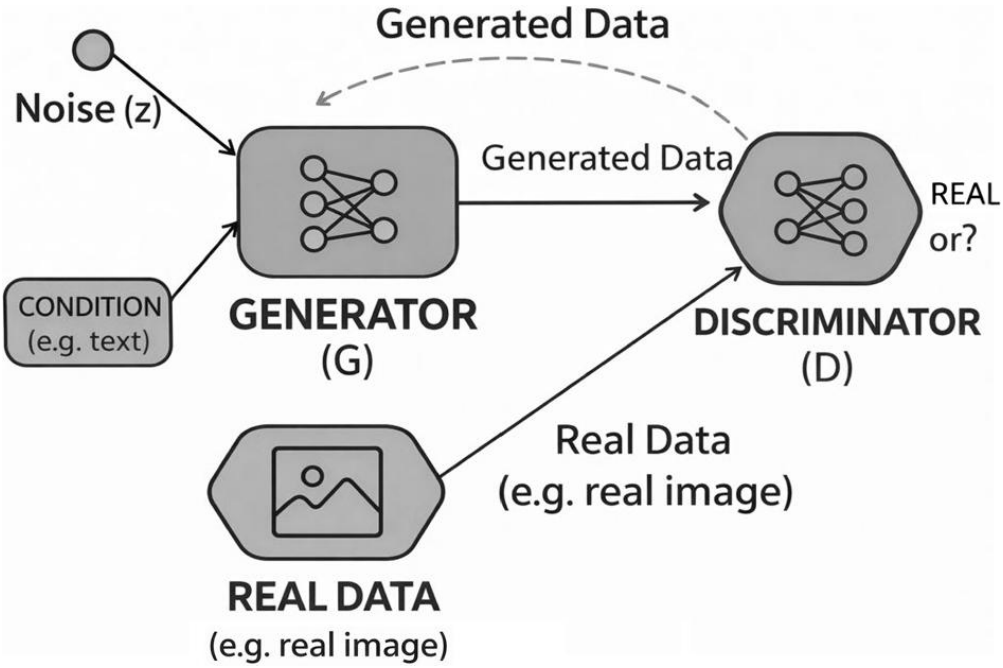

Figure 2: Architecture of GANs for multimodal content generation [47]

roughly the same number of users as Twitter. Many of the pre-existing social media contents are information that Communities-of-interest that describe users– virtual community members [48]. This information reflects the type of "social world" that is available to be supported at the place.

Different criminals were interested in the opportunities that were provided by need, resulting in social media sites becoming host to different criminals. possibilities of sharing and spreading information [49-51]. People were busy at YouTube and openly shared their work. Found the following results about intentions. The man accused, Anders Behring Breivik, whose arguments on June 21, after which he killed 69 people with a pistol and a handgun [52,

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53].

In Utøya Island near the Norwegian capital, Oslo, he posted his video manifesto for the YouTube website and He sent his 1,500- page manifesto at more than 1,000 e-mail addresses 6 hours prior [54, 55]]. Paedophiles around the world are using social media sites to approach underage children; communication infrastructure among the members of protest groups in Arabic countries and encouraged the people to protest. The clashes between the existing government and 'dwelters' have not been overthrown and one of them is the social media sites [56- 59]. These rarely brought information to the outside world to the channels which were not working. The research described in this paper is related to different studies and to some extent, combines the results. In this paper, we will be talking about related research done on Media Monitoring Systems, the architecture design of database system (social network analysis). Project is run by the Intelligence Advanced Research Projects Activity (IARPA) suggested to create 'crisis observatories', which would continuously monitor public information and then conduct large amount of data. Mining to forecast socio-economic situation crises [60, 61]. They recommended setting up observatories for: Financial and financial issues, conflicts, crime and corruption. They analogised social Event forecasting to weather forecasting.Steps from event forecasting to weather forecasting. Although such forecasts are not completely accurate.

Evolution of Social Media Tools and Technologies and Impact of Consumer-Generated Content (CGM)

This objective aims to explore the evolution and shift of social media management tools is the past 20 years. Previously marketers were looking into creating one piece after another for each platform. This was a time consuming and busy process, in particular for reaching out to larger groups. This transformation in Digital marketing, with the help of Analytics dashboards, Automation systems, Content Scheduling tools, and AI-driven applications, resulted in improved data utilization, making it more scalable [62]. The study focuses on the transformation of digital communication as a result of technological innovations, including sentiment analysis, predictive analytics, and integrated dashboards, which have revolutionized how organisations can control their communications on a global scale, with real-time campaigns that are more efficient and effective [63]. While technology has made it easier to build and operate multiple platforms, there are still a number of issues in that regard: Budget allocation, staffing limits and time are all constraints that may stifle marketers ability to perform well for their multi-platform campaigns.

Strategic issues: Developing a consistent messaging and brand approach through platforms that have different audiences is challenging [64].

Technological Issues: Algorithms fluctuate at any moment, new policy changes come out, and some platforms have restrictions that make it challenging to do a campaign. It aims at providing an all-round picture of the ways these problems hinder the stakeholders' perception of the brands, their customer confidence, campaign visibility and the marketing ROI [65]. Consumer-generated content, or what is commonly called user-generated content or UGC, is one of the most important aspects of marketing in today's society. Brand generated content and reviews / testimonials, social media posts and user experiences may be more credible than brand-created content. This study outlines the effect of CGM on brand perception, purchasing decisions and brand loyalty drivers, as well as explores opportunistic opportunities for incorporating CGM in their content strategies through integrated platforms

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[66]. Organizations can then implement higher levels of engagement in line with creating the brand consistency, increase trust and overall reinforce their promotional activities by putting consumers' real voice in a spotlight. A main goal is to delve into the real-world advantages of bringing together various social media platforms into one cohesive ecosystem. This will give the practitioners some guidance and would offer a theoretical contribution for academic researchers, and offer them insights into the best practices of unified digital marketing strategies [67]. A fairly large number of databases were utilized in the literature search to ensure a solid and fair study. Studies were selected from a number of databases in various disciplines. Key terms were selected to be used as keywords to collect the related papers. The following words have been classified into to groups by these keywords. The group was split into two parts: one interacting with IMC and another with social media. AND and/or OR were employed in the search words. For instance, if using AND you combine two words, you will only get papers containing both E.g. Papers containing both terms. This enabled us to improve our search:

The cluster of this is called the IMC cluster; more words in this cluster included in the IM cluster were: Integrated Marketing Communication, promotion mix, marketing communication and brand promotion. These words introduced the studies discussed aspects on promotion and business communication. This paper clarified the concept of how companies utilize the promotion mix while other ones clarified the relationship between IMC and brand promotions [68].

The social media cluster comprised of the following words; “social media marketing,” “consumer generated media,” “one platform social media,” “cross-platform scheduling tools,” “digital promotion strategies.” Here are some of the words that they have found to be able to find papers on-line. Several of them concentrated on the way people put together content, the way companies utilize devices for posting and the manner which digital strategies are mapped out[69].

Assigning both groups, together produced a broad search. It contained numerous marketing and social media studies but yet didn't lose focus. Most significant papers were fortunately thus “covered”, so to speak. Overall, 200 papers were taken. They weren't necessarily all the same variety. Some provided thinking about ideas and concepts, some supplied real-life instances, some gathered previous work and some supplied models and theories. In light of these interactions, the study was able to obtain knowledge from various perspectives [70, 71]. A simple understanding was provided via conceptual papers. They helped me realize the significance and what it means for IMC and social media. The case studies were more down-to-earth. They had a demonstration of how companies are advertising their products on social media. It was helpful they were there as they linked theory to reality. Similarly, the other review papers followed suit and also tested the field to demonstrate the various things they'd done before [72, 73]. This helped my learning gap filling. There were also some theoretical papers that suggested models to be studied and also practiced.

A few papers mentioned just one platform (for instance, Facebook, or Instagram). These demonstrated in detail the process of one application for marketing. The other papers were broader in scope and discussed social media use over various platforms and even in various work sectors such as education, health and business [74-78]. This consisted of detailed and extensive studies, giving both 'macro' and 'micro' perspectives. Indeed had the 283 papers provided a robust and comprehensive review. A thematic coding frame has been developed to analyse the data. Themes were coded from the articles and a thematic synthesis of findings

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was performed. In this process, there were found to be consensus and contradiction in the literature studied. For example, most of the studies highlighted that the fused systems had an impact on efficiency, but there were fewer studies that provided negative information about unified systems using AI with personalisation and fewer studies that discussed the negative aspects of AI personalisation and its potential ethical issues for SMEs [79, 70]. Validity of the study, the construct validity (careful design of the keywords in order to capture the phenomena investigated in the study) and external validity (applicability of the study across industries) were used. There were no primary data collection in this study and no ethical issues were raised as it was secondary data. Special attention was provided to transparency in reporting and limitations to ensure they do not result in having put at risk academic integrity [81].

