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GenAI-powered Social Bots for Crisis Communication: A Systematic Literature Review

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Full research paper

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Abstract

Climate change causes ever more natural hazards. In such crisis situations, individuals seek for information about the situations constantly. Due to its ever-growing relevancy in the everyday life, social media are increasingly used to seek and discuss crisis-related information. Social media platforms offer the possibility to deploy social bots (i.e., automated user accounts) that are partly credited to be used for malicious purposes but also considered useful by emergency management agencies (EMAs) to disseminate situational updates and information. Many tasks for which EMAs employ social bots rely on the publication of information in textual form. Recent advancements of generative artificial intelligence (GenAI) offer means to generate texts, images, and videos automatically. Therefore, we explore how social bots can benefit from GenAI in crisis communication. To this end, we conduct a systematic literature review and offer a research agenda to guide future endeavours.

Keywords social bots, generative artificial intelligence, social media, crisis communication

1 Introduction

In times of unpredicted crisis situations like natural hazards, individuals face uncertainty and struggle to make decisions regarding necessary actions to stay or to get save (Mirbabaie et al. 2022; Mirbabaie, Bunker, et al. 2020; Mirbabaie, Stieglitz, et al. 2020). This uncertainty emerges from the "sudden occurrence and unclear information" of the crisis situation (Brachten et al. 2018). With social media's increased relevancy and use in the everyday life (Yang et al. 2019), individuals use them to share and discuss (Zander et al. 2023) and seek crisis-related information, too (Stieglitz et al. 2018). Along with a crisis and its accompanying information scarcity, misinformation and rumours emerge in social media with the potential to harm health and society by offering false or misleading advice (Mehta et al. 2021). This is further exacerbated by social media platforms enabling the deployment of social bots to participate in the public social media discourse. Put differently, these social bots are (semi-)automated user accounts that are able to manipulate the public discourse by amplifying and sharing messages containing misinformation, rumours, or a particular agenda (Marx et al. 2020; Ross et al. 2019; Salge et al. 2022; Yang et al. 2019). For example, social bots were found to spread misinformation about bushfires in Australia (Weber et al. 2022). Research acknowledged that social bots' harmful potential is grounded in their capability to exert influence on the discourse during crisis situations in which individuals try to seek reliable and helpful information (Alarifi et al. 2016; Brachten et al. 2018).

Fortunately, social bots are not only used by malicious actors to exploit uncertain situations. In fact, IS researchers started to consider social bots as a mean for emergency management agencies (EMA) to diffuse information efficiently: Benevolent social bots provided sympathy or criticism toward false information during crisis situations (Brachten et al. 2018), offered links to scientific articles (Haustein et al. 2016), supported disaster medical assistance (Kawai et al. 2018), or authored news (Lokot and Diakopoulos 2015). Prospectively, Hofeditz et al. (2020) outlined potential uses cases of social bots in emergency management, ranging from message translations and emergency warning to fighting misinformation. Notably, one characteristic that these use cases share is their reliance on the communication of written information to social media users. In this respect, the recent advancements in the field of generative artificial intelligence (GenAI) offer means to produce sophisticated textual content based on a user-entered prompt (Dwivedi et al. 2023). ChatGPT, for instance, is thought to be able to support crisis communication by providing translations, generating news articles, and authoring social media updates (Hirsch 2023). Further, it can automate conversations by answering questions or generate updates on a situation (Deng and Lin 2023). To do so, GenAI uses advanced natural language processing techniques to produce text based on user-provided instructions (Deng and Lin 2023; Ouyang et al. 2022). Following this line of research, GenAI – we argue – has the potential to advance social media crisis communication (CC) in the form of GenAI-powered social bots. Thus, this work consults the body of literature to (1) consolidate the existing tasks and requirements of social bots in CC and (2) take the opportunity to synthesise possible synergies of social bots and GenAI to pave the way of future research and ultimately improve CC. Hence, we ask the following research question:

RQ1: How can GenAI support social bots in crisis communication according to literature?

On the downside, GenAI is credited to enable users to create false and deceptive content effortlessly (Dwivedi et al. 2023). Moreover, ChatGPT is unable to provide accurate information about recent events without additional input because it was trained on large text corpora containing information only to a fixed date (Deng and Lin 2023). Similar to other AI-based systems that suffer from biases induced through the training data (Rieskamp et al. 2023), language biases in generated texts poses another danger besides the limited knowledge of GenAI (Akter et al. 2021). Since the dissemination of inaccurate or biased information might be harmful in CC, it is crucial to consider possible interferences of GenAI's inherent issues with CC, i.e., possible collisions between GenAI's issues with requirements and tasks of social bots in CC. This work is therefore also concerned with challenges that might render the use of GenAI futile in CC with social bots:

RQ2: Which challenges need to be solved in the development of GenAI-powered social bots?

By answering these research questions, we contribute to IS research by outlining future avenues for the use of technology to benefit society. First, our contributions comprise a research agenda that demonstrates how IS research can marry GenAI with social bots for CC, including possible research questions (PRQ) and design objectives (DO) for design science research projects. Second, we emphasize possible challenges that should be examined in the design and development of GenAI-powered social bots. Third, we offer practical insights for EMAs to include GenAI-powered social bots in their communication strategies. To answer our research questions, we conduct a systematic literature review according to Webster and Watson (2002).

2 Background

2.1 Social Bots in Crisis Communication

In general, social media platforms have evolved into vital information and communication channels in urgent circumstances as a result of their growing importance and prevalence (Austin et al. 2012; Ross et al. 2018). Typically, in crisis situations, people search for specific guidance and comprehensive up-to-date information in order to gain control and lessen their sense of vulnerability (Lachlan et al. 2009, 2016; Ross et al. 2018). Thus, for interaction and data collection during emergencies, social media websites have emerged as invaluable tools (Cheong and Cheong 2011; Stieglitz et al. 2017). Nevertheless, they are influenced by social bots, which are constantly growing in number and abilities, and in turn, give crisis communication a new facet (Brachten et al. 2018). Hence, on social media sites, there exist (semi-)automated social bot accounts that resemble the behaviour of the users, although their goals could be distinct (Assenmacher et al. 2020; Stieglitz et al. 2017). Existing social bots have various purposes: Some of them aim to benefit (e.g., speed up the dissemination of important news or elucidate complex information in a clearer manner), while others, in contrast, serve malicious intentions including creating falsehoods, and influencing the public discourse (Cresci et al. 2015; Ferrara et al. 2016; Grimme et al. 2022; Orabi et al. 2020). The objective of the present study is to further illuminate the benevolent use of social bots in CC and to explore synergies with GenAI.

