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Cover Page Footnote

[Note: Please address all correspondence on this paper to Thompson S. H. Teo (Dr.) Phone: (65) 6516-3036 (Office); (65) 6779-2621 (Fax); Email: bizteosh@nus.edu.sg.] This manuscript underwent peer review. It was received 02/18/2024 and was with the authors for eight months for two revisions. Alvin Leung served as Associate Editor.

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Exploring Concerns of Fake News on ChatGPT: A Network Analysis of Social Media Conversations

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Abstract:

The emergence of ChatGPT represents a pivotal moment in artificial intelligence, yet there are ongoing concerns about its potential misuse for spreading false information. This study explores these issues and highlights the crucial role of social networks in influencing technological developments. Through a social network analysis of tweets collected over 22 weeks, we identify an engaged community voicing worries about fake news generated by ChatGPT, particularly in politics, journalism, and healthcare. Text analysis further supports these concerns regarding the tool's role in fake news dissemination. A supplementary analysis on Reddit, nearly two years after ChatGPT's launch, reveals a slight decline in negative sentiment regarding fake news on the tool, though concerns persist, with user sentiments remaining similar to those on platforms like Gemini and Copilot. This research primarily captures the perspectives and sentiments of early adopters of ChatGPT regarding its capacity to produce fake news, explores how social networks shape the narrative around this tool and emphasizes the necessity for stricter regulations. Implications to research and practice are discussed.

Keywords: ChatGPT, Disinformation, Fake News, Generative AI, Social Network Analysis, Misinformation.

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1 Introduction

ChatGPT is an artificial intelligence (AI) chatbot that demonstrates a high level of expertise in comprehending and producing natural language and exceptional levels of sophistication, sensitivity, and user-friendliness (Lock, 2022). Since its launch in late 2022, the tool has seen remarkable success, becoming one of the fastest-growing consumer applications on record (Hu, 2023). Traditionally, chatbots have relied on natural language processing (NLP) to interpret user queries (Dwivedi et al., 2023), leveraging language models and deep learning techniques to tackle NLP challenges and deliver quick customer responses (Bellegarda, 2004; Kushwaha & Kar, 2021). However, ChatGPT substantially enhances the functionalities of chatbots through the Generative Pre-training Transformer (GPT) architecture, which seamlessly integrates language models and deep learning capabilities (Radford et al., 2018).

The popularity of ChatGPT has further soared in light of its success in the Turing test, which is considered a significant milestone in the advancement of AI (Yalalov, 2022). However, there are growing concerns around its bias, with accusations that the tool is trained to be politically correct (AP News, 2023), while recent research suggests that it could favor specific political beliefs (McGee, 2023). Concurrently, there are apprehensions regarding the exploitation of this technology to generate fake news and various forms of erroneous or misleading information, with the risk being exceptionally high when the tool's output is based on inaccurate or inappropriate data residing in the systems (Dwivedi et al., 2023). This represents a significant drawback of the technology despite its favorable outcomes.

Fake news refers to factually incorrect or misleading content[1] (Dennis et al., 2021; Farkas & Schou, 2019; Nasery et al., 2023). In this context, fears that ChatGPT could be employed for large-scale false information generation were confirmed by OpenAI's founder (see Goswami, 2023), and numerous instances of fake news have already surfaced from its use. For example, ChatGPT was accused by the journalistic media of generating fake news articles (Moran, 2023). In another example, the tool leveled false allegations against an individual in the United States, substantiating it with fabricated fake news articles (Verma & Oremus, 2023). This growing threat was echoed by reports from Europol, the European Union's law enforcement agency, highlighting the false information concerns surrounding the tool (Chee, 2023), and by the director of Government Communications Headquarters, who warned the UK cabinet of the dangers of AI-driven false information (Riley-Smith, 2023).

ChatGPT is evolving rapidly. Its novelty, combined with growing concerns about fake news, makes it essential to understand the opinions and sentiments of early adopters, who are usually the most influential and enthusiastic, as their perspectives can greatly influence broader perceptions of the technology (Haque et al., 2022; Krishnan & Vasist, 2023). In this context, prior studies have shown that conversations on sociotechnical platforms like Twitter are helpful in garnering insights into users' opinions about an emerging technology (Grover et al., 2019; Mnif et al., 2021). Additionally, discussions about emerging technologies on these platforms can influence, guide, and shape how users respond to or embrace the technology (Grover et al., 2019). Such is the case with ChatGPT, where capturing opinions can prove crucial given the concerns about false content originating from these platforms, which could hinder progress despite their benefits[2]. Also, such information can provide critical insights into a product's likelihood of success or failure (Haque et al., 2022).

Therefore, given the fast-evolving narrative around ChatGPT and the increasing threat of it becoming a source of false information (Cecil, 2023), it is crucial to analyze the emerging network conversations about concerns regarding the tool's role in generating fake news and other types of false information. Hence, we ask: *What insights can be drawn from networked conversations regarding the opinions and sentiments of early ChatGPT adopters regarding the tool's potential to produce fake news?*

To address this research question, we draw on the concept of collective intelligence (Gregg, 2010; Kapetanios, 2008) and apply the Capture-Understand-Present framework developed by Fan and Gordon (2014). Given the role of discourse on social networking sites in forming collective intelligence (Aswani et

[1] Fake news is often used interchangeably with other issues like misinformation, which is false or misleading information, and disinformation, which involves spreading false information to deceive (Lazer et al., 2018). Considering the prevailing definitional ambiguities, we use the terms "fake news" and "false information" interchangeably in this study.

[2] We have already seen growing concerns about the misuse of AI, prompting calls for a six-month pause on the development of systems more advanced than GPT-4, which powers ChatGPT, due to potential risks to society (Narayan et al., 2023).

al., 2018; Shiau et al., 2018) and shaping users' behavioral inclinations toward technologies (Grover et al., 2019; Sinha et al., 2020), we employ social network analysis (SNA) and explore how Twitter (also known as X)[3] users' discussions related to ChatGPT-generated fake news contribute to the tool's perception among users (Krishnan & Vasist, 2023). Using NodeXL Pro (Smith et al., 2010), we conduct an SNA of Twitter conversations and examine the networked conversations among Twitter users discussing ChatGPT and fake news. We identify influential individuals and community structures that drive user engagement in ChatGPT and fake news discussions. Through text analysis of relevant tweets, we investigate the top-mentioned and top-replied-to users along with their key concerns. We also assess sentiment regarding ChatGPT's potential for generating fake news and explore the diverse domains from which these key users originate. Lastly, we incorporate Reddit as an additional social network and conduct a supplementary analysis to gain broader insights into users' sentiments toward AI chatbots, including Google Gemini and Microsoft Copilot, particularly concerning their potential to generate fake news.

Our findings confirm recent apprehensions related to the misuse of generative AI (Dwivedi et al., 2023), the potential dangers, and the need to regulate its use effectively. Using SNA to investigate the spread of fake news narratives using ChatGPT, we add to the growing body of research that seeks to understand social networks' role in influencing emerging technologies' trajectories (Yadav et al., 2023). In doing so, we contribute to the literature on collective intelligence and consensus building, emphasizing the role of social networks in shaping public perceptions of technologies. Our study also offers crucial insights for practitioners considering the use of ChatGPT by underscoring the need for appropriate controls to mitigate any negative consequences and optimize the benefits of such technologies. By emphasizing the potential for ChatGPT to trigger a fake news crisis, our findings nudge policymakers to craft regulations that mitigate the risks posed by the technology. Through this study, we hope to contribute to a more responsible and ethical use of ChatGPT and other emerging technologies by highlighting the need for effective regulation and appropriate safeguards.