Data Analysis and Synthesis

Unlike traditional advertising—characterized by one-way, mass broadcasting—digital platforms such as Facebook, Instagram, Twitter (X), LinkedIn, TikTok, and YouTube foster a participatory culture built on interactive, two-way communication [82]. In these environments, consumers no longer act as passive recipients of brand messages but actively engage in dialogue, critique, and co-creation of content, thereby influencing brand narratives in real time. The literature consistently highlights that social media provides several strategic advantages: it enhances brand visibility, builds consumer trust through authentic interactions, and nurtures long-term loyalty via continuous engagement [83, 84]. Beyond relational benefits, the digital environment generates vast consumer datasets that enable firms to implement micro-targeting, behavioral segmentation, predictive analytics, and real-time optimization of campaigns. Consequently, social media has shifted from being a supplementary channel to an indispensable pillar of consumer-centric Integrated Marketing Communication (IMC) strategies [85, 86].

Consumer-Generated Media (CGM) and Trends in Social Media Marketing

Consumer-Generated Media (CGM) is one of the most quickly evolving powerful and disruptive facets of the social media universe. CGM is not just reviews, testimonials, memes, unboxing content, reactions, nor viral challenges but anything in relation to the brand perception that is not made by the brand itself. CGM has been found to be more perceived as 'real-world' and as trustworthy as advertising by companies, hopefully because it is not perceived as being 'sold' for commercial purposes or goals. Positive user-generated content (YC) brands can contribute a lot to the brand's equity, create emotional connection and accelerate purchasing decision-making, and user-generated content (YC) can help [87. 88]. On the other hand, negative CGM comes with substantial risks in terms of reputation, for instance, a voice from Twitter, while probably not fatal, can tarnish credibility, and spread like wildfire and for hours. There is a need for active and engaged collaboration in the development of CGM, according to researchers. This leads to more consumer advocacy and will generate deeper consumer loyalty, because brands that seek consumer input and take an "open book" approach to problem-solve feedback, involve the consumer in co-creation [89, 90]. Also, CGM improves electronic word of mouth (eWOM), which has been proven to be one of the most powerful and effective marketing direct communication methods. By incorporating CGM into IMC, not only do campaigns be more credible but also do they develop relations with consumers over time. One of the conceptual approaches put forth in

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the Integrated Marketing Communication (IMC) is to construct a plan to coordinate the messages to the brand using various channels. The emphasis on concern for consistency, synergy and reinforcement in the delivery of a unified consumer experience that is heavily stressed in IMC literature is no longer being encouraged by the digital world because it is now an IMC two-way interactive world, in which social media plays the key role in getting a unified consumer experience [90, 91]. Social Media provide brands with opportunities and methods to communicate in more personalized ways, through personalized ads that algorithms target, artificial intelligence chatbots and real time interactions with consumers. Results from research clearly shows that messaging integrated into any company's IMC project has higher engagement measures and efficiencies and stronger brand recall that those messaging that does not have any relationship with the IMC projects. The traditional marketing roles have changed, the 4Ps of marketing have undergone significant changes, product, price, place have been transformed and promotion has been changed [92, 93]. This is the most dynamic change in this area. Whereas mass campaigns are being replaced with segmented, personalized and interactive strategies, such as building relationships with influencers, creating real-time brand storytelling and distributing interactive content. For instance, Nike's “Just Do It” campaigns make use of day-to-day social media, and Coca-Cola's “Share a Coke” project used consumer-generated hashtags to make certain their model was more personalized. By integrating customers' opinions to the process of creating products and services, the social media allows for their participation in the co-creation [94].

Nowadays, there are specific disruptive trends refining the method of doing digital marketing, and scholarship can clearly assist you with this objective: Influencer Marketing: Leverages social media influencers as a source of authenticity and reach between brands and audience. While discussing these quality issues such as influencer fatigue, fake followers and over-commercialization also holds new challenges [95]. Immersive Technologies: Augmented reality (AR) filters, Virtual Reality (VR) Shopping experiences and AI personalisation are transforming the customer journeys into interactive memorable shopping experiences Social Commerce, such as Instagram and TikTok pages, have other functions in the apps which facilitate the inclusion of in-app shopping, communication and commerce [96]. AI and Automation: AI-driven scheduling, chatbots and predictive buildin offer the tools to make precision camping on a large scale, and asks questions about personalization and consumer trust [97]. This all speaks to highly interactive, personal and transactional space, a space which is constantly changing with technology and consumer habits. Although there have been tremendous strides, there are some challenges and gaps with regard to the literature: There is a focus on engagement metrics (likes, shares, clicks) suggesting that there is a gap between such immediate indicators and long-term results like customer lifetime value and brand equity [98, 99]. There is a lack of research with solid empirical and theoretical evidence for new platforms like TikTok, Instagram Reels and Threads. Unstandardised performance measures for quantification of. Most research tends to be focused around major corporations and a lack of attention will be paid to how it can be effectively implemented in SMEs, without incurring excessive costs.Most research focuses are usually on big companies and little and no attention is given to how it can be effectively implemented in an SME for (fair) inexpensive and effective. The lack of these limitations highlights the importance of improved research methods that are comparative and longitudinal in nature, to address the gaps in the research [100].

Here are some Great Examples of successful campaigns: Nike, Starbucks, Coca-Cola

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showcase cross-platform storytelling, influencers and consumers! For SMEs this is also handy: unified systems will help to reduce the complexity that can constrain the market entry. However, there is still scope for further investigations within the following areas: integrated social media in Integrated Marketing Communication (IMC); and integrated social media marketing [101]. The results of the previous research have been able to conclude that social media is not only a tool that can support marketing, but it is also a foundation in creating an interactive relationship system between brands and consumers that can impact all areas of companies consumer-brand relationship, brand equity management and competitiveness. For consumers, social media is a double-edged sword; it offers a new opportunity for innovation and engagement in their interactions with the brand, while it may also provide opportunities for confusion, crisis and misinformation. Unified management systems emerge and provide: A single management solution for the same technology, through a unified platform and different channels [102].

Literature Review

Testimonials, user-generated posts and viral campaigns are seen as being more believable and authentic than a firm's campaign. It is indeed likely that Positive CGM will definitely be in the forefront with emotional connection, loyalty, and will make differentiation from word of mouth. But bad news has the power to rapidly expand, further increasing a company's reputation risk exposure. Research focuses on how proactive companies who address negative feedback openly and transparently and who solicit feedback for better collaborate better with their customers both to build trust and for customers to be advocates. Also, there is a lot of positive to IMC and tools associated with social media that are successful and cooperative. By leveraging social platforms, personalization, demographic targeting, and analytics optimization becomes possible if added to IMC strategies. From engagement, visibility and brand equity, Nike, Coca-Cola and even Starbuck's are few of the many worldwide exemplars discussed of the value an integrated campaign brings to the story itself, the need for participation, and cross platform messaging [103]. These are also mentioned in literature as an obstacle, however, some key strategic, operational, and technological challenges have been identified. Some difficulties have to deal with the operation, like managing multiple accounts simultaneously, that necessitates the usage of funds, skills and time. The challenges are how to communicate the same message for different audiences across multiple platforms, and to their different expectations [104]. The other constraint is that algorithms and other platform specific features are changing continually as well as privacy laws and the regulations about them. Marketers have been using rates of likes, shares, or comments as the measure of success, but, these measures don't work long term that have long term effects such as customer lifetime value or long-term brand equity. This is worsened by the SMEs, due to inadequate resources and skills. New platforms such as TikTok, Instagram Reels, and Threads have not received much attention in academic articles and integration models or frameworks that have been tested for their effectiveness and used to help support effective adoption over the last 4 years. The impact of the studies in general stress that the problem of fragmented social media management can be solved by bringing up a social media management system [105-108]. These platforms give the main axis of control of the dashboards to schedule, monitor and analyze performance in several channels. They reduce duplication of effort, increase efficiency, uniformity of brand and holistic analytics. For small businesses, these tools are crucial to making things easier, their workflow is more

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manageable, and their scalability adds to their value. The second avenue of opportunity is the convergence of the technologies [109-113].

Artificial Intelligence (AI) and machine learning (ML)

Artificial Intelligence (AI) and machine learning (ML) can provide predictive insights, optimize the distribution of content and improve the personalization of content. The automation tool does the job of scheduling and reporting; allows marketers to allocate more of their time on strategy and less on repetitive tasks. Consumers are interacting with brands in augmented and virtual reality, and it's having an impact.Consumers are now interacting with brands and in augmented (AR) [114] and virtual reality (VR) [115] which is impacting consumers in meaningful ways.AR (Augmented Reality) and VR (Virtual Reality) are technologies that bring an interactive and memorable "immersive experience" to engagement and are revolutionizing the way that consumers have historically engaged with new brands and products. With the rise of social commerce, where people can buy and sell directly within the social space, the opportunities are even wider, with social communications, social engagement and buying/selling right in the same consumers' path [116-119].