By now, many facets of social bots have been examined, highlighting their potential benefits and drawbacks (Sætra 2020). According to Brachten et al. (2018), it is possible to better comprehend the influence of social bots in pressing situations by looking at how they amplify and spread information that contains rumours and misinformation. The capacity to mimic human behaviour and engage with users is emphasized in many types of research on the traits of social bots (Assenmacher et al. 2020; Chen and Subramanian 2018; Cresci et al. 2017; Grimme et al. 2018; Orabi et al. 2020; Yang et al. 2019). Social bots' features are further facilitated by cutting-edge capabilities to expand the scope of their use (Assenmacher et al. 2020; Grimme et al. 2022).

People encounter a variety of difficulties when faced with emergencies, some of which include the abundance of information available on social media, the complexity of confirming the veracity and accuracy of the information, the requirement to track and evaluate social media data instantaneously, and the troubles of engaging with society and resolving its issues effectively (Hofeditz et al. 2019). Many of these issues can be resolved by social bots, which at present are capable of disseminating facts, monitoring social media content in a timely manner, sorting and categorizing news, replying to common questions automatically, running surveys and gathering feedback, and assisting with distributing resources and integration (Ferrara et al. 2016; Grimme et al. 2017; Stieglitz et al. 2017).

According to a survey, municipalities and other government organizations count on automation and technology to speed up disaster assistance and response timeframes more frequently (Hofeditz et al. 2022; Schaefer et al. 2021; Söderström et al. 2021). Making sure they are recognized as a dependable source, though, is one of the major issues (Schuchard et al. 2019; Shao et al. 2018; Suarez-Lledo and Alvarez-Galvez 2022; Vosoughi et al. 2018). The implementation of ethical values including justice, openness, data security and privacy, and responsibility, according to preliminary findings, has a beneficial impact on assessed trustworthiness (Hofeditz et al. 2019, 2022; Rieskamp et al. 2023).

2.2 Generative Artificial Intelligence

An innovative facet of artificial intelligence known as generative AI has the power to generate original material that goes outside samples or data that already exist (Baidoo-Anu and Owusu Ansah 2023; Mørch and Andersen 2023). It has important ramifications for a variety of use cases, opening new possibilities and addressing difficulties. GenAI systems can discover core patterns and frameworks in data by utilizing a variety of algorithms, which enables them to produce original content across domains including photos, videos, music, and text (Baidoo-Anu and Owusu Ansah 2023; Hsu and Ching 2023; Mørch and Andersen 2023; Treleaven et al. 2023).

Recently, major advancements in the production of text by artificial intelligence (AI) have been achieved, partly as a result of the creation of sophisticated natural language models (Cingillioglu 2023; Saul 2023). One of them is ChatGPT-4 from OpenAI's generative pre-trained transformer (GPT) series, a very advanced AI-powered language model that can produce text that is both meaningful and logically adequate (Cingillioglu 2023; Subaveerapandiyan et al. 2023; Treleaven et al. 2023; Y. Zhang et al. 2023). It acquired vocabulary, spelling, and typical expression forms from enormous data sets consisting of books, papers, and online sites; and learned to predict the subsequent words in a statement based on prior terms by the means of an "autoregression" procedure followed by a more sophisticated natural

language generation (NLG) method using a transformer-based neural network (Cingillioglu 2023; Gatt and Krahmer 2018; C. Zhang et al. 2023). Public institutions may benefit from GenAI's capacity to produce consistent and pertinent material at scale to effectively communicate with the public and disseminate important information in times of crisis, especially in case its features were incorporated into social bots intended for crisis management (Dwivedi et al. 2023; Jones 2023).

Nevertheless, it is crucial to consider the moral ramifications and possible difficulties linked to the usage of GenAI in responding to crises. As disinformation may be harmful during emergencies to reduce potential hazards, it is essential to maintain transparency and to properly curate and verify data (Dwivedi et al. 2023; Graf and Bernardi 2023; Sison et al. 2023; Wahde and Virgolin 2023). The accuracy and reliability of the data generated by GenAI systems must be maintained by implementing appropriate validation procedures and human monitoring (Mørch and Andersen 2023; Sison et al. 2023; Tlili et al. 2023). The sector of education is especially grappling with ethical questions and concerns with spotting artificial intelligence-generated information (Ahmad et al. 2023; Bearman and Ajjawi 2023; Cingillioglu 2023). Educational institutions must adjust to the AI age, train students for AI-created facilities and handle possible plagiarism concerns (Ahmad et al. 2023; Baidoo-Anu and Owusu Ansah 2023; Bearman et al. 2023; Thurzo et al. 2023; Yeadon et al. 2023).

In crisis circumstances, the timely distribution of information is essential (Buck et al. 2022; Lee et al. 2022; Wang et al. 2021). Automated text-based messaging, revisions, and warnings may be generated by systems driven by GenAI (Fayyad 2023; Lee et al. 2022; Mørch and Andersen 2023; Fayyad 2023). These automatic messages can be customized for certain channels, like social media websites, where people are used to getting real-time information (Lee et al. 2017; Mulhern 2009; White 2011). Thus, crisis communication specialists may effectively reach a large audience and provide essential recommendations, safety precautions, and other crucial information. Additionally, GenAI can help in handling the surge in requests and queries during a crisis (Vassilakopoulou et al. 2023), as it may generate automatic replies by using NLP approaches, handling frequent problems, and giving pertinent information (Chen et al. 2021; Cingillioglu 2023; Dzikovska et al. 2014; Lund et al. 2023; Mørch and Andersen 2023). This feature not only offers to lessen the workload for human responders but also makes sure that information is distributed consistently and accurately even in stressful conditions.

3 Methodology

To answer our research questions, we conduct a systematic literature review (SLR) according to Webster and Watson (2002). In doing so, we can draw upon the cumulative knowledge of IS literature on social bots and GenAI to demonstrate how these technologies facilitate CC. Since we merge two fields of research not yet considered together, we conduct two searches: First, we collect literature on social bots in CC (search A). Second, we seek literature on GenAI (search B).