The rest of the paper is organized as follows. Section 2 reviews the literature on concerns related to ChatGPT and the spread of fake news. It also explores the importance of collective intelligence through social media, highlights how Twitter data can be used for this purpose, and emphasizes the role of social networks in analyzing public discourse and perceptions around emerging technologies. Section 3 discusses the methodology applied for the current study and unpacks the characteristics of the emergent network on Twitter. This section also incorporates Reddit as an additional social network to enhance insights into users' sentiments toward AI chatbots beyond ChatGPT, such as Google Gemini and Microsoft Copilot, particularly regarding their potential to generate fake news. The implications for research and practice are addressed in Section 4, followed by a discussion of limitations and future research directions in Section 5, with concluding remarks in the final section.

2 Literature Review

2.1 ChatGPT and Fake News

Fake news is not a new phenomenon, but it has gained prominence recently as various actors have started exploiting social networks to carry out targeted false information campaigns to manipulate public opinion on specific issues. The rise of generative AI and large language models (LLMs) like ChatGPT has further intensified the problem of fake news (Barman et al., 2024). The advanced capabilities of LLMs allow malicious actors to create convincing and contextually relevant content (Spitale et al., 2023), which can be readily weaponized to drive false information campaigns (Zhao et al., 2023).

In this context, ChatGPT utilizes a large data corpus, including several years of opinions and knowledge on the internet, to train its algorithms, allowing it to provide answers to users based on what it has learned from the data (Dekens, 2023). Although these algorithms are trained to predict responses based on patterns in the data they observe, incomplete or biased training data can result in presenting false or misleading information to chatbot users (Desmarais, 2024). The tool's attempt to deliver a fully formed, definitive response by evaluating sources itself contrasts sharply with the past when users would query a search engine and be presented with a range of links, both reliable and inaccurate, ultimately leaving them to decide which sources to trust. This novelty of the tool makes it difficult for users to evaluate the credibility of the

[3] X was previously known as Twitter. In this study, the term "Twitter" exclusively refers to X.

information and leaves them uncertain about what to believe, thereby creating an environment conducive to the spread of false information and various forms of fake news (Cecil, 2023).

Early studies on the tool support this by showing that it can produce convincing text that mimics conspiracy theories and misleading narratives, often citing non-existent references (Hsu & Thompson, 2023). Likewise, the tool has been found to reproduce country-specific propagandistic and harmful narratives based on recent research that tested the tool on three different languages (Böswald & Saab, 2023). Nonetheless, it is pertinent to note that the tool's utility for spreading false information is not exclusive to the political sphere, as exemplified by its use for the proliferation of COVID-19 conspiracy theories as well (Coldewey, 2023).

ChatGPT's ability to create convincingly realistic fake content has triggered worries about its possible exploitation for generating fake news (Howard et al., 2023). Perceptions about the tool and trust determine how users adopt and engage with it (Choudhury & Shamszare, 2023). In this context, collective intelligence plays a role in shaping consensus, offering valuable insights into users' overall opinions and perspectives (Kornrumpf & Baumöl, 2013; Singh et al., 2020). Hence, amid the increasing prevalence of fake news on ChatGPT, we aim to develop a thorough understanding by tapping into the collective intelligence of users' perspectives regarding the tool's role in generating fake news.

2.2 Harnessing Collective Intelligence through Social Media Conversations

Social media platforms help individuals with varied perspectives come together to exchange and validate their ideas (Muninger et al., 2019; Shiau et al., 2018). Discourse on social media platforms frequently centers around contemporary and popular societal topics involving exchanges of ideas, thoughtful considerations, and persuasive discourse (Chung & Zeng, 2020; Phang et al., 2013). In this regard, collective intelligence, described as the convergence of diverse minds on the internet that come together to validate and assess individual ideas (Gregg, 2010; Kapetanios, 2008), helps harness diverse viewpoints to improve decision-making, as the collective knowledge of multiple individuals tends to be more reliable and precise, particularly when dealing with a new and rapidly changing field (Kornrumpf & Baumöl, 2013; Page, 2007). On social media platforms, this depends on user engagement and interaction where individuals are both consumers and creators of knowledge, as well as learners (Glenn, 2015; Grover et al., 2019; Kapetanios, 2008).

Amongst social media platforms that facilitate technology-driven conversations, Twitter is regarded as highly effective for its social broadcasting capabilities (Sinha et al., 2020). Twitter's features allow hashtags around topics and mentions within content, indicating engagement among the platform's users and demonstrating a degree of awareness around a particular topic. In addition, Twitter can bring together experts from various geographical locations, facilitating connections and enabling them to voice their views (Joseph et al., 2017). Our choice of Twitter is further motivated by the public nature of tweets (He et al., 2013) and the platform's proven utility for comprehending trends related to emergent technologies (e.g., Sinha et al., 2020). Here, we rely on Twitter as the social media platform of choice to leverage collective intelligence and gather users' perspectives on the tool's role in generating fake news.

Twitter discussions help harness collective intelligence about popular technology-related subjects, impacting, regulating, and shaping users' behavioral inclinations toward the technology, alongside influencing policies related to the technology (Grover et al., 2019; Sinha et al., 2020). In the past, Twitter conversations have been used to analyze public opinion about nanotechnology (Runge et al., 2013), comprehend acceptance of blockchain (Grover et al., 2019) and robotics (Sinha et al., 2020), and community interactions on Twitter have also served as signaling mechanisms for the funding and success of blockchain ventures (Albrecht et al., 2020). Likewise, sentiments on Twitter have been effective in forecasting cryptocurrency prices (Kraaijeveld & De Smedt, 2020), with the number of tweets being a predictor of trading volumes and realized volatility in the bitcoin market (Shen et al., 2019). Among other studies, content from Twitter has been effectively leveraged to highlight concerns over non-fungible tokens (Meyns & Dalipi, 2022), which have garnered significant popularity in recent times (Clark, 2021). Similarly, Twitter conversations have been leveraged to comprehend the sentiment surrounding the metaverse as a technology (Krittanawong et al., 2023). Furthermore, past research suggests that Twitter conversations have helped discern drivers of fake news and conspiracy theories surrounding domains such as healthcare (Ahmed et al., 2020) and politics (Brummette et al., 2018).

Building on previous efforts to grasp opinions about emerging technologies and the collective consensus that influences these discussions, we aim to leverage Twitter's potential for collective intelligence in this

study. Specifically, we utilize SNA to examine the Twitter discourse surrounding concerns related to ChatGPT's dissemination of fake news (Krishnan & Vasist, 2023).

2.3 Frameworks for Social Network Analysis

Several analytical frameworks have been employed in past research to examine the adoption of emerging technologies using data from social networks like Twitter. Meyns and Dalipi (2022) apply a text-mining approach, incorporating topic modeling to uncover perceptions and concerns about non-fungible tokens through Twitter posts. They use a data science trajectories framework (Plumed et al., 2019), which supports an open-ended and flexible approach to data analysis through the stages of exploration, acquisition, preparation, modeling, evaluation, and result exploration. Krittanawong et al. (2023) use Twitter data to analyze sentiment, examining public perceptions of the metaverse and its impact on mental health. Runge et al. (2013) investigate public discourse surrounding nanotechnology by analyzing Twitter data, assessing the volume and tone of the content, and identifying linguistic patterns. They also manually code tweets into sentiment categories to evaluate public sentiment.