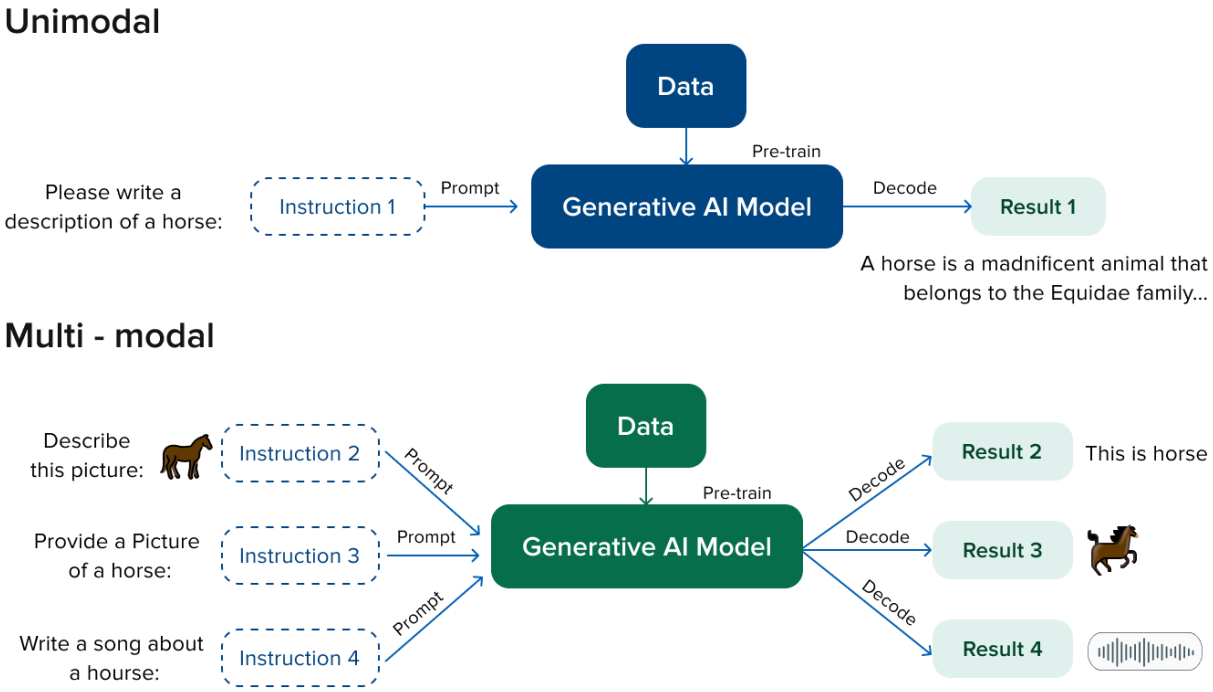

Figure 2a: Architecture of the Unified Unimodal and multimodal AI Management System

Reviews of Platforms: The first step is for the company to scrutinize all the social media they are utilizing. They can keep a miniature list of platforms, such as Twitter, Facebook or Instagram and record the number of posts that go and the number of replies they receive [120, 121]. This step is easy yet crucial since it indicates which platform is healthy and which one is getting close to death. For instance, there may be times when you get loads of likes on Instagram and scarcely any on Twitter [122-124]. The merged analysis confirms its value that the integrated approach to social media as a part of IMC holds great promise, yet it is also faced with many challenges. It allows companies to enhance engagement, personalization, and efficiency, while at the same time being mindful and responsible for their efforts, as well

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as being flexible, minimalistic, and adaptable. A one-size-fits-all approach to digital marketing, consumer-centric digital marketing, unifying marketing management systems and tools powered by AI are likely to be the cornerstones of digital marketing tomorrow [125-128]. In this article, it's clarified that social media has developed from personal messages to a force for promoting, corporate activities, and consumer culture. Its reach spans various sectors and empowers companies to create greater engagement, expand reach and bring consumers to the value creation process. A hallmark of social media that remains the same, however, is that there are ample opportunities to work together innovatively and grow, but there are also challenges: incorrect information, privacy concerns, campaign challenges, and more [129, 130].

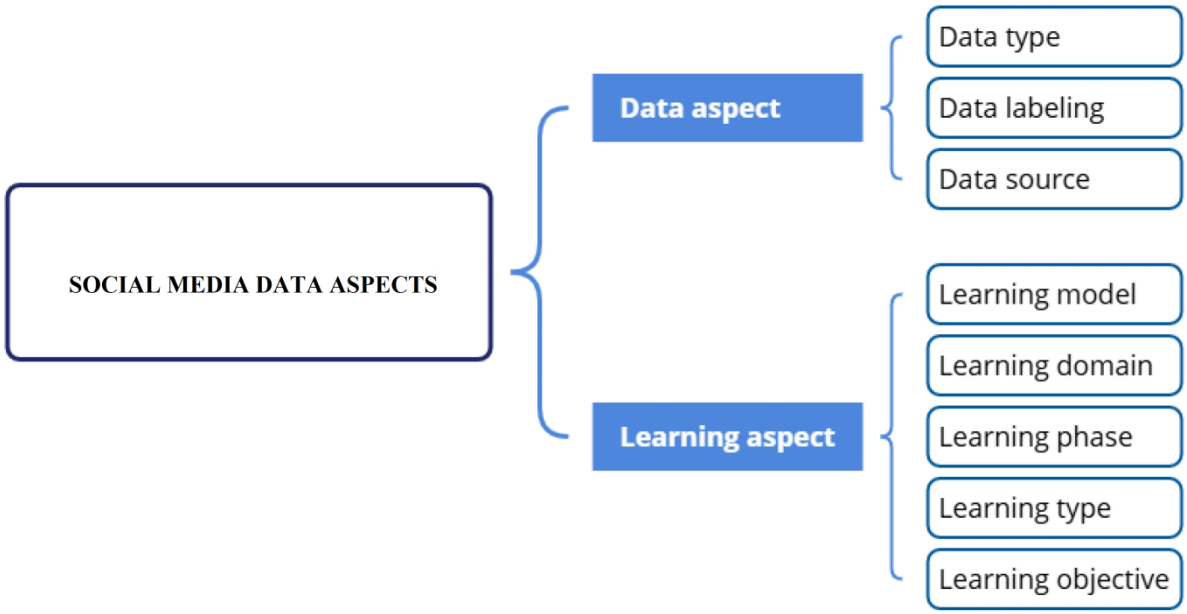

Figure 2b: Taxonomy of the common essential aspects of AI-driven Social Media Data Management [131]

In the context of the marketing aspect, using social media nowadays in Integrated Marketing Communication (IMC) is unreplaceable. One specific theme of the review was that businesses today should consider that the power of the media today which is made up of thoughts, ideas and contributions of the consumers themselves, or also known as 'User-Generated Media' or ideally referred to as UGM, has increased in comparison with the traditional media because of being more effective [132-134]. Marketers will be required to be consistent with their messaging, utilizing data-driven messages, and pursuing a multi-platform marketing approach strategy to gain consumer trust, loyalty and brand equity to compete. Consolidated management systems, one of the key findings from this review, have had an impact [135]. They can easily schedule, monitor, and analyze content, and they can help to eliminate the inefficiencies and inconsistencies that can occur with different types of content marketing. These benefits involve enhanced workflow control, consistency in brand and providing clarity on customer expectations, establishing guidelines for sustainable and scalable digital marketing practices [136-139].