3.1 Data Collection

To retrieve literature, we employ the AIS eLibrary and litbaskets.io (Boell and Wang 2019). The former offers IS conference articles. Among others, this includes the AMCIS 2023 proceedings that are upcoming at the point of writing this article. The latter provides access to 847 journals that are relevant to IS research (largest basket according to Boell and Wang 2019). Thus, we source articles from a wide range of journals and conference proceedings that are pertinent to the field of Information Systems.

Equipped with databases to conduct the searches in, we start with an explorative search to familiarise ourselves with the terminology used and collect search parameters. During this process, we iteratively refine our keyword search string so that the results fit our topic but are sufficiently broad to include suited papers that use uncommon terminology. This results in the following search strings:

Keyword search A: *("social bots" OR "social bot" OR "social chatbot*" OR chatbot* OR chat-bot OR "conversational agent*" OR "dialog system*" OR "dialogue system*" OR "relational agent*") AND (crisis OR emergenc* OR hazard*)*

Keyword search B: *("generative AI" OR "generative artificial intelligence" OR "generative model*" OR "creative AI" OR "creative artificial intelligence" OR ChatGPT)*

3.2 Data Analysis

The assessment of the articles' relevancy adheres to the following screening criteria to decide about the inclusion or exclusion: We consider research articles only. Moreover, we define criteria A1–A3 and B1–B2 for the searchers A and B respectively. Regarding search A (i.e., social bots in CC), we include articles that present (A1) tasks or (A2) requirements of social bots in CC on social media. Further, we exclude

articles that study intentions of malicious use of social bots (A3). The articles of search B (i.e., GenAI) are included if they present (B1) features or (B2) challenges of GenAI. In cases of disagreement regarding whether a criterion applies, the authors discuss the articles to reach an agreement regarding its inclusion or exclusion. In addition to the articles retrieved using the database searches, we conduct forward and backward searches. Figure 1 visualises the results at each step during the process. The search process yields 16 articles regarding search A and 23 regarding search B.

We analysed these articles inductively. With respect to our research goal, we focused on tasks and requirements of social bots in CC on social media, whereas the analysis of the GenAI literature intends to outline the features and challenges of GenAI. To this end, we followed a three-step procedure. First, we read all articles of search B in depth and annotated tasks and requirements that were named. Similarly, we studied all articles of search B and annotated the articles corresponding to the mentioned features and challenges of GenAI. Second, we consolidated our annotation into tables for each aspect (i.e., task, requirement, feature, challenge; cf. Table 1 to 4). Lastly, we discussed heterogenous descriptions and unified the terminology.

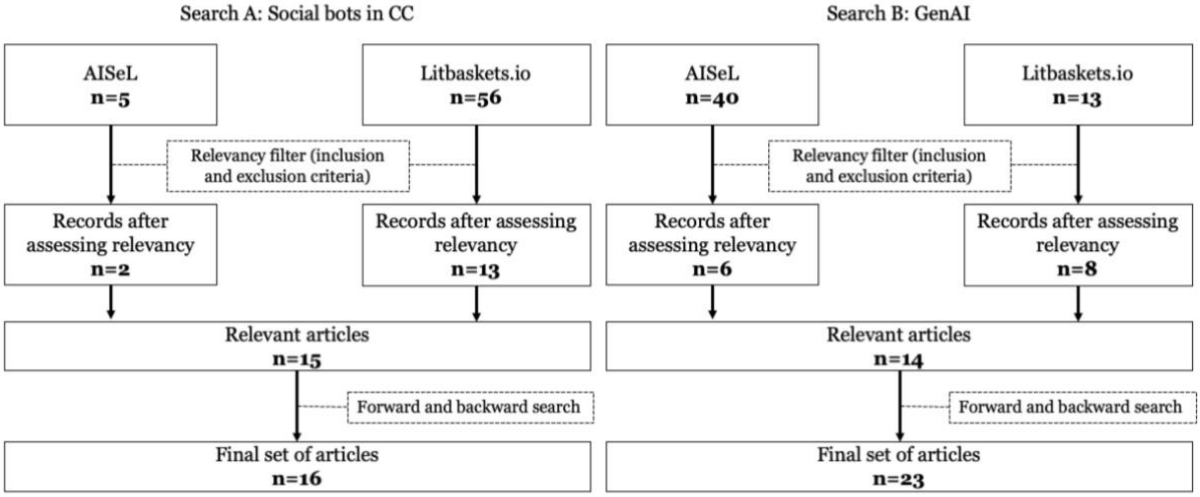

Figure 1: Literature search process.

4 Results

4.1 Social Bots in Crisis Communication

Error! Reference source not found. summarises tasks of social bots in CC mentioned in the literature. Primarily, research on the use of social bots in CC considers them suitable to **disseminate information** about the situation to the public (Brachten et al. 2018; Chin et al. 2023; Maniou and Veglis 2020; Reuter-Oppermann et al. 2022; Sermet and Demir 2018; Stieglitz et al. 2022; Ta et al. 2020; White et al. 2022). Besides updates about the current situation, information can include action advice and warnings (Hofeditz et al. 2019) throughout all disaster phases (Cheng and Jiang 2020). Besides the provision of information, social bots are useful to provide **psychological support**. This encompasses mental support (Brachten et al. 2018; Cheng and Jiang 2020; Zhu et al. 2022), social and emotional support (Ta et al. 2020), and empathy (Jiang et al. 2022). In addition to the two tasks that are referred to most often, social bots can assist in several other tasks: First, they can be used to **translate messages** to other languages. This applies to messages from EMA to the public as well as to inquiries from the public to EMA (Hofeditz et al. 2019). On a related note, social bots are suggested to be used for automated **question answering** (Chin et al. 2023; Hofeditz et al. 2019). Third, social bots can be employed to monitor social media communities to **watch out for issues** related to a crisis situation (Hofeditz et al. 2019). Both question answering and scouting for issues add to the users' preparedness (Chin et al. 2023; Hofeditz et al. 2019). Further, EMA can leverage social bots to accept **emergency reports** from the public (Hofeditz et al. 2019), and social bots are mentioned to **fight or criticise misinformation** (Brachten et al. 2018; Hofeditz et al. 2019). Lastly, they can be used to **recruit and manage volunteers** in crisis situations (Hofeditz et al. 2019).