A widely used framework for analyzing social media data is the Capture-Understand-Present (CUP) framework developed by Fan and Gordon (2014). It consists of three phases: (a) the *Capture* phase, which involves collecting, pre-processing, and extracting relevant information from the data; (b) the *Understand* phase, where advanced analyses such as social network analysis and sentiment analysis are conducted; and (c) the *Present* phase, where the results are evaluated and presented.

Numerous studies have applied this framework, often introducing subtle variations to adapt it to specific research needs. For instance, Sinha et al. (2020) utilize this framework and expand it by adding a fourth step, which involves interpreting the results of content analysis based on emerging themes within the field. As an exploratory study, they assess factors influencing the acceptance of robotics in the workplace by analyzing Twitter data with descriptive, geospatial, network, and content analyses on the extracted tweets. Among other examples that discuss the CUP framework, Grover et al. (2019) emphasize the importance of incorporating a provision to display the results of the analysis and highlight their significance. Hence, they employ a four-stage process—capture, analyze, visualize, and comprehend—to evaluate the acceptance of blockchain technology by harnessing collective intelligence through Twitter data mining. To gain insights, they integrate manual content, hashtag, and sentiment analyses, including lexicon-based extraction methods.

Given the structured methodology of the CUP framework and its widespread use in previous studies on emerging technologies, we adopt this framework in the current study to investigate emerging network discussions about concerns related to ChatGPT's role in producing fake news and other forms of false information.

3 Methodology and Network Characteristics

In this section, we adopt the CUP framework and provide a detailed explanation of each step. The steps are visually illustrated in Figure 1 and are described in detail below.

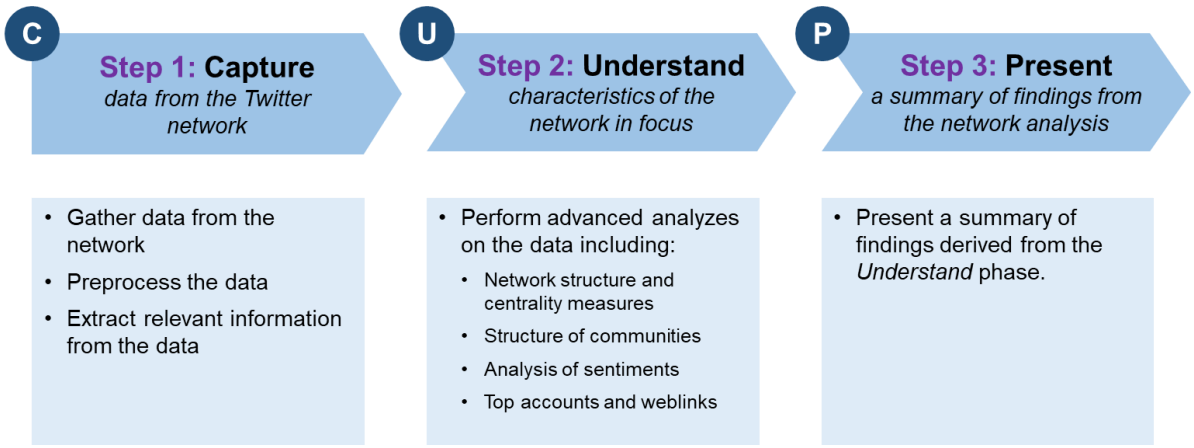


Figure 1. Framework for the Current Study

3.1 Step 1: Capture Data from Twitter

3.1.1 Gather Data from the Network

Twitter operates as a profile-centric social network with an asymmetrical following model that facilitates broad content dissemination, while interactive elements (e.g., hashtags, retweets, and mentions) strengthen its function as a hub for information diffusion (Son et al., 2019; Theocharis et al., 2023; Zhu & Chen, 2015), including in contexts such as content related to emerging technologies (Li et al., 2019). To extract data from Twitter, we employed NodeXL Pro (Smith et al., 2010). We used Version 1.0.1.513 of the software and its Twitter search functionality for the current analysis.

Our initial search query comprised "ChatGPT" and "fake news" as keywords. Since "fake news" has been used synonymously with the concepts of misinformation and disinformation in prior literature (Domenico et al., 2021; Vasist & Krishnan, 2023), we included both these terms as additional search keywords. The ChatGPT tool was publicly released on the 30th of November, 2022, through the Open AI website (Johnson, 2022), and its subsequent version, GPT-4, on the 14th of March, 2023 (Harshini, 2023). The tool garnered over a million users within the initial five days of its release (Nerdynav, 2023; Ruby, 2023). Given the fast-growing popularity of the tool, its new releases, and its expanding user base, we aimed to capture all relevant tweets between the 30th of November 2022 and the 4th of May 2023, encompassing a total of over 22 weeks and over seven weeks since the launch of GPT-4[4]. The November 2022 release of ChatGPT is considered a significant milestone in the tool's development despite previous iterations being available (Mollick, 2022). However, concerns regarding false information propagation gained prominence after users interacted with this latest version. Hence, tweets posted before the 30th of November were excluded from the analysis. Based on the aforementioned search protocol, this process returned a total of 53482 edges[5] (a line connecting two vertices) and 24243 vertices (nodes or dots in SNA), as well as 41061 duplicate edges (the total number of multiple connections between two vertices). To safeguard user privacy and adhere to ethical standards, we anonymized the dataset by omitting usernames, guided by recent research on the responsible use of social media data (Gliniecka, 2023; Kwon & Park, 2023).

3.1.2 Pre-process the Extracted Data

Improper data processing can result in contradictory outcomes during the analysis phase (Singh et al., 2020). Hence, we subjected the data to a three-step data pre-processing phase. First, the content of tweets was assessed, and those that did not correspond with the search phrases were eliminated. Second, we checked for bots or automated accounts that could distort the data (O'Regan & Choe, 2022). In the final stage, we reassessed the duplicate edges and computed the edge weights. Based on this processing of extracted data, we proceeded to extract relevant information from it.

3.1.3 Extract Relevant Information from the Data

The analysis with NodeXL Pro includes computing graph metrics, identifying group structures, and generating visual representations of the graphs. This process (such as generating word and word pair features) may lead to new columns being added to the two main worksheets in the extracted data—the edges and vertices sheets (Hansen et al., 2019).

The count of edges and vertices in the social network are presented in Table 1.

Table 1. Overall Count of Edges and Vertices in the Network

Graph Metric	Value
Graph Type	Directed
Vertices	14077
Unique Edges	9045
Edges With Duplicates	13928
Total Edges	22973

[4] The data was collected using Twitter API 2.0 importer.
[5] Vertices (or nodes) represent users within the social network, while edges represent the links formed between these users through their interactions.

The dataset encompasses 22,973 edges (conveying interconnectivity), which can be further categorized into 5,111 individual tweets, 4,352 retweets, 10,733 mentions, 2,226 replies, and 551 quotes.

3.2 Step 2: Understand Network Characteristics

3.2.1 Network Structure and Centrality Measures

The network graph (see Figure 2) was constructed using the Harel-Koren Fast Multiscale layout algorithm (Harel & Koren, 2000), and the vertices were grouped into clusters using the Clauset-Newman-Moore cluster algorithm (Clauset et al., 2004).