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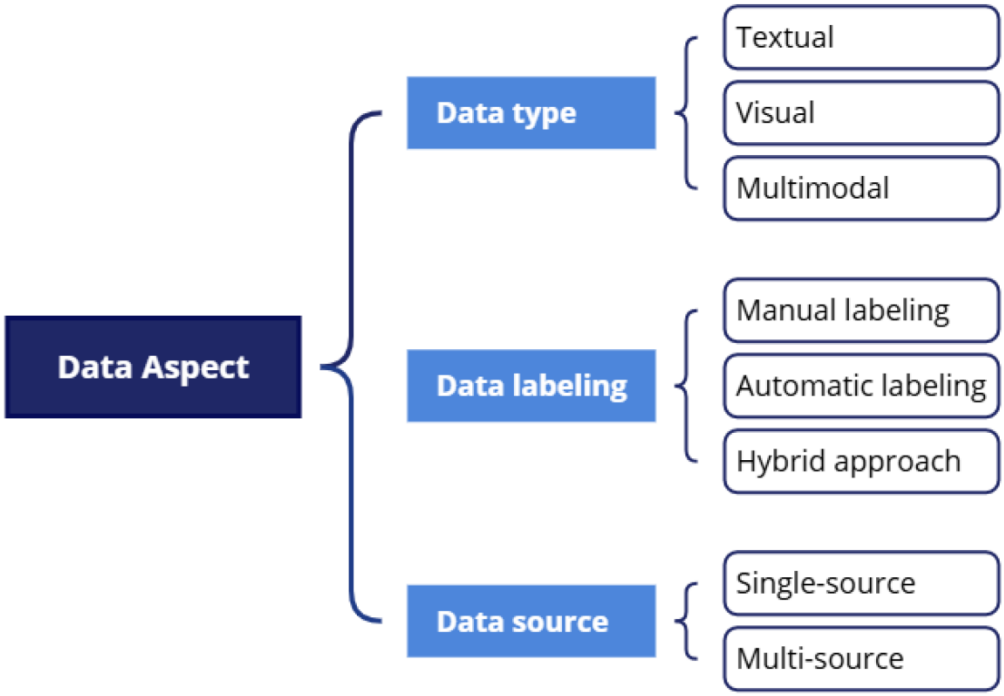

Figure 2b: Data aspects of AI-driven Social Data Management Categories [140]

$w2=\frac{(w1-f)}{A+1}$ Eq (13)

The tweets generated by the users, denoting their opinions, emotions and feelings about a particular topic, are deemed as, Facial expressions, for example, likes/dislike and friend relationships are such pieces of information [141]. We view this

$h2=\frac{(h1-f)}{A+1}$ Eq (14)

Every owner/Personnel of the knowledge base, knowledge-based system or any Knowledge level agent will have Some conceptualisation (either explicit or implicit). An ontology is an explicit specification of something [142, 143]. Social Media is a part of the World Wide Web (WWW) and there are several social. There are specific applications designed for mobile phones: or home computers (e.g., PlayStation): These are found running in the browser (the LiveJournal colour interface here), and may be activated from within the browser [144]. Thus,

So too does the mobile web embrace social media and is therefore available in areas where traditional fixed line browsers can't get internet access. Any digitally encoded information can be broken down into public, semi-public and private [145].

The classification layer is the layer that produces the final Result of the Prediction from the Features extracted from the data.

$Ui^{l} = \sum_{j} wji^{l-1}y^{l-1}$ Eq (16)

The Uniform Resource provides access to the public information for everyone who desires to have access. Identifier (URI) or other identifier. Also, there is a significant amount of deep web (unindexable) information on the WWW, but it is normally possible to search it using search engines is not indexed by search engines but can be viewed by human with a browser [146]. There are some people who have to be able to access semi-public information Access will only be granted in response to an attempted access by an authentic and authorised user.

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Some groups that are members of a A specific amount of information on a social media site can be accessed by that site's social media users [147, 148].

Method & Evaluation

This section elaborates the Methodological Contribution to the field as shown below the Unified Social Media Management System is actually a simple idea. The system comprises several components that collaborate to perform essential tasks, including identity verification, scheduling post releases, monitoring the system's performance, and creating captions with artificial intelligence algorithms. The component that users can access visually referred to as the User Interface interacts with the Backend Application. The Backend Application performs all the processes, such as identity verification, scheduling post releases, and publishing them. The Backend Application collaborates with the AI Module to generate captions and provide recommendations. Besides, the Backend Application communicates with Social Media Platform APIs for posting content on Facebook, Instagram, LinkedIn, and X. In case users opt to subscribe to the premium plan, the Payment Gateway such as Stripe takes care of the financial transaction. All the data contained in the Unified Social Media Management System, including user accounts, published posts, subscription plans, and the system's performance, is stored in the Database. The Unified Social Media Management System utilizes the Database to store all this data. It is accessible to the User Interface and Backend Application. The Backend Application and the AI Module ensure that the Unified Social Media Management System fulfills its intended purpose while Social Media Platform APIs facilitate content publication on Facebook, Instagram, LinkedIn, and X. This way of building the Unified Social Media Management System makes it easy to add parts keeps everything working smoothly and makes sure that all the parts can talk to each other in a secure way. The Unified Social Media Management System is, about making it easy to manage social media. The Unified Social Media Management System has parts, including the User Interface, the Backend Application, the AI Module and the Payment Gateway all working together to make the Unified Social Media Management System work well. The Unified Social Media Management System is made up of these parts. They all work together to make managing social media easy.

$$\mathrm{U}i^{l} = \mathrm{f}(\mathrm{u}i^{l}) + b^{(l)} \qquad \text{Eq (17)}$$

Easily becomes one of the few people who can view the private information. Typically, this is digital Corporations or individuals who keep confidential information on their networks – the information in the spreadsheet, for example, or the information in e-mail messages. Other multimedia files not easily accessible from the Internet. Some portions of these can be still copied to websites and made public at a company. On the Extranet or website (semi-publicized). If only the public information took into account, then it would be massive. For instance, if in 2005 the number of digital media products was compared to paper (printed) products, the two were comparable. Comparatively, the amount of information in 2010 was 150 exabytes, while the amount of data in 2010 was already 1,200 exabytes. Allude to 70% of the material being developed by the user. Unlike, for instance, the communication system for many common social activities, there are no other common equivalent activities.

$$\mathrm{P}(\mathrm{y} = \mathrm{j}|\mathrm{xi}, \mathrm{W}, \mathrm{b}) = \frac{exp^{XTwj}}{\sum_{j=0}^{n} exp^{XTWj}} \qquad \text{Eq (18)}$$

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$$S_h = 60° \begin{cases} 0 + \frac{(\beta_g - \beta_b)}{(m_x - m_n)}, if m_x = \beta_r \\ 2 + \frac{(\beta_b - \beta_r)}{(m_x - m_n)}, if m_x = \beta_g \\ 4 + \frac{(\beta_r - \beta_g)}{(m_x - m_n)}, if m_x = \beta_b \end{cases} \quad \text{Eq (19)}$$

for $\beta_b = 1, \beta_r = 1$ and $\beta_g = 1$

$$S_h = 60° \begin{cases} 0 + \frac{(\beta_1 - 1)}{(m_x - m_n)}, if m_x = \beta_r \\ 2 + \frac{(\beta_b - 1)}{(m_x - m_n)}, if m_x = \beta_g \\ 4 + \frac{(\beta_r - 1)}{(m_x - m_n)}, if m_x = \beta_b \end{cases} \quad \text{Eq (20)}$$

In this section Method and evaluation will be first approach will be compared to the Cross-Modal synthesis approach. As the current techniques of Text-to-3D/XR are challenging for virtual assets, games, design and other applications, especially in light of the new Gaussian splatting and multi-view diffusion techniques. The integration of image, text and audio with cross-modal synthesis families is more factual and more aligned and integrated creative workflows are possible. GAN-based models have low latency (suitable for real-time creative applications), are easy to train and generate quickly, but have stability problems during training and mode collapse at scale (reducing their diversity and robustness). Although Diffusion Models are more stable during training, they are more capable of representing the data distribution, and have greater fidelity, they come with a high computational cost and latency associated with the iterative sampling procedure, which is expensive for interactive systems. Large-scale text-to-image and text-to-video systems use powerful text encoders and transformer backbones, and require large amounts of paired data, with extensive filtering and complicated safety pipelines, which makes scaling and accessibility difficult

for $\beta_b = 2, \beta_r = 2$ and $\beta_g = 2$

$$S_h = 60° \begin{cases} 0 + \frac{(\beta_1 - 2)}{(m_x - m_n)}, if m_x = \beta_r \\ 2 + \frac{(\beta_b - 2)}{(m_x - m_n)}, if m_x = \beta_g \\ 4 + \frac{(\beta_r - 2)}{(m_x - m_n)}, if m_x = \beta_b \end{cases} \quad \text{Eq (21)}$$