In **Error! Reference source not found.**, we outline the requirements for social bots we found in the literature. First and foremost, researchers emphasize that social bots must provide **accurate and timely** information (Maniou and Veglis 2020; Sermet and Demir 2018; Stieglitz et al. 2022). This means that information should also include a timestamp to indicate the timely relevance and the

information's source (e.g., a link to the EMA's website) (Sermet and Demir 2018; Stieglitz et al. 2022). Moreover, **personalization** is an important issue in the communication (Maniou and Veglis 2020; Zhu et al. 2022). This refers to the delivery of relevant information, for one, in terms of the location that is pertained from the crisis situation (Sermet and Demir 2018; Stieglitz et al. 2022). Additionally, it is required that social bots should be able to process media of **multiple modalities** (e.g., text, images, videos) (Sermet and Demir 2018; Stieglitz et al. 2022). Stieglitz et al. (2022) collected extensive requirements and further mentioned that (1) the implementation of a social bot should **avoid social cues**, (2) it must be **recognisable** to which organization a social bot belongs and how user data is processed, (3) a social bot should be able to process texts in **multiple languages**, (4) a social bot should have **access to organizational databases** to retrieve information and should be able to output them on various channels, (5) it should always be possible to **fall back to human conversation**, and (6) a social bot should be able to **answer questions**.

4.2 Generative Artificial Intelligence

We present features of GenAI literature in **Error! Reference source not found.**. The **production of text** in human-like quality is mentioned the most among these features (Bubeck et al. 2023; Deng and Lin 2023; Dwivedi et al. 2023; George et al. 2023; Kaluarachchi et al. 2022; Kshetri 2023; Rix and Hess 2023; Sirithumgul 2023; Sun et al. 2022). The general procedure to generate text is to enter a prompt to which the GenAI writes an answer (Bubeck et al. 2023; Wang et al. 2023). In doing so, GenAI can produce creative and non-creative texts (Ahmad et al. 2023; Sison et al. 2023), with varying formality (Wang et al. 2023), and for different purposes (Fayyad 2023). Types of texts are, for instance, social media posts (Sirithumgul 2023) or news articles (Hofeditz et al. 2021; Rix and Hess 2023; Sirithumgul 2023). In fact, ChatGPT itself claims that it can facilitate news writing in crisis situations (Hirsch 2023). Furthermore, GenAI is able to translate texts from and to various languages (Ahmad et al. 2023; Bubeck et al. 2023; Deng and Lin 2023; Dwivedi et al. 2023; Sirithumgul 2023). Besides the translation, it can also summarize texts to retrieve its gist (Bubeck et al. 2023; Sirithumgul 2023). Among the most relevant features, GenAI is able to engage in dialogues (Ahmad et al. 2023; Deng and Lin 2023; George et al. 2023; Sirithumgul 2023) and question answering (Bubeck et al. 2023; Deng and Lin 2023; Dwivedi et al. 2023; George et al. 2023; Sirithumgul 2023). Specifically, it is said to be useful to communicate with stakeholders (Wang et al. 2023) and maintain conversations (Schöbel et al. 2023). Additionally, the assistance of GenAI in text production can automate and augment human tasks that, in turn, result in cost and time savings (Deng and Lin 2023; Fayyad 2023; Kowalczyk et al. 2023; Sirithumgul 2023). For one, this includes the **editing of texts** (Ahmad et al. 2023; Bubeck et al. 2023; Kshetri 2023; Sirithumgul 2023; Sison et al. 2023) and **extracting and categorising information** (Kshetri 2023; Sirithumgul 2023). Far less often than text production, GenAI is considered useful regarding the **generation of images** (Bubeck et al. 2023; Kowalczyk et al. 2023; Mørch and Andersen 2023; Sun et al. 2022), **videos** (Kowalczyk et al. 2023; Sun et al. 2022), and **audio** material (Kowalczyk et al. 2023; Mørch and Andersen 2023; Sun et al. 2022). Lastly, chatting with an AI was also found to provide **emotional support** (Kaluarachchi et al. 2022).

Next, we present challenges regarding the use of GenAI in **Error! Reference source not found.**. First, researchers pointed out that GenAI **cannot replace human expertise** despite it very knowledgeable appearance (Fayyad 2023; George et al. 2023; Sirithumgul 2023). Emily Bender first coined the term *stochastic parrot* to describe GenAI's inability to understand the meaning of text and instead compiling pure repetitions of the data that it learned: That "is a system for haphazardly stitching together sequences of linguistic forms it has observed in its vast training data, according to probabilistic information about how they combine, but without any reference to meaning" (Bender et al. 2021). This reliance on data entails, however, **privacy and data security** issues (Bubeck et al. 2023; Dwivedi et al. 2023; Mørch and Andersen 2023; Schöbel et al. 2023; Sirithumgul 2023; Sison et al. 2023). For instance, the new possibilities for personalized content brought by quickly generated content raises concerns regarding user profiling (Kowalczyk et al. 2023).

Furthermore, GenAI's inability to comprehend meaning and its probabilistic generation process can lead to **hallucinations** (i.e., erroneous and factually false output) (Bender et al. 2021; Bubeck et al. 2023; Deng and Lin 2023; Dwivedi et al. 2023; Fayyad 2023). This is aggravated by its **lack of updated information**: A GenAI model is trained on a finite volume of data and to introduce current information, the training process must first be started over with the updated data (Dwivedi et al. 2023). This further extends to GenAI's **lack of understanding of the context** it is used in: It cannot understand nuances of human language (e.g., tone). Thus, every relevant contextual information must be passed to it within the prompt (Ahmad et al. 2023). Another issue emerges from the training data itself and the encoded **biases** therein (Deng and Lin 2023; Kowalczyk et al. 2023; Sison et al. 2023): To train ChatGPT, for instance, broad distributions of texts from the internet were used to compile text

corpora (Ouyang et al. 2022). However, content on the internet does not emerge from all over the world equally, but it is largely influenced by the Western culture and developed countries (Kshetri 2023). Thus, these texts tend to represent hegemonic world views (Bender et al. 2021) and entail discrimination, racism, sexism, and misogyny (Bubeck et al. 2023; Dwivedi et al. 2023). These biases, in turn, are reflected in the GenAI's output.