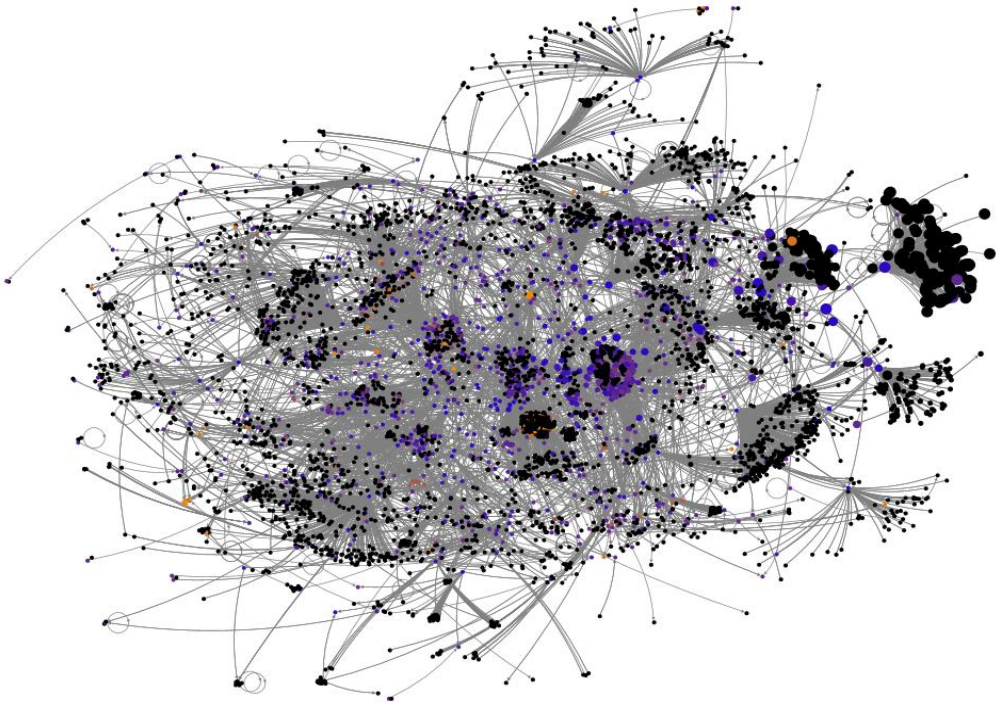


***Figure 2. Graph of Social Network Discussing Fake News and Related False Information in the Context of ChatGPT**

*Note: The size of nodes represents eigenvector centrality, while the darker blue shades indicate greater betweenness centrality.

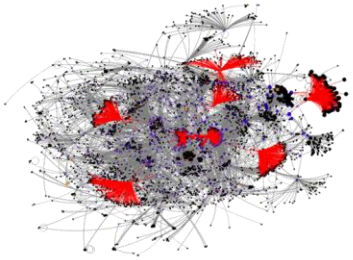
Centrality indicates how important a node is within the network, determined by specific objective measures (Hansen et al., 2019). In a social network, an actor's prestige or in-degree indicates the degree to which they are sought after by others (Russo & Koesten, 2005). Individuals with high in-degree scores in a network tend to act as conversation initiators, facilitating connections between users (O'Regan & Choe, 2022).

The mean in-degree centrality for the current network is 1.091 (see Table 2). Those with the highest scores were engaged in multiple discussions regarding the potential risks associated with ChatGPT. These included (a) conversations led by a prominent AI specialist in deep learning regarding ChatGPT spreading false information about masks and vaccines during the COVID-19 pandemic, (b) discussions based on an article published in a cryptocurrency and blockchain-focused magazine that mentioned allegations of a smear campaign against a cryptocurrency exchange, where ChatGPT was accused of falsely linking the exchange's founder to the Chinese Communist Party using a fabricated LinkedIn profile and a non-existent *Forbes* article, and (c) discussions around a tweet claiming that Democrats created ChatGPT to spread false information.

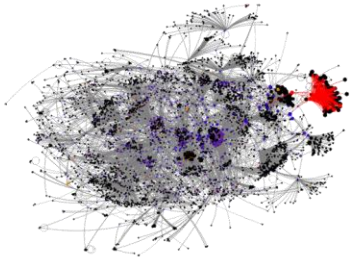
Table 2. Metrics Related to Centrality Scores

Key centrality measures (in-degree, out-degree, eigenvector, and betweenness centrality)	
Minimum In-Degree	0
Maximum In-Degree	285
Average In-Degree	1.091
Median In-Degree	1.000
Minimum Out-Degree	0
Maximum Out-Degree	48
Average Out-Degree	1.091
Median Out-Degree	1.000
Minimum Eigenvector Centrality	0.000
Maximum Eigenvector Centrality	0.425
Average Eigenvector Centrality	0.001
Median Eigenvector Centrality	0.000
Minimum Betweenness Centrality	0.000
Maximum Betweenness Centrality	10641312.196
Average Betweenness Centrality	11939.717
Median Betweenness Centrality	0.000

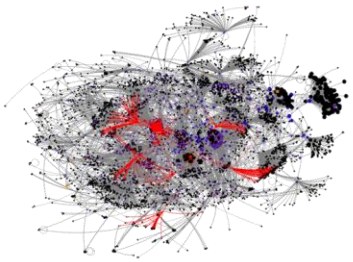
Network graph: Red-colored lines are edges linked with top 10 in-degree centrality vertices



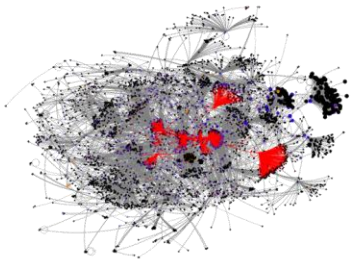
Network graph: Red-colored lines edges linked with top 10 Eigenvector centrality vertices



Network graph: Red-colored lines are all edges linked with top 10 out-degree centrality vertices



Network graph: Red-colored lines are edges linked with top 10 betweenness centrality vertices



Out-degree refers to the number of outbound edges originating from a vertex and connecting to others (see Table 2), reflecting how frequently a Twitter account shares content on a specific topic and interacts with other users via mentions or replies. Among users with high scores, one accused ChatGPT of spreading false claims linking lying to dopamine, while another warned that ChatGPT's dissemination of fake news from the Chinese government could have serious consequences, citing its tendency to learn from unreliable data and produce more false information. A Twitter account of a venture fund investment firm gained significant out-degree centrality, mainly due to a post highlighting NewsGuard's[6] report on ChatGPT's potential to propagate false information (NewsGuard, 2023). Similarly, a Twitter account of a nonprofit community organization promoting critical thinking showed high out-degree centrality scores, primarily due to its tweets raising awareness about the dangers of false information generated by ChatGPT.

Eigenvector centrality considers both a vertex's degree and the centrality of its connected vertices, thereby reflecting the quantity and quality of connections (Hansen et al., 2019). Those with high scores in this context tend to be important actors with a greater ability to disseminate information (see Table 2). The analysis reveals that a significant proportion of the accounts demonstrate low eigenvector centrality scores, suggesting that they are positioned on the periphery of the broader Twitter network. Among those with high eigenvector centrality scores is a senior editor at an American political news and analysis website, who gained popularity after ChatGPT allegedly provided false information in response to a query about the person. Additionally, the Twitter accounts of a television commentator and a law firm affiliate had high scores, driven by their tweets discussing allegations of political bias and the spread of supposedly false political information by ChatGPT.

Betweenness centrality (see Table 2) identifies actors facilitating information flow within the network (Hansen et al., 2019). Without these accounts, the dissemination of information would be significantly impeded. The Twitter accounts of OpenAI, the developer of ChatGPT, one of OpenAI's co-founders, and NewsGuard, an organization focused on combating fake news, displayed the highest betweenness centrality scores. In the initial months following ChatGPT's launch, these accounts were actively involved in discussions about ChatGPT's tendency to generate fake news. Their high betweenness centrality suggests they function as gatekeepers, controlling the flow of information between various communities within the network (Oliveira & Gama, 2012).