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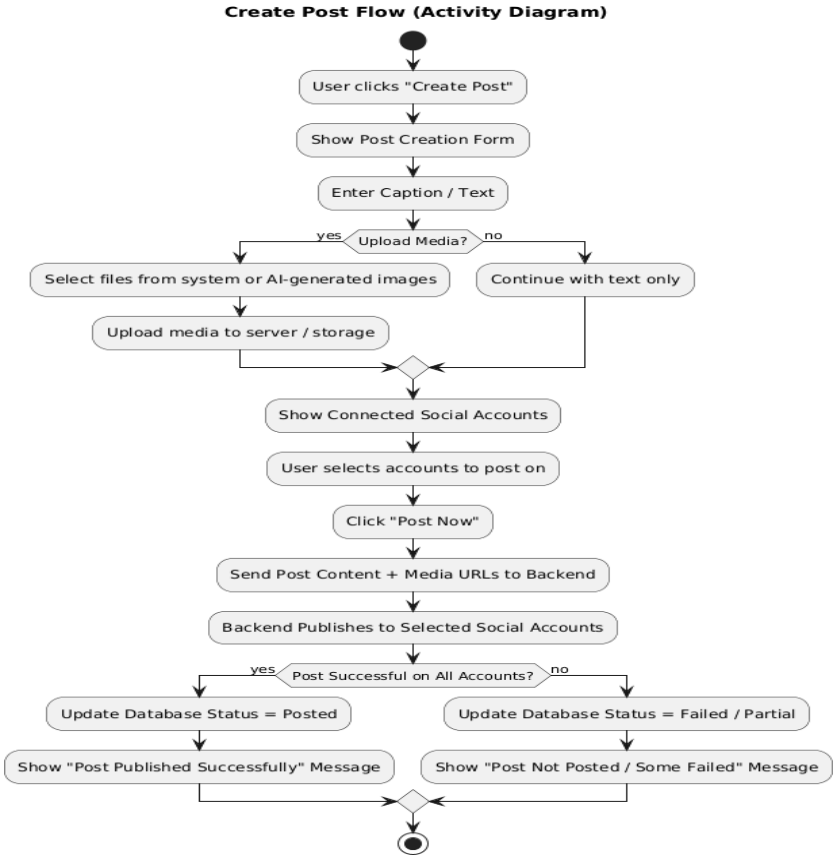

Figure3: Architecture of the Unified Social Media Management System

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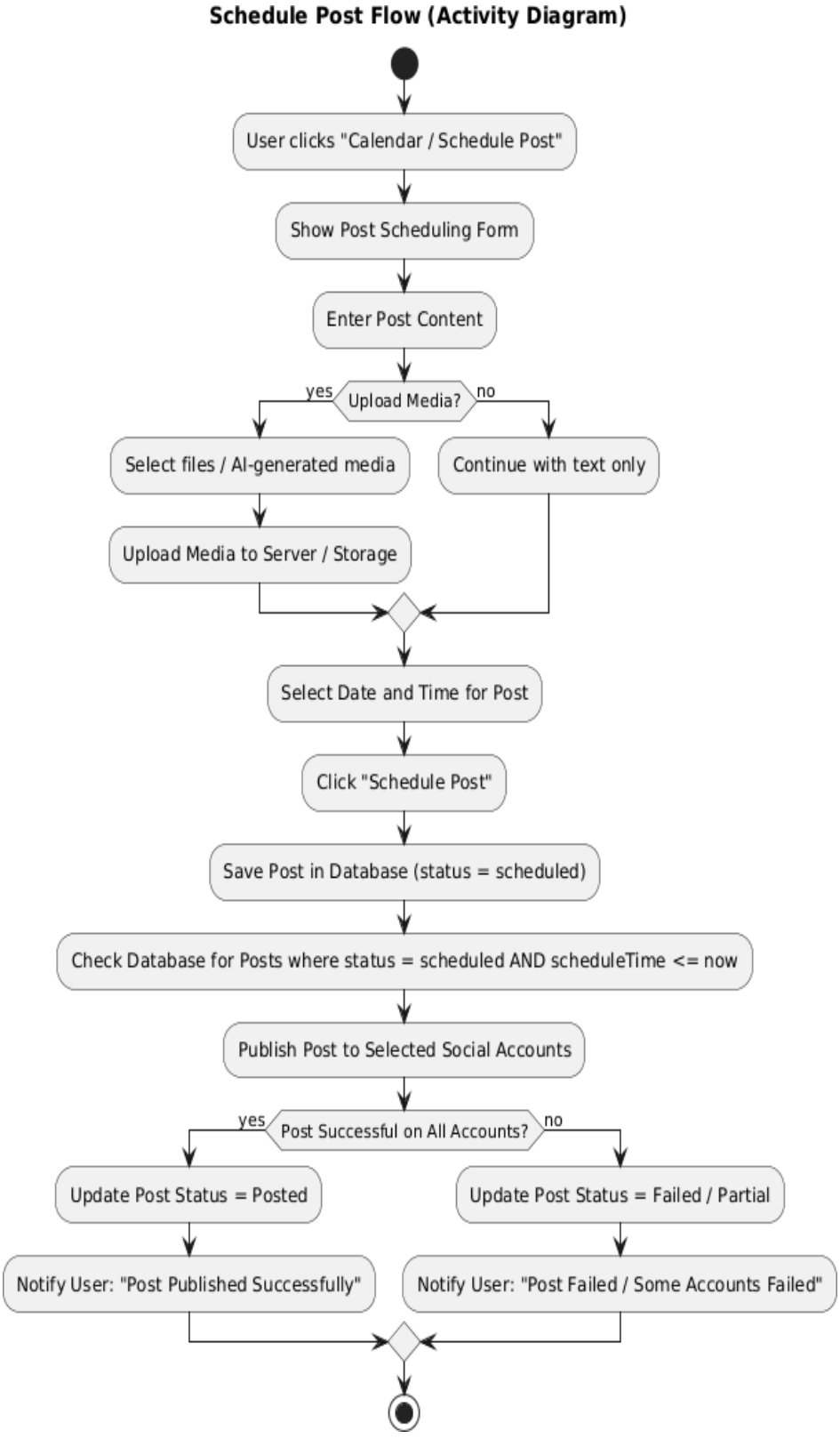

Figure 4: Post Workflow

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The above Figures shows the domain model. It identifies things in the system. How they connect. Post,Schedule, Payment, AI Suggestions A User has a role. The User owns Workspaces.Workspace is associated with Posts. Posts are connected with Schedules. Schedule specifies when posts will be released. Social Accounts can be like Facebook, Instagram, LinkedIn or X accounts that are tied to the User by the User

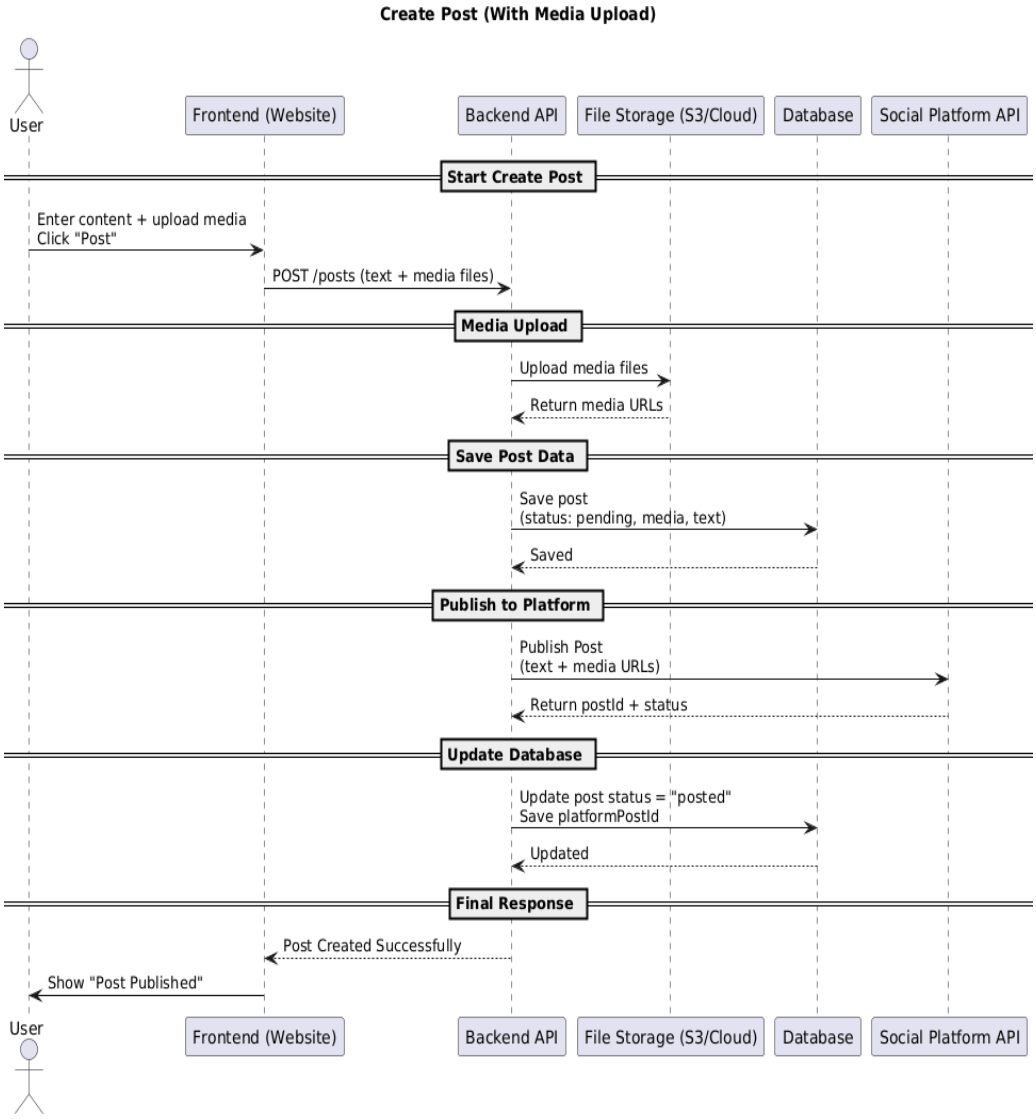

Figure 5: Create Post processing

in the system. A domain model provides us with a better understanding of how components of the system interact with one another. It also indicates to us the steps that must be done prior to any design or coding. User, Workspace, Team Member, Social Account, Post, Schedule, Payment and AI Suggestions are the system components that we need to understand their interaction. The relationship between these components and how they work with User, Workspace, Team Member, Social