Major limitations of GenAI further include its **lack of explainability, transparency, and accountability** (Dwivedi et al. 2023; Mørch and Andersen 2023; Schöbel et al. 2023; Sun et al. 2022). On the one hand, GenAI is largely considered a black-box due to its sheer complexity (Dwivedi et al. 2023). On the other hand, it remains unanswered who is accountable for the output generated and the potential harm that may stem from it (Mørch and Andersen 2023). Moreover, GenAI is tied to **costs**: This refers to costs of developing GenAI, which requires human resources as well as computer centres to run the software (Bender et al. 2021). The latter also causes costs during the use of GenAI (Kshetri 2023). Further, the operation of computer centres requires electricity, which is tied to environmental costs too (Bender et al. 2021). Lastly, the broad accessibility and improved performance of GenAI tempts researchers to apply it to ever more benchmarks and purposes, creating opportunity costs "on the one hand in terms of time not spent applying meaning capturing approaches to meaning sensitive tasks, and on the other hand in terms of time not spent exploring more effective ways of building technology with datasets of a size that can be carefully curated and available for a broader set of languages" (Bender et al. 2021).

Beyond the challenges that originate from the GenAI's nature, human-related challenges arise too. First, humans are known to exhibit an **aversion toward algorithms and AI** (Dwivedi et al. 2023; Rix and Hess 2023; Schöbel et al. 2023). In addition, similar to the digital divide, access to AI varies heavily across nations, leading to an "**AI divide**" especially in developing countries (Bubeck et al. 2023; Kshetri 2023). Moreover, GenAI can be used for **malicious purposes**. The easy generation of text, image, and video material provides an easy way to create disinformation and deepfakes to deceive others, which, in turn, enables societal polarization (Bubeck et al. 2023; Deng and Lin 2023; Hirsch 2023; Kowalczyk et al. 2023; Kshetri 2023; Mørch and Andersen 2023; Sison et al. 2023). Additionally, GenAI poses a cybersecurity threat as well (Kshetri 2023; Sirithumgul 2023). For example, it can assist the creation of malicious software (Hirsch 2023) or the design adversarial attacks (Deng and Lin 2023).

5 Discussion

GenAI features characteristics that provide support for tasks and address requirements of social bots in CC. In this respect, design science research is beneficial to guide the purposeful and effective development. However, there are also challenges that need to be accounted for in future research. Some of these challenges relate directly to requirements of social bots, while others overshadow all tasks of GenAI-powered social bots. An overview of these relations is given in Figure 2. It visualises the influence from GenAI's feature and challenges on the tasks and requirements of social bots in CC. The solid arrows indicate a support relation, whereas the dotted arrows demonstrate that one concept impedes the other. To distinguish tasks, requirements, features, and challenges visually, their boxes are shaped and coloured differently, i.e., grey rounded box, grey cornered box, blue rounded box, and blue cornered box, respectively. The GenAI's challenges above the horizontal dotted line at the top refer to impediments that pertain all aspects. In subsection 5.1, we propose an answer to the RQ1, while subsections 5.2 and 5.3 address RQ2. Along the discussion, we propose design objectives (DO) and possible research questions (PRQ) to guide future research.

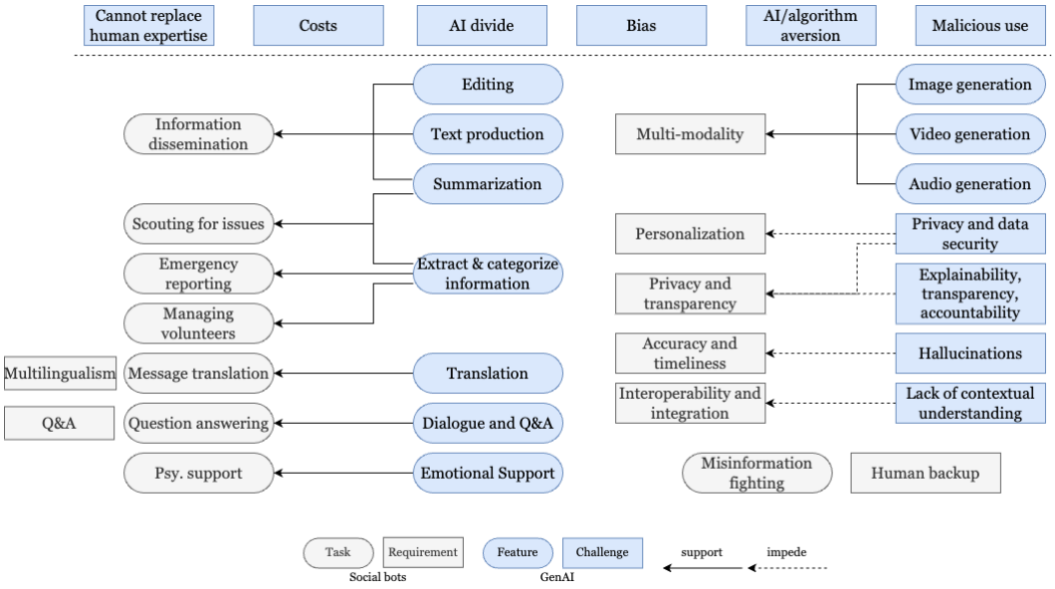

Figure 2: Synthesis of social bots' tasks and requirements and GenAI's features and challenges.