[6] NewsGuard provides transparent tools designed to combat misinformation, helping readers, brands, and democracies identify and counter false narratives circulating online. It also monitors the spread of misinformation across digital platforms (NewsGuard, 2024).

PageRank, akin to Eigenvector centrality, can function as a metric for gauging influence. This algorithm assesses the significance of individual nodes by analyzing the quality of inbound edges. This methodology recognizes individuals who receive significant endorsement from their surrounding actors. The reliability and trustworthiness of an account underscore its ability to influence and hold sway over other influential users within the network. The PageRank analysis indicates that an AI expert specializing in deep learning and evolutionary computation, along with the editor of a cryptocurrency and blockchain-focused magazine, were viewed as the most authoritative figures by other network members.

3.2.2 Structure of Communities

The structure of a community on social networks is an outcome of the heterogeneous distribution of edges on a global and local scale (Oliveira & Gama, 2012). The detection of this structure bears considerable significance in SNA (Clauset et al., 2004; Girvan & Newman, 2002; Kim et al., 2018; Kim & Hastak, 2018; Leskovec et al., 2010). It allows for the development of a comprehensive network graphic by utilizing communities as meta-nodes. Also, it facilitates the recognition of unique characteristics that differ from the average properties of the network. Toward this, we used the Clauset-Newman-Moore algorithm (Clauset et al., 2004), which places each node into a community and repeatedly merges pairs of communities, reassessing modularity after each step until the maximum modularity gain is reached (Kumar & Singh, 2024; Wei et al., 2022). In the current study, the structure was identified as a community cluster (Smith et al., 2014). Such clusters typically emerge around popular topics on Twitter, drawing participation from multiple actors and forming several small and medium-sized groups with moderate inter-group links (Smith et al., 2014).

To determine topics among the top communities, we focused on users with the highest centrality scores and analyzed the conversations involving these users. Based on the analysis of this content, we developed a description of each group's predominant theme. Any disagreements between the authors during this process were resolved by reexamining and recoding the content. Table 3 summarizes the ten largest communities with illustrations.

Table 3. Top Ten Communities in the Network

Label	Vertices	Description	Examples of tweet excerpts
G1	4049	An isolates group with a range of topics, including (a) concerns regarding the potential impact of ChatGPT on the credibility of journalism, (b) the possibility of the tool triggering a false information nightmare, (c) the duality of AI, which involves not only propagating fake news but also defending the truth, (d) use of ChatGPT to create fake news organizations and websites, (e) remarks by an American businessman about the worsening fake news crisis, which the user attributes to tools such as ChatGPT, (f) false accusations made by ChatGPT against an individual in the United States and (g) the ban on ChatGPT in New York City schools due to fears of false information.	*"A fake news frenzy: why ChatGPT could be disastrous for truth in journalism…"* *"New York City schools ban access to #ChatGPT over fears of cheating and misinformation…"*
G2	525	Discussions related to ChatGPT as an illustrative case of how AI can be utilized to disseminate partisan propaganda and ideological viewpoints.	*"ChatGPT is an example of how AI can be used to spread partisan propaganda and ideology."* *ChatGPT, built by registered Democrat voters, was designed to lie and spread dangerous left-wing misinformation…"*
G3	465	The issue of biases and false information on AI-based tools, such as ChatGPT, and the remarks made by the CEO of Open AI regarding the possible use of chatbots for disseminating false information on a massive scale.	*"…while people are exploring the possibilities with the chatbot, they need to be cautious about the downside of the technology."*
G4	461	The potential for ChatGPT to generate fabricated news websites and the ability to become a superspreader of false information.	*"… last week I decided to create a fake news outlet. The results are pretty frightening."*
G5	312	Discussions surround political and gender bias and false sexual harassment accusations that ChatGPT directed toward an individual in the United States.	*"…ChatGPT tells you a joke about men but not women, because it's offensive and inappropriate! ChatGPT is politically motivated…"*
G6	269	Discussions around journalism's credibility with the	*"The most worrying fact to be reiterated is*

Table 3. Top Ten Communities in the Network

Label	Vertices	Description	Examples of tweet excerpts
		advent of ChatGPT and China's remarks on ChatGPT as a US tool to spread false information.	*that ChatGPT has no commitment to the truth…"*
G7	256	Accusations that ChatGPT is disseminating false information on masks and vaccines concerning COVID-19	*"…spreading Covid misinformation on masks and vaccines."*
G8	236	Discourse stemming from a Bloomberg article about the adverse effects of AI (Brustein, 2023), the restricted access to this technology dominated by a select group of firms, and the deliberation surrounding the proposition for an immediate cessation of advanced AI research due to its potential hazards, including the spread of false information	*"…potential effects on society are so enormous that it can be tough to focus on more immediate concerns."*
G9	199	Discussion related to an alleged ChatGPT-based defamation campaign against a cryptocurrency exchange concerning the exchange founder's purported affiliations with the Chinese Communist Party.	*"This is a crazy story—we'll see more of this as AI-based disinformation spreads…"*
G10	157	Uncertainties surrounding ChatGPT, the narrative changing with every passing day, and the unreliability of material produced by LLMs.	*"AI: Disinformation, misinformation, and meltdowns…"*

Figure 3 portrays the interrelationships between various groups. A grey line indicates the presence of connections or relationships between the vertices. Furthermore, we analyzed the information flow among different groups. G1 is a group that exists in isolation, without interacting with other groups. The graph (see Figure 3) also indicates a reasonably dense interaction between Groups G2 and G3, followed by G3 and G4.

The exchange of conversations between G2 and G3 may be attributed to two factors. The first factor relates to a tweet from the founder of a surveillance organization dedicated to protecting free expression. The founder accused NewsGuard of limiting freedom of expression while claiming to fight false information in response to NewsGuard's assertion that GPT-4 produced more inaccuracies than GPT-3.5. The second factor involves several users who raised concerns with OpenAI and its founders about ChatGPT spreading false information, mainly related to politics and biases, with some messages accusing ChatGPT of distorting the truth and limiting the discussion of alternative viewpoints.

The main discussions between G3 and G4 can be traced to the Twitter account of the founder and CEO of a cross-partisan political reform group in the United States and NewsGuard, which focuses on combating fake news. The discourse centers around a tweet from the founder and CEO, who praises NewsGuard for its efforts to differentiate false information from legitimate journalism. The tweet also highlights that the quality of output from tools like ChatGPT depends on the quality of the input used to train them.