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Account, Post, Schedule, Payment and AI Suggestions are shown through the domain model. User, Workspace, Team Member, Social Account, Post, Schedule, Payment and AI Suggestions. For example, if most users like short videos, AI can guide the company to make more of them. Research should study how this can be done safely and how companies can still control the quality of content.

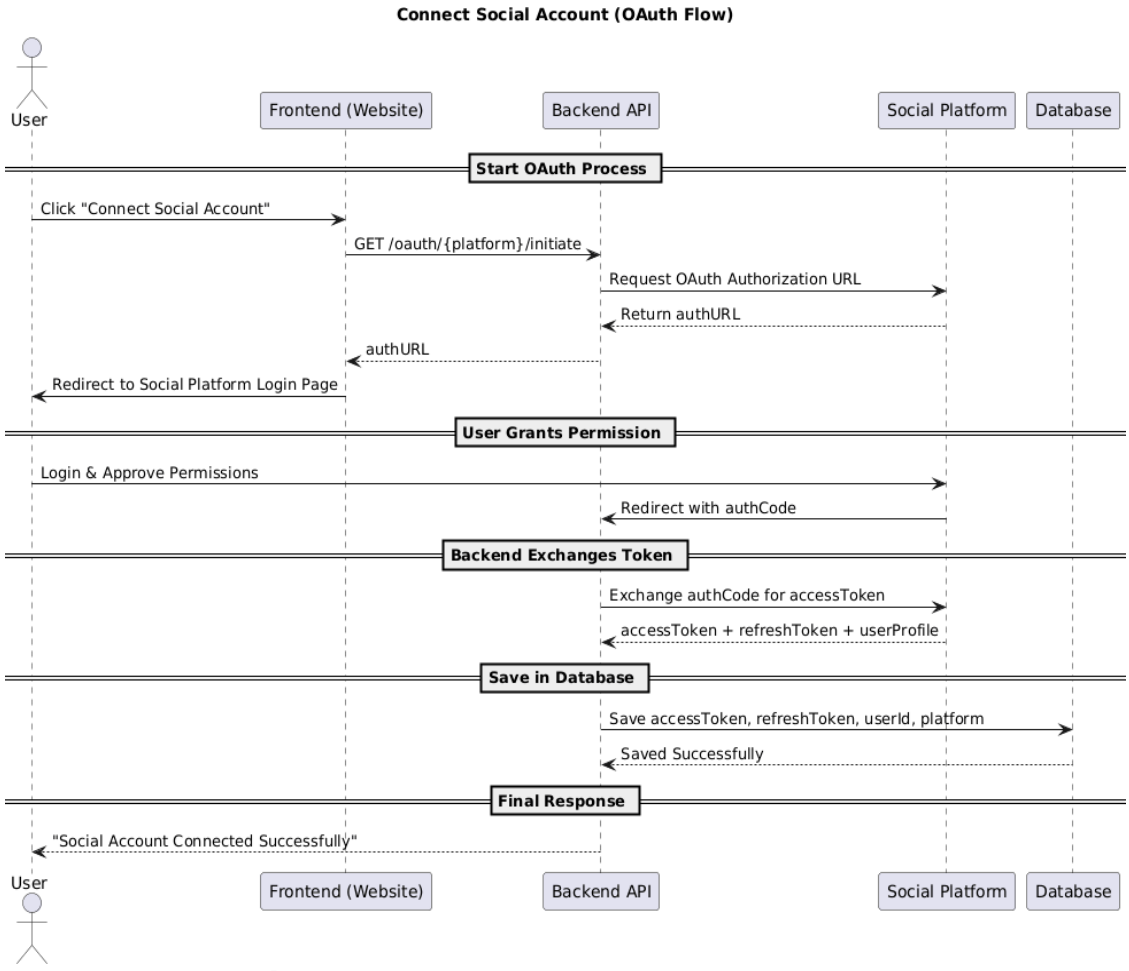

Figure 6: Connect Social Accounts

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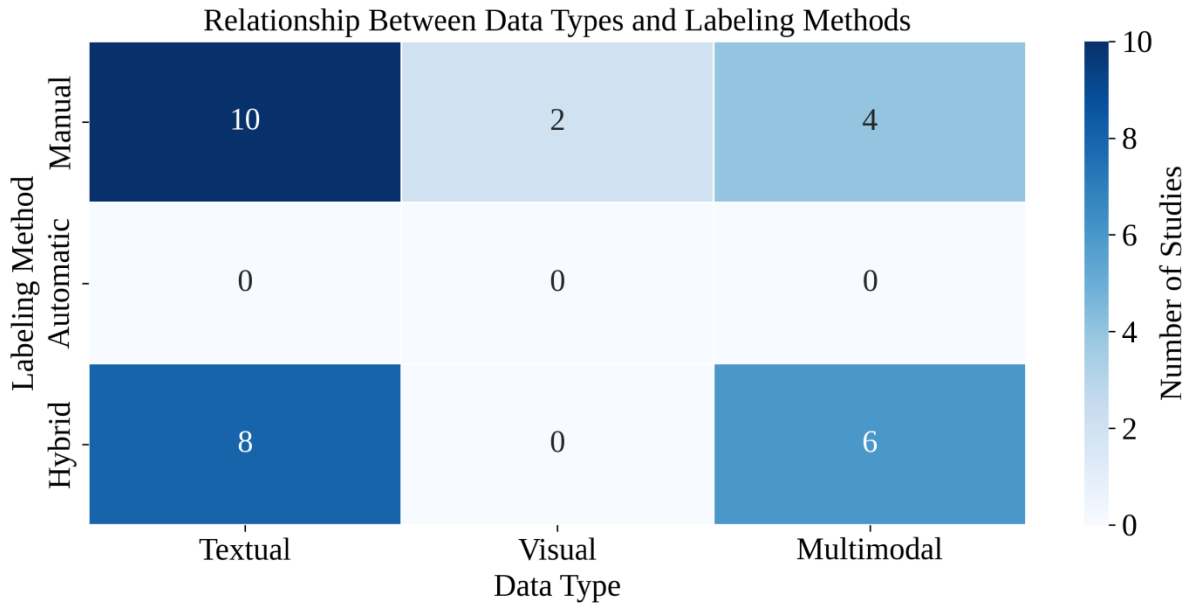

Figure 7: Relationship between data types and labeling methods used in the work

Figure 7: illustrates the relation between data types and labelling methods for textual data and the most common approach in literature is the manual labelling. However, with the increasing volume of multimodal data, there is a shift in research towards more sophisticated analytical approaches, hybrid labelling in this case. Data type – relationship between the reviewed studies and labelling. The number of studies in each combination is indicated by the intensity of the colour. Manual labelling of textual data and hybrid labelling of multimodal and textual data are the most prevalent methods, with hybrid labelling of multimodal data also being present. There is still scope for improvement as automatic labelling is used relatively little across all types of data.

Figure 8 exposes the important trade-offs between data processing strategies in disaster management systems. The multimodal approaches are not only more complicated to process, but also more costly in terms of implementation and much more complex in terms of data (2), but they offer superior information richness (5) and accuracy (4). This is in contrast to the textual approaches which were more likely to have a stronger focus on real-time processing (5) than their visual and multimodal counterparts (2). The information richness dimension clearly shows a hierarchy with multimodal being the most complete (5) and textual the least (2) method. All three approaches have predictable resources required - at textual level resources are very low, at visual level moderate, at multimodal level high, with regard to the resource requirement, complexity of processing, and amount of data. The relationships highlight the importance of key decisions disaster management teams must make when selecting suitable data processing techniques to meet their operating conditions and information requirements.