5.1 Synergies of GenAI and Social Bots in Crisis Communication

In crisis situations, social bots are needed to provide information to the public (e.g., Brachten et al. 2018; Cheng and Jiang 2020; Chin et al. 2023; Hofeditz et al. 2019; Maniou and Veglis 2020; Reuter-Oppermann et al. 2022; Sermet and Demir 2018; Stieglitz et al. 2022; Ta et al. 2020; White et al. 2022). GenAI's ability to generate text (e.g., Ahmad et al. 2023; Bubeck et al. 2023; Deng and Lin 2023; Dwivedi et al. 2023; Fayyad 2023; George et al. 2023; Hirsch 2023; Hofeditz et al. 2021; Kaluarachchi et al. 2022; Kshetri 2023; Rix and Hess 2023; Schöbel et al. 2023; Sirithumgul 2023; Sison et al. 2023; Sun et al. 2022; Wang et al. 2023) enables social bots to support this use case by phrasing information into high-quality text to be disseminated, quickly generating clear emergency instructions, ensuring vital information reaches diverse communities effectively. In a similar vein, GenAI-powered social bots can summarize texts (Bubeck et al. 2023; Sirithumgul 2023), which is useful to put EMA reports into shorter social media posts or news articles. While producing situational updates, GenAI's translation feature (Ahmad et al. 2023; Bubeck et al. 2023; Deng and Lin 2023; Dwivedi et al. 2023; Sirithumgul 2023) can help EMA address their goal of multi-language support (Hofeditz et al. 2019; Stieglitz et al. 2022) by rapidly translating and conveying a government emergency alerts into multiple languages while preserving cultural sensitivity. Further, GenAI can also provide editing services to EMA employee-written text (Ahmad et al. 2023; Bubeck et al. 2023; Kshetri 2023; Sirithumgul 2023; Sison et al. 2023). Summarization can further allow GenAI-powered social bots to facilitate scouting for issues (Hofeditz et al. 2019) by aggregating information posted on social media. In this respect, GenAI's ability to extract and categorize information (Kshetri 2023; Sirithumgul 2023) can support this use case too. Moreover, the extraction and categorization can help initial steps in volunteer management (Hofeditz et al. 2019) by registering volunteers. Further, GenAI-powered social bots can offer a mean to automatic question answering that frees human resources from responding to inquiries manually (Ahmad et al. 2023; Bubeck et al. 2023; Chin et al. 2023; Deng and Lin 2023; Dwivedi et al. 2023; George et al. 2023; Hofeditz et al. 2019; Schöbel et al. 2023; Sirithumgul 2023; Wang et al. 2023), especially it refers to common questions, such as safety instructions, first aid recommendations and available resources. Besides informational inquiries, the provision of psychological support is also needed (Brachten et al. 2018; Cheng and Jiang 2020; Jiang et al. 2022; Ta et al. 2020; Zhu et al. 2022), which was exemplarily shown to be feasible through human-machine communication (Kaluarachchi et al. 2022). Despite GenAI research's predominant focus on text production, it provides means to generate image, audio, and video material too (Kaluarachchi et al. 2022; Kowalczyk et al. 2023; Mørch and Andersen 2023; Sun et al. 2022), which can empower social bots to address its multi-modality requirement (Sermet and Demir 2018; Stieglitz et al. 2022).

In this regard, we suggest drawing upon the design science research paradigm (Gregor and Hevner 2013; Hevner et al. 2004) and set out the design objective (DO) to develop GenAI-powered social bots for the tasks mentioned above. This involves not only the implementation of applications, but also the design of workflows and processes to use them efficiently and effectively. Prior to the design of an GenAI-

powered social bot, we suggest to critically reflect on the objective for each task and requirement to examine why they are necessary in CC.

DO1: Conceptualisation and implementation of an GenAI-powered social bot for the critically reflected tasks and requirements of social bots in CC.
DO2: Design of workflows and processes to manage and use GenAI-powered social bots in EMA.

5.2 Challenges of GenAI-powered Social Bots in Crisis Communication

The requirements for privacy and transparency (Stieglitz et al. 2022) and personalization (Maniou and Veglis 2020; Sermet and Demir 2018; Stieglitz et al. 2022; Zhu et al. 2022) are challenged by the employment of GenAI. While the disclosure *that* AI is used can be done easily (Stieglitz et al. 2022), Italy's ban of ChatGPT over privacy regulation violations (BBC 2023) and the noncompliance of recent GenAI models with the European Union's AI Act (Bommasani et al. 2023) emphasize challenges for GenAI's use by EMAs. Furthermore, the lack of explainability, transparency, and accountability (Dwivedi et al. 2023; Mørch and Andersen 2023; Schöbel et al. 2023; Sun et al. 2022) renders a problem to the requirements of social bots as well: The complexity of GenAI models makes it infeasible to disclose its inner workings and to comprehend how output is generated (Dwivedi et al. 2023). Similarly, the accountability and property rights of generated outputs raise legal questions (Mørch and Andersen 2023). In this regard, we suggest several aspects to be investigated by future research. To this end, we propose possible research questions (PRQ).

PRQ1: How can EMA deal with the legal implications of using GenAI-powered social bots?
PRQ2: How can outputs of GenAI-powered social bots be explained and made transparent?
PRQ3: How can accountability be managed when GenAI-powered social bots are used for CC?

Essential to dissemination of information in crisis situations are their accuracy and timeliness (Maniou and Veglis 2020; Sermet and Demir 2018; Stieglitz et al. 2022). However, GenAI is prone to generate erroneous and factually false output (Bender et al. 2021; Bubeck et al. 2023; Deng and Lin 2023; Dwivedi et al. 2023; Fayyad 2023), which impedes the fulfilment of the accuracy requirement in all tasks that rely on GenAI-powered social bots to generate texts. Consequently, human oversight becomes necessary for cases in which the accuracy is indispensable. In such cases, augmentation might be the better choice than automation (e.g., editing; cf. Ahmad et al. 2023; Bubeck et al. 2023; Kshetri 2023; Sirithumgul 2023; Sison et al. 2023). However, augmentation and human oversight may not release as many workloads as complete automation does. Thus, we propose to address the following questions:

PRQ4: For which of GenAI-powered social bots' tasks in CC is human oversight necessary?
PRQ5: How can GenAI-powered social bots augment EMA's crisis communication?
PRQ6: How can human oversight of GenAI-powered social bots be implemented efficiently in terms of costs and resources?