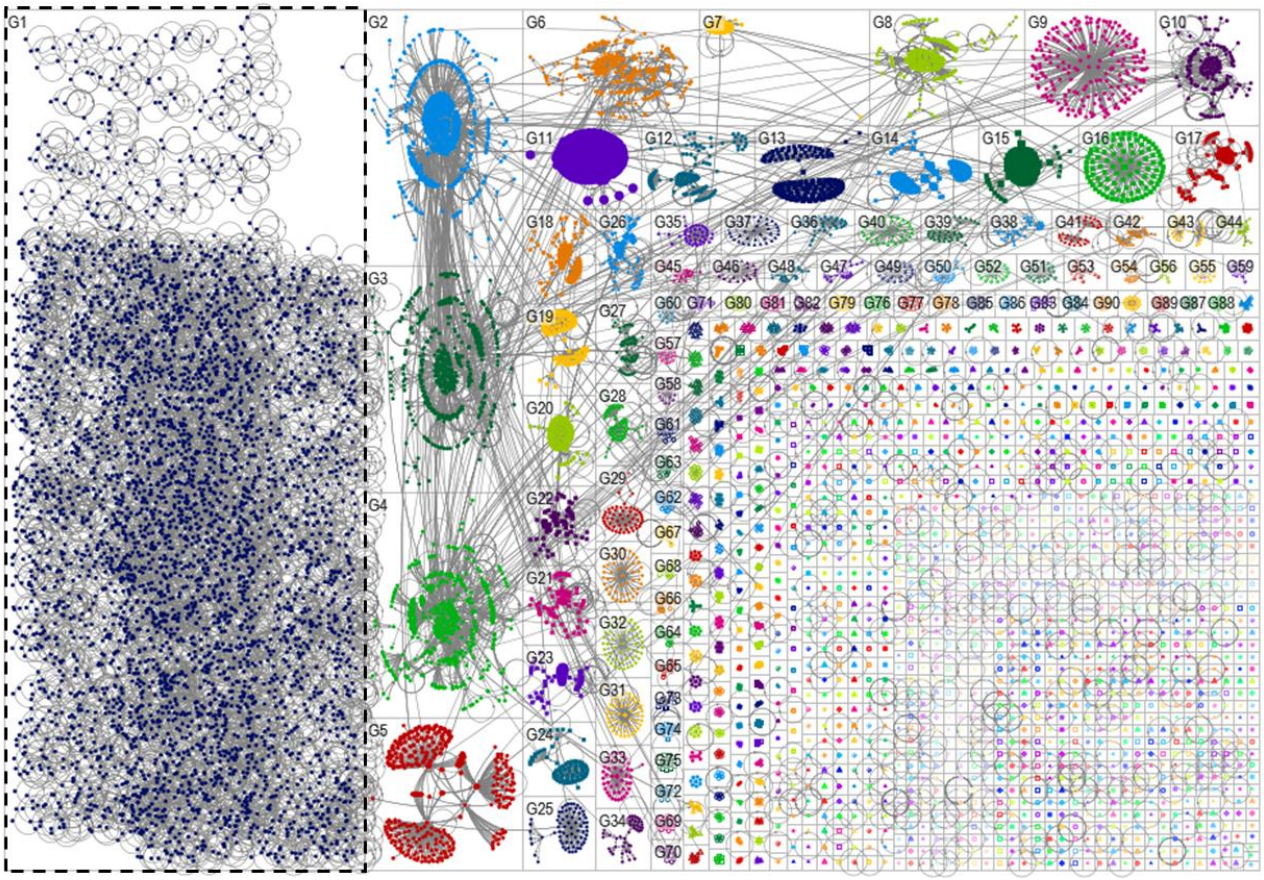


***Figure 3. Community Structure**

*Note: The group number appears in the top left corner of each outlined box. Dots represent individual users, while the grey lines illustrate connections between users both within the same group and across different groups. The isolates group G1 is shown inside a dashed boundary.

3.2.3 Analysis of Sentiments

The sentiment was analyzed in depth using text analysis. We used the built-in feature on NodeXL Pro for sentiment analysis, which is supported by a lexicon of terms compiled by Dr. Bing Liu's research group at the University of Illinois at Chicago (Hu & Liu, 2004; Liu et al., 2005). The terms "fake," "misinformation," and "disinformation" were excluded from the list of negative words for two primary reasons. First, "fake news" was embedded within the search parameters employed in this study. Second, the terms "misinformation" and "disinformation" frequently occur in conjunction with discussions of fake news (Egelhofer & Lecheler, 2019) and were part of the search protocol used for the study. We excluded these terms since incorporating them in the list could potentially skew the outcomes of the sentiment analysis. The findings indicate that a majority, constituting 59.73 percent of the words, exhibited a negative sentiment, highlighting the apprehensions surrounding disseminating fake news via ChatGPT (see Figure 4).

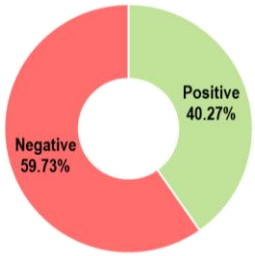


Figure 4. Text Analysis Related to Sentiments

3.2.4 Top Accounts and Weblinks

Top accounts were identified based on the frequency of their usernames in the aggregated tweets dataset. The ranking of top replied-to users was determined by analyzing the frequency with which their usernames were featured in the initial section of the compiled corpus of tweets. It is important to note that instances where their usernames are referenced elsewhere in the message are classified as mentions and are not included in this ranking.

Noteworthy Twitter accounts frequently mentioned include those of an AI expert specializing in deep learning and evolutionary computation and the editor of a cryptocurrency and blockchain-focused magazine. The AI expert's tweet drew attention for criticizing ChatGPT for spreading false information about masks and vaccines during the pandemic, while the latter's article highlighted ChatGPT's role in a smear campaign against a cryptocurrency exchange by linking its founder to the Chinese Communist Party.

Other key accounts included a business news organization that gained attention for its coverage of rapid AI advances and concerns about spreading false information. Additionally, an article on the same organization's website raised the issue of ethics and expressed apprehensions about the possibility of organizations compromising on false information and related negative consequences in their efforts to outcompete ChatGPT. Among the most responded-to users were a prominent AI expert who voiced concerns about ChatGPT and LLMs being used by malicious actors to generate false information and a clinical psychologist who expressed concerns about the potential harm AI could pose to humanity.

Analysis of the top weblinks featured in the tweets revealed that the most prominent link concerned allegations about ChatGPT spreading false information on COVID-19 masks and vaccines. The second most frequently accessed link raised concerns about ChatGPT's impact on journalistic integrity with a deluge of false information. Other notable links included a column from *USA Today* discussing ChatGPT's role in disseminating baseless allegations of sexual misconduct, purportedly tied to a fabricated 2018 article from *The Washington Post*. The analysis of top URLs also highlighted discussions surrounding false information related to climate change.

Lastly, a scrutiny of the disciplines in which the primary users of the network are distributed reveals a diverse range of domains, including AI experts, business leaders, institutions, journalistic media, politics, and social welfare communities, among the core users involved in the discussions (refer to Table 4).

Table 4. Core Users in the Twitter Network Categorized by Domain

Domain	Prominent Twitter users in these domains[7]
AI experts	An AI expert specializing in deep learning and evolutionary computation.
	A leading voice in the field of AI.
Business leaders	One of the co-founders of OpenAI.
	An entrepreneur and Tech journalist.
	CEO of OpenAI, the technology firm that developed ChatGPT.
Consultants/Authors	An author and clinical psychologist.
	A linguist, Author, National Media Consultant, and Translation Industry Expert.
	An author and marketing consultant.
Institutions	An early-stage venture fund.
	The technology firm behind the development of ChatGPT.
Journalism	A political journalism website.
	A business news organization.
	A professor and director of the Tow Center for Digital Journalism at Columbia's Graduate School of Journalism.
	A journalism tool that combats false information.
	The editor of Fortune Crypto magazine.
Politics	A political activist and television correspondent.

[7] Usernames are excluded in alignment with guidelines on the responsible use of social media data (Gliniecka, 2023; Kwon & Park, 2023).

Table 4. Core Users in the Twitter Network Categorized by Domain

Domain	Prominent Twitter users in these domains[7]
	Twitter handle of the President of the United States.
	A political commentator and President of a media group.
	Founder and CEO of a cross-partisan political reform group.
Social welfare	A nonprofit community organization promoting science and critical thinking.
	The founder of a surveillance organization that safeguards the right to free expression.