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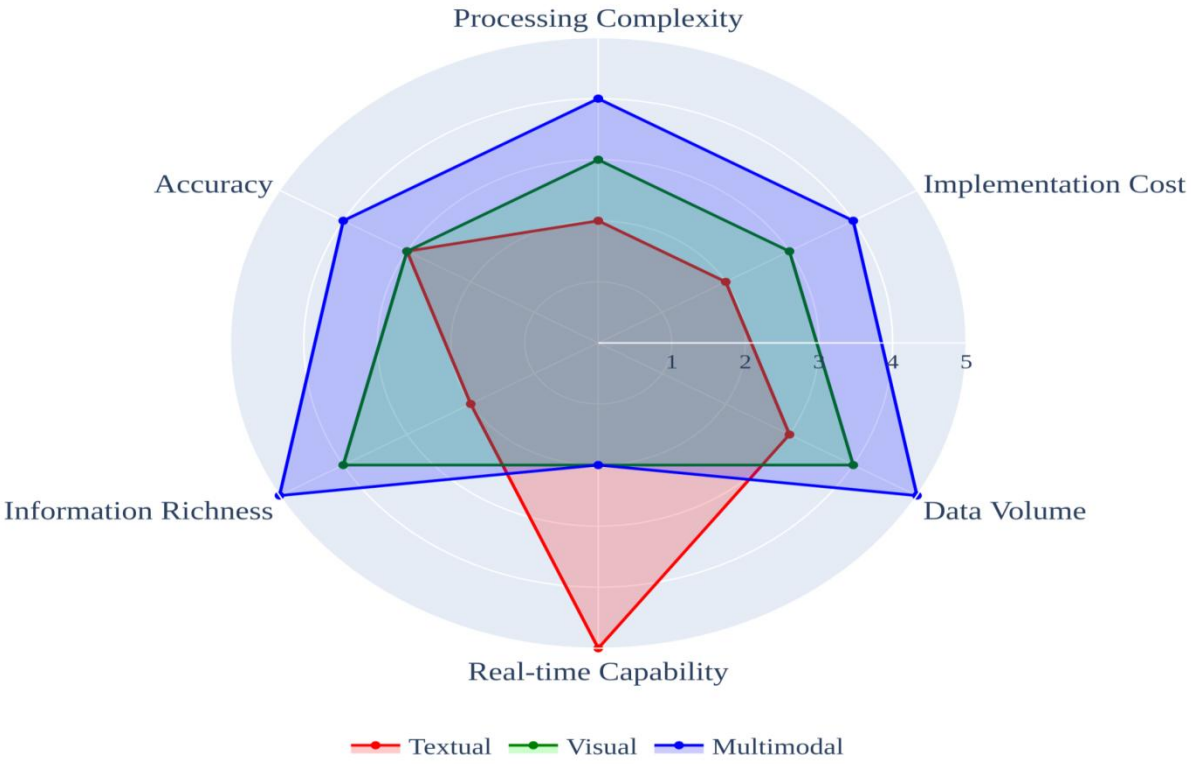

Figure 8: The advantages and disadvantages of different kinds of data in the context of AI-based crisis management are discussed qualitatively. The more intense the benefits (or the challenges), the greater the number. The radar chart is an aid to the quantitative results, showing that the major trade-offs are: information richness, complexity of processing and implementation costs.

The data aspects in AI-driven crisis management solutions are comprehensively analyzed in the sequence of Figure 6, Figure 7, Figure 8, Figure 9 and Figure 10, which provides a multi-perspective view of the data. These numbers provide various forms of analysis: distribution, time evolution, cross-variable relationships, quantitative performance and qualitative trade-offs. The combined results of these numbers will give complementary data to support the aspects data analysis. The result shows that the needs for technology and operations shape the evolution of AI-enabled crisis data strategies. For a few reasons, text based analysis has taken over: it's very resource cheap, and secondly, because Twitter data has been readily available via their public API. The rise in the number of cases of multimodal integration, however, reveals a pattern of solving the contextual problems of unimodal inputs and is particularly evident in relation to the detection of contextualities such as damage to infrastructure or humanitarian needs.

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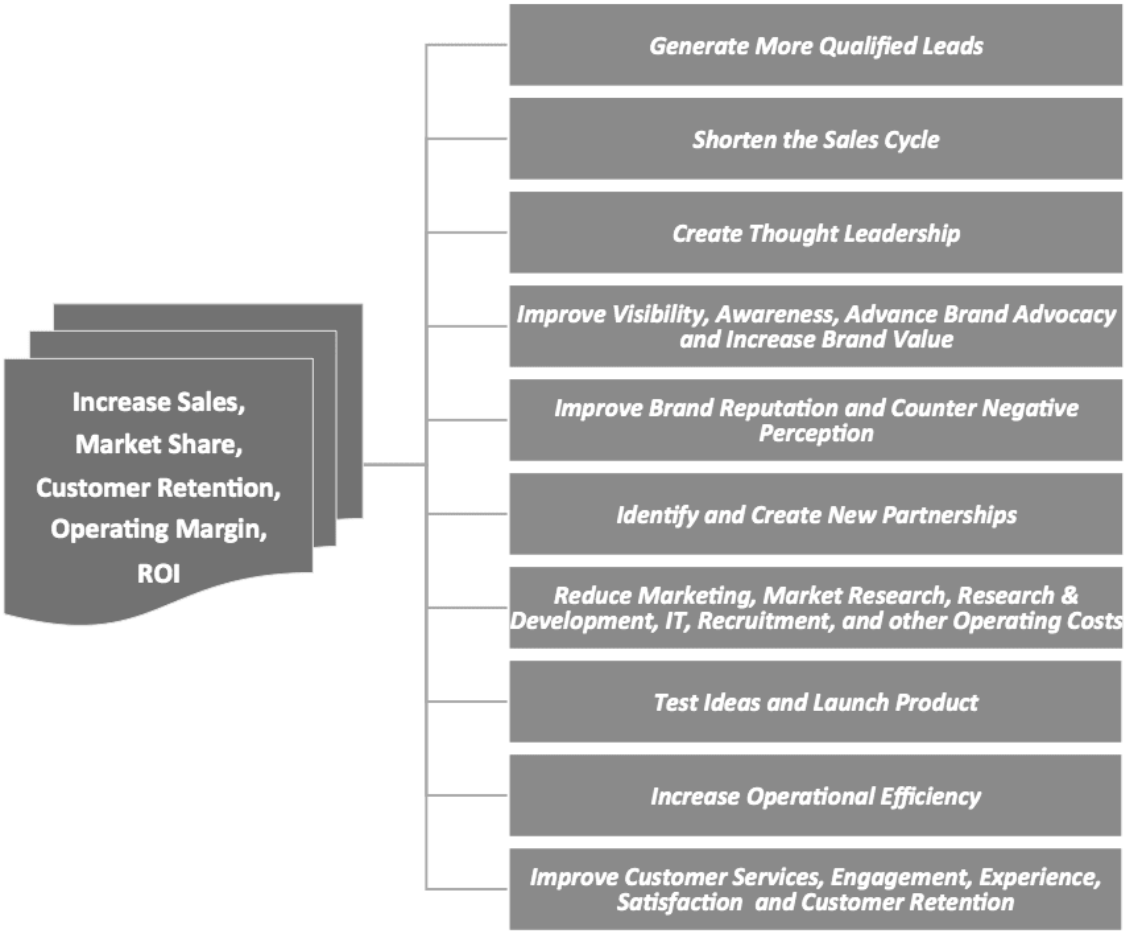

Figure 9: Data Driven Social media Platform Monitioring the Improvements in the different kinds of data

The preference for hybrid labeling highlights the need for human-in-the-loop (HITHL) workflows when dealing with crisis data that can be ambiguous or have misinformation. The transition to multi-modal and hybrid data architectures indicates a domain that is becoming more and more about interpretability, inclusiveness and multi-platform resilience and adaptability—hallmarks of next generation crisis management solutions.

The work proposed is presented in Table 1 and compared with the published studies from 2018 to 2026. Existing surveys are predominantly about unimodal data and single source data, but not so many about multimodal data, multiple source data or annotation strategies. Some of the reviewed research studies included the development of machine learning models, but not a complete domain analysis of learning, phase analysis of learning, learning type analysis, and a methodology for labelling the learning. Our work is extended to the year 2020–2026 and provides a wide analysis, while systematically analyzing the unimodal and multimodal data, single and multiple data sources, labeling approaches, learning models, learning domains, learning phases, types of learning and learning objectives. The work

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provides a broad coverage, outpacing the previous survey work, and provides a comprehensive overview of recent developments in intelligent social media analytics and multimodal generative AI frameworks.