Social bots are further said to be useful in fighting misinformation. Unfortunately, the analysed articles provide no details beyond "criticizing fake information" (Brachten et al. 2018, p. 4) and "fighting misinformation in social media by using keyword search and highlighting of false messages" (Hofeditz et al. 2019, p. 10). To refute specific instances of misinformation, however, one first needs to detect them. In this respect, researchers have developed, among others, machine learning approaches to detect falsehoods (e.g., Mridha et al. 2021). Yet, since a training dataset cannot include information about upcoming crises, no AI approach can assess information's veracity without additional information. Consequently, research suggested the employment of knowledge bases that store verified information to compare media content with (Ghosh and Shah 2018). Drawing upon this line of research, GenAI-powered social bots can serve as parsers of natural language to extract information from social media (Kshetri 2023; Sirithumgul 2023), which can subsequently be assessed in the light of verified information that EMA collected about the current situation. Compatible with this, Stieglitz et al. (2022) require the integration and interoperability with organizational systems to retrieve data. Consequently, we propose:

PRQ7: How can GenAI-powered social bots validate extracted information against a given knowledge base?
PRQ8: How can GenAI-powered social bots query organizational systems (e.g., knowledge base) to retrieve situational information?

There are other measures to fight misinformation besides verifying information's veracity. From a preventative perspective, EMA can provide general educational information. For instance, earlier research demonstrated the effectiveness of prebunking and inoculation (van der Linden et al. 2017,

2020), which GenAI-powered social bots can support in the creation of educational material (i.e., images and videos (cf. Bubeck et al. 2023; Kowalczyk et al. 2023; Mørch and Andersen 2023; Sun et al. 2022)).

PRQ9: Which preventative misinformation countermeasures can GenAI-powered social bots support?

5.3 General Issues of GenAI empowering Social Bots in Crisis Communication

GenAI cannot replace human expertise (Fayyad 2023; George et al. 2023; Sirithumgul 2023), and the opportunity to fall back to a human employee of EMA was considered crucial in CC (Stieglitz et al. 2022). While these aspects do not pertain to the technical nature of GenAI-powered social bots, future research should still examine organizational use and management of technology. In this respect, future research is suggested to establish how GenAI-powered social bots can augment the work of EMA employees rather than automate it. Hence, researchers should engage in the design of principles to manage GenAI applications, including workflows, processes, and responsibilities. This includes the earlier mentioned property rights and legal implications (PRQ1) too (Mørch and Andersen 2023).

PRQ10: How can GenAI-powered social bots augment EMA employees?
PRQ11: How can EMA manage GenAI-powered social bots without wiping out efficiency gains obtained through them?

Strongly tied to the management are the costs that GenAI-powered social bots generate. Our analysis reveals four types of costs that necessitate a closer investigation, namely development costs, operating costs, environmental costs, and opportunity costs (Bender et al. 2021; Kshetri 2023). First, EMA needs to analyse whether the purchase and use of GenAI-powered social bots outweigh the costs compared to communicating manually or using other technologies. Besides the acquisition and operations, GenAI-powered social bots are digital technologies that require energy (Bender et al. 2021). Ideally, this energy is produced in an environmental-friendly way. Nonetheless, EMAs need to pay attention that their efforts in CC (e.g., by using GenAI-powered social bots) during climate change caused natural hazards do not cause additional environmental damage.

PRQ12: How cost-efficient is the use of GenAI-powered bots for CC in terms of development, acquisition, and operation?
PRQ13: Does the benefit of GenAI-powered social bots for CC outweigh potential environmental damage?

Research further raises concerns about an AI/digital divide (Bubeck et al. 2023; Dwivedi et al. 2023; Kshetri 2023). The digital divide renders issues since the IT revolution because entities that use IT have an advantage over those that do not (Dwivedi et al. 2023). This divide is likely to widen further given the potential influence GenAI can exert on the economy (Bubeck et al. 2023). Since the digital divide and vulnerability to climate caused hazards are related (Hagerty 2023), it is important to support developing nations that would not benefit from improved CC otherwise. Although bridging the digital divide is already under investigation (e.g., Vassilakopoulou and Hustad 2023), we would like to emphasize its importance in the context of CC in times of ever more natural hazards with the potential to harm life and property. Additionally, while research points out the AI divide in developing countries in particular because they lack the resources to acquire GenAI technology (Bubeck et al. 2023; Kshetri 2023), it remains unanswered whether a technology such as GenAI-powered social bots are suitable for their needs at all.

PRQ14: How can GenAI-powered social bots benefit CC globally?
PRQ15: How and to what extent can developing nations benefit from GenAI-powered social bots?

Developing countries not only lack the resources to deploy GenAI technology, they are heavily underrepresented during the development and training of GenAI (Kshetri 2023). In fact, GenAI's training data is often biased towards the Western world, reinforcing hegemonic world views and discriminatory traits (Bender et al. 2021; Bubeck et al. 2023; Dwivedi et al. 2023). Considering that several countries prohibit any form of discrimination by law (e.g., Charter of Fundamental Rights of the European Union), it is crucial to avoid GenAI-powered social bots publishing biased outputs. Hence, PRQ11 should pay attention to handling biases as well. Similarly, human oversight should verify unbiasedness too (cf. PRQ6). Biases primarily originate from the data used to train GenAI models (Bender et al. 2021; Bubeck et al. 2023; Deng and Lin 2023; Dwivedi et al. 2023; Kowalczyk et al. 2023; Kshetri 2023; Sison et al. 2023). Hence, we also suggest research to mitigate the problem on a technical level. Approaches to mitigate biases in AI are commonly categorized into pre-processing (i.e., preparing the data beforehand), in-processing (i.e., modifying the AI algorithm), and post-processing (i.e., mitigating biases in the output) (Rieskamp et al. 2023).

DO3: Design of approaches to mitigate biases in GenAI-powered social bots' output.

Algorithm aversion describes the behaviour individuals exert when they avoid algorithmic decision support, even though the algorithms outperforms human decision makers (Dietvorst et al. 2018). Our analysis reveals that this behaviour is expected for GenAI as well (Dwivedi et al. 2023; Rix and Hess 2023; Schöbel et al. 2023). Thus, like in other sectors, research is necessary to mitigate the aversion employees of EMA have. In the context of the requirement to disclose GenAI-generated contents (cf. Stieglitz et al. 2022), we expect yet another group to experience the aversion: the public. Social bots are often thought to spread misleading and false content (Shao et al. 2018). Similarly, the creation of false content is one of the greatest threats posed by GenAI (Bubeck et al. 2023; Deng and Lin 2023; Dwivedi et al. 2023; Hirsch 2023; Kowalczyk et al. 2023; Kshetri 2023; Mørch and Andersen 2023; Schöbel et al. 2023; Sirithumgul 2023; Sison et al. 2023). Therefore, the public's algorithm aversion is most likely worsened by the negative reputation of GenAI-powered social bots. Therefore, research is essential for individuals to take safety advice and warnings seriously.