3.3 Step 3: Present a Summary of Findings from the Network Analysis

We employed SNA to examine the networked discussions of early ChatGPT users, focusing on their opinions and concerns about the tool's potential to generate fake news. The discussions contributing to high centrality values emphasized ChatGPT's tendency to generate health-related and political fake news, as well as the concerning cycle where its reliance on unreliable data could result in further false information. Additionally, certain organizations garnered attention for their efforts in raising awareness about the dangers of fake news during a potential crisis. Specifically, the discussions among individuals with high eigenvector and betweenness centrality scores focused on allegations of political bias concerning fake news generated by ChatGPT. Meanwhile, the PageRank values underscored the significant role of AI experts and journalists in driving conversations about the tool's tendency to produce fake news. In summary, the network structure and centrality measures confirm apprehensions about ChatGPT's tendency to generate fake news and highlight the influential voices in the debate over the tool's negative aspects.

The network structure revealed a community cluster typical of popular Twitter topics. The key topics that connected groups include false political information and biases, with accusations that ChatGPT stifles alternative viewpoints. Additionally, concerns about threats to free expression and the impact on legitimate journalism due to ChatGPT's capacity to generate fake news were prominent in these discussions, while sentiment analysis reveals increasing concerns about ChatGPT's tendency to create and spread fake news.

In addition to the aforementioned observations, the analysis of top accounts and weblinks highlighted ethical issues and potential compromises by companies competing in the AI race. It also raised concerns about the possible misuse of ChatGPT by malicious actors to spread false information. Additionally, the potential dangers of AI to humanity were emphasized, drawing attention to the negative aspects of AI advances. Issues such as false allegations made by ChatGPT against certain individuals and ChatGPT's connection to climate change-related false information also emerged. Finally, the analysis showcased the engagement of prominent Twitter users from various fields in discussions about ChatGPT's role in generating fake news.

Overall, the analysis demonstrates that ChatGPT, as a disseminator of fake news, has generated reservations and skepticism about the tool's capabilities. This has captured the interest of business leaders, AI experts, and community welfare groups, who are now taking measures to raise awareness and counteract the spread of AI-generated fake news. Simultaneously, the journalistic media has been apprehensive regarding the improper use of the tool but also garners extensive readership for its articles on this topic (Alba & Love, 2023; Brustein, 2023).

We contend that the collective intelligence emerging from these discussions not only reflects concerns but also helps build consensus and shapes the direction of technological progress by amplifying these issues within the network. For example, interactions between groups not only highlighted worries about ChatGPT's role in spreading false information but also engaged influential users from different groups. In particular, exchanges between Groups G2 and G3 involved numerous users who used tweets to bring prominent figures, including OpenAI, into the conversation about ChatGPT's fabrication and dissemination of false information. Recent events have further supported this, underscoring the growing threat of generative AI tools in spreading false information (Goswami, 2023).

In this context, we are also witnessing efforts to mitigate the negative impacts of ChatGPT. OpenAI has begun implementing measures to ensure the safety and security of its AI systems, acknowledging the crucial importance of safety in the face of ongoing controversies (Mauran, 2023a, 2023b). Likewise, Elon Musk has launched xAI, describing it as a "maximum truth-seeking AI" in response to concerns about the potential dangers AI poses to humanity, with plans for improved versions of the tool in the future (Reuters,

2024; Roth, 2023). Nonetheless, considering the nascent stage of the technology, it remains uncertain how it will evolve and how its widespread adoption in society will shape its future trajectory.

3.4 Supplementary Analysis

We conducted a supplementary analysis[8] with three variations to gain broader insights into users' sentiments toward AI chatbots beyond just ChatGPT, including Google Gemini and Microsoft Copilot, especially regarding their potential to generate fake news. First, we chose Reddit as an alternative social media platform to gather user perspectives and sentiments, offering insights beyond Twitter. Our choice of Reddit was influenced by its key affordance of anonymity (Massanari, 2015), which promotes open discussion and stronger group ties (Kwon & Park, 2023). Second, we broadened our search protocol on NodeXL Pro by adding two additional keywords, "AI" and "fake information," as some use "fake news" and "fake information" interchangeably (e.g., Svintsytskyi et al., 2023; Zhou et al., 2019), and "AI" was included due to our focus on AI chatbots. However, due to platform limits, our Reddit search was restricted to the latest 250 posts in reverse chronological order (SMRF, 2023a). Third, we conducted three separate searches, each focusing exclusively on one AI chatbot: ChatGPT, Gemini, or Copilot. All three searches were conducted in October 2024, nearly two years after the ChatGPT tool was publicly launched in November 2022 (Johnson, 2022). This approach allowed us to compare sentiments[9] related to fake news across these three different chatbots. Also, it enabled us to explore how sentiments among early adopters differed from those involved in discussions about the tool nearly two years after its launch.

The Reddit communities focused on fake news related to ChatGPT, Gemini, and Copilot formed networks of 2,281, 1,744, and 1,641 users, respectively. The analysis uncovered two key insights. First, the negative sentiment regarding fake news on ChatGPT has slightly declined, now standing at approximately 51%, compared to nearly 60% in the initial analysis. Second, user sentiment across all three chatbots is quite similar, with negative sentiment slightly exceeding positive sentiment, though the difference is minimal. The results are summarized in Figure 5.

The decrease in negative sentiment surrounding fake news generated by ChatGPT, compared to its early days, could be attributed to the growing attention toward AI-generated false information and the rising demand for regulation (UN, 2023; WEF, 2024). This global push for regulation, addressing the threat of fake news, may have reassured users, easing fears about the misuse of such platforms. However, the supplementary analysis shows that concerns persist, with user sentiments about fake news on ChatGPT comparable to those on platforms like Gemini and Copilot.

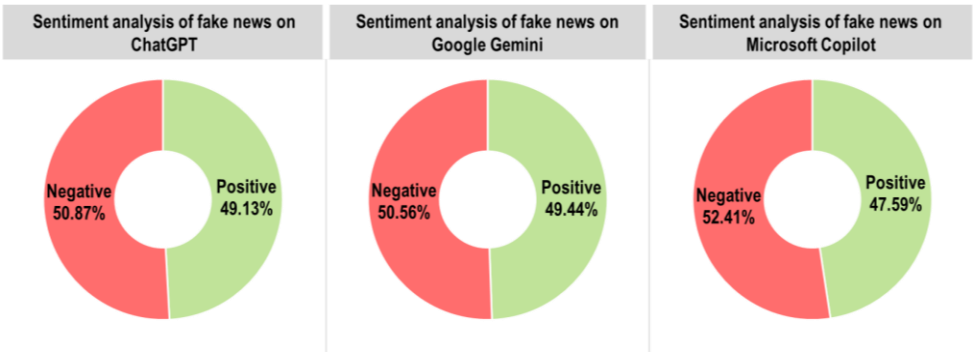


Figure 5. Analysis of Users' Sentiments toward ChatGPT, Google Gemini, and Microsoft Copilot Based on Reddit Conversations

4 Discussion

This study provides important insights into the role of social networks in the early stages of technology development by examining Twitter discussions about ChatGPT and the tool's potential to spread false information. The findings confirm apprehensions about ChatGPT's ability to produce fake news and

[8] We thank Reviewer 2 for this thought.
[9] Similar to the primary analysis, we excluded fake, misinformation, and disinformation from the negative words list, as these terms were used as search parameters, and their incorporation could potentially skew the outcomes of the sentiment analysis.

highlight the role of key users and networked discussions in influencing these dynamics. A supplementary analysis conducted on Reddit nearly two years after ChatGPT's launch indicates a slight decrease in negative sentiment toward fake news generated by the tool; however, concerns persist, with user sentiments remaining comparable to those on platforms like Gemini and Copilot. Based on the findings, the study offers implications for research and practice, which are elaborated below.