Table 1: Comparative Analysis

Data	Single Data Source	Multiple Data Sources	Labeling Methods	Learning Models	Learning Domains	Learning Phases	Learning Types	Learning Objectives
[7]	2018	2009–2018	✓	✗	✓	✗	✗	✓
[2]	2020	2007–2019	✓	✓	✓	✓	✗	✓
[11]	2020	2014–2020	✓	✗	✓	✗	✗	✓
[9]	2021	2007–2019	✓	✗	✓	✗	✗	✓
[1]	2022	2008–2021	✓	✗	✓	✓	✗	✓
[10]	2022	2011–2021	✓	✗	✓	✓	✗	✓
[12]	2023	2018–2022	✓	✗	✓	✗	✗	✗
Proposed	**2026**	**2020–2024**	✓	✓	✓	✓	✓	✓

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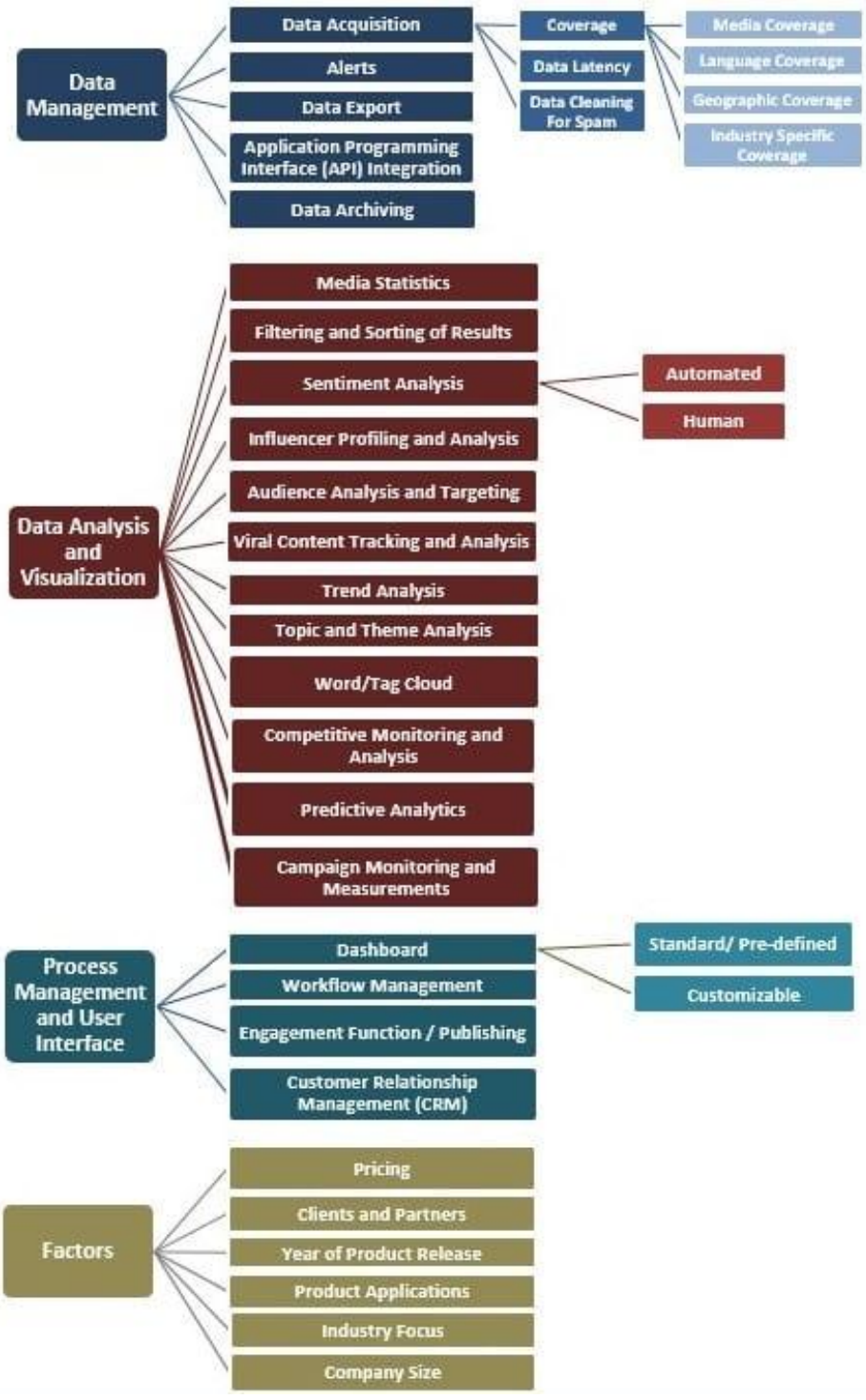

Figure 10: Features and Factors affecting the Data Driven Social media Platform Monitioring

Conclusion & Future Directions

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In the end, this articletells us one clear thing that Social media is not just something extra for marketing anymore. It has become the main part. Every brand, big or small, is now depending on it to talk with people and show their products. Without social media, marketing feels incomplete today. For digital marketers the problem is not only to save time. The bigger problem is to make posts that look real and honest. People do not like fake or copied content. So the work is to be fast with the help of tools, but also keep the trust of the audience. Both things must stay together. Technology, like AI, is very helpful. It can tell when to post, give hashtags, and even read what people are saying. This makes the job simple. But trust is more important than speed. If people think their data is not safe or the brand is hiding something, then they will leave. That is why companies must be open and clear in their work. Social-media gives many chances. It helps in sharing new ideas, reaching more people, and building a strong brand. But it also brings problems because platforms keep changing and there is always strong competition. So, companies must keep learning and adjusting again and again. This study collected information from many sources and also pointed out where research is still missing. It also shared some useful advice for companies. So, it is not only for students or theory, but also for real business use. It can guide organizations to plan better, earn trust, and grow in this fast digital world. While significant advancements have been made, continued research is required to address unresolved gaps:

More AI in Future: In the coming years, AI can play an even bigger role in social media work. Right now, AI mostly helps in scheduling posts or suggesting hashtags. But in the future, AI can also learn from people's behavior and suggest

Privacy and Safety: When many platforms are joined together, data privacy becomes a big issue. People will not like it if they think their personal data is not safe. In the future, there should be more focus on building systems that protect user data properly. Research can also look at how to make users trust these tools more. For example, tools can give clear messages about what data is being collected and how it will be used.

Help for Small Businesses: A lot of small businesses cannot buy expensive tools like Hootsuite or Sprout Social. They need cheaper and easy options. In the future, researchers can try to find out how unified systems can be made simple and low cost. If this happens, then even small shops, startups, or local companies can use them to promote their products. This will help them compete with bigger companies.

New Platforms and Changes: Social-media is never the same. New apps come quickly, like TikTok, and old platforms like Facebook or Instagram change their rules again and again. Future studies should focus on how one tool can quickly adapt to these changes. If a tool is flexible, it will not become outdated fast. For example, if tomorrow a new app becomes popular, the tool should add support for it without much delay.

Balance Between Human and AI: Even though AI is very helpful, it cannot replace people fully. AI can do the fast work, like setting post times or checking

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reactions. But only humans can understand culture, emotions, and how words will affect people. Future work should look at how both can work together. A good balance means AI does the routine work and humans take the creative and sensitive decisions.

Look at Long-Term Impact: Today, most research only looks at likes, shares, and comments, which are short-term. But in the future, studies should also focus on long-term effects. For example, how do unified platforms affect customer trust, brand reputation, or sales growth over many months or years? This type of research will show the real value of these tools, not just quick results.

Overall Learning: From this survey, it is clear that social media has become a very powerful tool for both small and large organizations. It is not only about posting but also about building connections, trust, and brand value. By studying different tools and methods, we can see how unified systems can make this process easier and more effective.

AI as Support, Not Replacement: AI is very useful in social media management, but it cannot replace humans fully. It can suggest times, hashtags, or even check reactions, but the final creativity and message should always come from people. This balance is important because users connect more with real and authentic content, not with machine-generated words only.

Value for Businesses: The study also shows that unified platforms can save time and reduce workload. For businesses, this means they can spend less time on repeated posting and more time on planning good strategies. Small businesses especially get benefit because they often do not have large teams to manage different accounts.

Challenges to Consider: Even with many advantages, there are still problems that must be solved. Privacy, cost, and fast changes in platforms are some challenges. If these are not handled, many organizations may hesitate to use such systems. This reflection reminds us that technology should always be updated and flexible.
Future Vision: Looking at the future, social media management will continue to grow. With new platforms and more AI features, there will be more opportunities as well as new risks. The reflection is that organizations must be ready to adapt and learn again and again. This way they can get the maximum benefit while staying safe and trustworthy for their users.

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