PRQ16: How can EMA employees' algorithm aversion towards GenAI-powered social bots be mitigated?
PRQ17: How can the public' algorithm aversion towards GenAI-powered social posts be mitigated?

6 Conclusion

This work contributes IS research by outlining potential pathways to improve social media CC. Specifically, we consolidated tasks and requirements of social bots and explored the suitability of GenAI-powered social bots in a twofold systematic literature review: We reviewed literature of social bots in CC to gather tasks and requirements. Subsequently, we surveyed features and challenges of GenAI. In our discussion, we matched both and (1) emphasized potential synergies of GenAI's features and social bots' tasks and requirements (e.g., authoring news updates and multilingualism), (2) highlighted specific characteristics of GenAI that might impede the use of GenAI-powered social bots in CC (e.g., black box models vs. transparency requirement, and (3) pointed out general challenges that the use GenAI involves but hinders all tasks and requirements (e.g., biased output). Along with this discussion, we offer a research agenda to guide future research in the field. This agenda includes possible research questions to be studied and design objectives for design science research approaches.

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Appendix 1: Literature classification

Tasks	**Source(s)**
Situational information dissemination	(Brachten et al. 2018; Cheng and Jiang 2020; Chin et al. 2023; Hofeditz et al. 2019; Maniou and Veglis 2020; Reuter-Oppermann et al. 2022; Sermet and Demir 2018; Stieglitz et al. 2022; Ta et al. 2020; White et al. 2022)
Psychological Support	(Brachten et al. 2018; Cheng and Jiang 2020; Jiang et al. 2022; Ta et al. 2020; Zhu et al. 2022)
Message translation	(Hofeditz et al. 2019)
Question answering	(Chin et al. 2023; Hofeditz et al. 2019)
Scouting for issues	(Hofeditz et al. 2019)
Emergency reporting	(Hofeditz et al. 2019)
Misinformation fighting	(Brachten et al. 2018; Hofeditz et al. 2019)
Managing volunteers	(Hofeditz et al. 2019)

Table 1: Tasks of social bots in CC.

Requirement	**Source(s)**
Accuracy and timeliness	(Maniou and Veglis 2020; Sermet and Demir 2018; Stieglitz et al. 2022)
Personalization	(Maniou and Veglis 2020; Sermet and Demir 2018; Stieglitz et al. 2022; Zhu et al. 2022)
Multi-modality	(Sermet and Demir 2018; Stieglitz et al. 2022)
Minimal social cues	(Stieglitz et al. 2022)
Privacy and transparency	(Stieglitz et al. 2022)
Multilingualism	(Stieglitz et al. 2022)
Interoperability and integration	(Stieglitz et al. 2022)
Human backup	(Stieglitz et al. 2022)
Answering questions	(Stieglitz et al. 2022)

Table 2: Requirements of social bots in CC.

Feature	**Source(s)**
Production of human-like text	(Ahmad et al. 2023; Bubeck et al. 2023; Deng and Lin 2023; Dwivedi et al. 2023; Fayyad 2023; George et al. 2023; Hirsch 2023; Hofeditz et al. 2021; Kaluarachchi et al. 2022; Kshetri 2023; Rix and Hess 2023; Schöbel et al. 2023; Sirithumgul 2023; Sison et al. 2023; Sun et al. 2022; Wang et al. 2023)
Translation	(Ahmad et al. 2023; Bubeck et al. 2023; Deng and Lin 2023; Dwivedi et al. 2023; Sirithumgul 2023)
Summarization	(Bubeck et al. 2023; Sirithumgul 2023)
Dialogue and Q&A	(Ahmad et al. 2023; Bubeck et al. 2023; Deng and Lin 2023; Dwivedi et al. 2023; George et al. 2023; Schöbel et al. 2023; Sirithumgul 2023; Wang et al. 2023)
Editing	(Ahmad et al. 2023; Bubeck et al. 2023; Kshetri 2023; Sirithumgul 2023; Sison et al. 2023)
Extract and categorize information	(Kshetri 2023; Sirithumgul 2023)
Image generation	(Bubeck et al. 2023; Kowalczyk et al. 2023; Mørch and Andersen 2023; Sun et al. 2022)

Video generation	(Kowalczyk et al. 2023; Sun et al. 2022)
Audio generation	(Kowalczyk et al. 2023; Mørch and Andersen 2023; Sun et al. 2022)
Emotional support	(Kaluarachchi et al. 2022)

Table 3: Features of GenAI.

Challenge	**Source(s)**
Cannot replace human expertise	(Fayyad 2023; George et al. 2023; Sirithumgul 2023)
Privacy and security of data	(Bubeck et al. 2023; Dwivedi et al. 2023; Kowalczyk et al. 2023; Mørch and Andersen 2023; Schöbel et al. 2023; Sirithumgul 2023; Sison et al. 2023)
Hallucinations	(Bender et al. 2021; Bubeck et al. 2023; Deng and Lin 2023; Dwivedi et al. 2023; Fayyad 2023)
Lack of contextual understanding	(Ahmad et al. 2023)
Bias	(Bender et al. 2021; Bubeck et al. 2023; Deng and Lin 2023; Dwivedi et al. 2023; Kowalczyk et al. 2023; Kshetri 2023; Sison et al. 2023)
Explainability, transparency, and accountability	(Dwivedi et al. 2023; Mørch and Andersen 2023; Schöbel et al. 2023; Sun et al. 2022)
Costs	(Bender et al. 2021; Kshetri 2023)
AI and algorithm aversion	(Dwivedi et al. 2023; Rix and Hess 2023; Schöbel et al. 2023)
AI divide	(Bubeck et al. 2023; Dwivedi et al. 2023; Kshetri 2023)
Malicious use	(Bubeck et al. 2023; Deng and Lin 2023; Dwivedi et al. 2023; Hirsch 2023; Kowalczyk et al. 2023; Kshetri 2023; Mørch and Andersen 2023; Schöbel et al. 2023; Sirithumgul 2023; Sison et al. 2023)

Table 4: Challenges regarding the use of GenAI.

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