4.1 Implications to Research

The study offers three implications for research. First, the study contributes to the literature on collective intelligence and consensus building by emphasizing the significance of social networks in influencing the general perception of technologies. In the context of emerging technologies, the realization of benefits is contingent upon reaching a point of consensus (Cathy Li, 2023). A key advantage of collective intelligence lies in its ability to foster consensus around an emerging technology and enable a clear understanding of user perceptions (Grover et al., 2019). In this regard, while the study highlights the issues of false information on the ChatGPT platform, it also reflects a growing consensus to address these issues and advance technology uptake. Supporting this trend, a supplementary analysis conducted nearly two years following the release of ChatGPT reveals a slight reduction in negative sentiment linking the tool to fake news. Concurrently, recent research demonstrates the effective application of ChatGPT and other generative AI models in identifying harmful content on social media (Lingyao Li et al., 2024), highlighting their emerging value. Moreover, these technologies are increasingly being explored for possibilities related to fake news detection (Chen et al., 2025), illustrating a transition from initial apprehensions to realizing their constructive potential.

Second, the study empirically validates concerns expressed in recent research regarding the potential misuse of ChatGPT as a tool for false information campaigns (Dwivedi et al., 2023). Our analysis of social network conversations shows that ChatGPT generates fake news across several domains, including politics, journalism, healthcare, and academia. The study highlights not only the urgent need for safeguards against its misuse but also the risks posed by outputs based on flawed or inappropriate data. ChatGPT's human-like content can easily pass as authentic, fueling the spread of false information with serious consequences. Nonetheless, there is a positive aspect to consider. Given their vast access to online information, LLMs can be leveraged to identify and flag previously disproven claims. Furthermore, with careful evaluation of the data and algorithms for potential biases, these AI tools—often scrutinized for facilitating the spread of false information—can instead serve as effective mechanisms for combating fake news (Cherneva, 2024).

Lastly, the study's findings have implications for research methodology as it showcases the potential of SNA in extracting valuable insights from user-generated data on social media platforms. The study incorporates data obtained from social media users and harnesses insights by integrating descriptive analytics, such as hashtags, with network analytics, including centrality and community structure, as well as content analysis through sentiment and semantic analysis. In doing so, the study illustrates the power of this approach in uncovering hidden patterns and relationships in social networks. Specifically, the study further underscores the value of SNA in extracting insights from social media data to understand complex emerging trends and technologies better (Yu et al., 2020).

Overall, the study's findings have significant implications for research methodology and emphasize the importance of social networks in influencing the adoption of emerging technologies (Yadav et al., 2023).

4.2 Implications to Practice

The findings of our study have significant implications for organizations and policymakers as they navigate the potential use of ChatGPT. First, the findings highlight the importance for organizations to remain vigilant yet optimistic in leveraging ChatGPT and LLMs, as the widespread dissemination of AI-generated fake news across sectors such as politics, journalism, and healthcare—alongside the engagement of influential stakeholders—underscores the urgent need for proactive measures to mitigate this growing concern. The issue may be particularly pronounced with the rise of LLMs, as these models can significantly accelerate the speed, diversity, and scale at which false information is generated and disseminated (Barman et al., 2024). To address this challenge, organizations should implement responsible AI practices that prioritize safety, trust, and transparency while encouraging inclusivity and collaboration among stakeholders to ensure the long-term sustainability of AI systems. The study further highlights the considerable risk of malicious actors exploiting ChatGPT to produce false content. To mitigate this threat, organizations must enforce strict access controls and usage policies, ensuring that AI

systems are utilized solely by authorized users and applied responsibly for legitimate and ethical purposes. Interestingly, the same AI systems that have raised concerns about generating fake news can also serve as powerful tools to combat it. Leveraging advanced pattern recognition, contextual analysis, and language processing, these AI-driven solutions can help moderate content, check facts, and identify false information (Li & Callegari, 2024).

Second, our findings also have implications for policymakers, particularly in light of the legal challenges facing ChatGPT and the growing number of lawsuits related to its use (Hines, 2023). The study emphasizes the increasing risk of fake news generated by ChatGPT, stressing the urgency for policymakers to acknowledge and address the looming fake news crisis it may create. Although regulations on AI usage, including requirements for Generative AI to adhere to transparency standards and copyright laws, are being introduced in various countries (European Parliament, 2023), there are concerns that such regulations may stifle innovation (Timis, 2023). Toward this, AI regulation must strike a balance between safeguarding public interest and fostering innovation, recognizing that AI applications carry varying levels of risk (Wheeler, 2023). A “one-size-fits-all” approach could either over-regulate or under-regulate depending on the context, making it essential to adopt a targeted, risk-based framework that aligns regulatory measures with specific AI use cases (Wheeler, 2023). In this context, by analyzing various instances of ChatGPT-generated fake news, we contend that this study can inform policymakers in developing a more refined regulatory approach, incorporating risk-based classifications for Generative AI tools. This would allow AI advancements to progress safely while avoiding undue constraints on innovation. By highlighting the risks and advocating for necessary safeguards and regulations, we aim to support the responsible and ethical use of ChatGPT and other emerging technologies.

5 Limitations and Avenues for Future Research

The findings of this study must be viewed in light of two limitations. The first limitation pertains to the phase of data collection, wherein our focus was confined to the Twitter platform and discussions on it. Previous research has recognized the significant impact of Twitter conversations in comprehending the uptake of emerging technologies (e.g., Sinha et al., 2020). While we attempted to address this limitation by incorporating Reddit as an additional platform for the supplementary analysis and explored users' sentiments toward fake news beyond ChatGPT by including Google Gemini and Microsoft Copilot, future studies could expand their investigation by incorporating other social networks. This would allow for a more precise evaluation of the spread of information throughout the community structure of social media. Second, the recently imposed constraints of the Twitter and Reddit platforms affected our ability to search and extract data from its networks. For instance, Twitter's rate-limiting feature impacts API users by restricting the number of requests they can make within a set time period, while retweet availability is also limited (Bogdankovich, 2024; SMRF, 2023b). Although our data collection timeframe aligns with prior research analyzing Twitter data on emerging technologies (Mareddy & Gupta, 2022; Veltri, 2013), future research could explore temporal trends based on how data extraction limitations evolve. Specifically, they could analyze trends before and after the introduction of ChatGPT, examine how user perspectives shift with the release of new large language models (LLMs), and investigate long-term attitudes toward ChatGPT’s potential to create and spread fake news.

6 Conclusion

The launch of ChatGPT represents a significant milestone in AI, garnering substantial attention for its impressive capabilities and immense potential. However, the tool's capabilities have sparked concerns about its potential misuse, particularly in generating fake news. Amid rising concerns about AI misuse for spreading false information, the study used SNA to examine the emerging network structure surrounding concerns about ChatGPT's role in creating and distributing fake news. We analyzed tweets from the Twitter network over 22 weeks, from the 30th of November 2022 to the 4th of May 2023. The analysis revealed a network of core users, influencers, gatekeepers, and conversation starters from diverse sectors, including business leaders, AI experts, journalists, political figures, and fact-checkers. The emergent network actively discussed concerns about fake news on the ChatGPT platform, confirming skepticism about the tool's capabilities. Text analysis supported this negative outlook, highlighting worries over ChatGPT's potential for fake news creation. A supplementary analysis conducted on Reddit nearly two years after the launch of ChatGPT shows a slight decrease in negative sentiment regarding fake news associated with the tool; however, concerns persist, with user sentiments comparable to those on platforms like Gemini and Copilot. This study provides novel insights for research and practice,

emphasizing the need for regulatory efforts to maximize the tool's benefits while minimizing its risks as it evolves.

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