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Performance of Generative AIs in Detecting Dengue-Related Misinformation: ChatGPT and Google Bard

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Abstract
Dengue outbreaks have become a common occurrence in South Asian countries, including Bangladesh. It has caused widespread concern among people from all walks of life. Various misinformation about dengue proliferates among people, mainly through social media platforms. The project was designed to investigate the performance of generative AIs in detecting dengue-related disinformation. In this study, two famous generative AIs were chosen to explore the performance of generative AI in detecting dengue-related misinformation: ChatGPT and Google Bard. These AI platforms were given widely distributed misinformation about dengue and asked to determine whether it was accurate or untrue. False information was identified through content analysis of various stories about the dengue outbreak, particularly those circulating on social media platforms. After getting responses from generative AIs, the answers were cross-checked using fact-checkers and public health databases such as WHO and CDC to determine whether the answers were correct or not. This study examined the performance of three AI systems (ChatGPT and Google Bard) in reacting to ten regularly disseminated misconceptions about dengue, particularly on social networking sites. Based on public health database statements (e.g., WHO, CDC) and fact-checker comments, ChatGPT and Google BARD demonstrated promising outcomes in detecting disinformation and presenting factual information. Dengue outbreaks have become common in developing nations such as Bangladesh, and spreading dengue-related misinformation has become commonplace. While it is known that generative AI systems have inherent limitations and may not always excel at dealing with complex real-world circumstances, they have shown promise in terms of consistent answers and performance in the public health sector. More studies in this field are needed to realize the full promise of AI chatbots in these sectors.

Keywords: dengue misinformation, generative AI, social media, public health, fact-checking

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Introduction

Dengue, the most prevalent viral disease transmitted by mosquitoes globally, is caused by the dengue virus (DENV), primarily carried by female Aedes aegypti mosquitoes. There are a total of four dengue viruses that are closely associated with each other, commonly known as dengue serotypes. In recent decades, dengue fever has risen worldwide (WHO, 2023). Approximately half of the global population is susceptible to contracting dengue infection. Each year, the virus affects nearly 390 million individuals, resulting in approximately 40000 fatalities annually (CDC, 2023).

Asia is the continent where dengue outbreaks occur most frequently, especially in South Asian nations, including Bangladesh, Thailand, Indonesia, and the Philippines (Sharmin et al., 2015; Wilder-Smith et al., 2020). Dengue outbreaks have been occurring frequently in the world recently, but people usually do not know enough about the disease; misconceptions and the education level of the populace play a major role in determining people's awareness of dengue and their ability to take preventive action (Hsan, 2019; Elson et al., 2020).

The dengue outbreak is now a common phenomenon in Bangladesh. The virus is prevalent across the country and plays a substantial role in the occurrence of illness and death. Although the first dengue case was found in 1964, the official outbreak started in 2000, and the intensity and fatality have increased since then (Atia et al., 2023). During the outbreak of Dengue in 2019, it was observed that the infection rate experienced an astonishing surge, surpassing the threshold of 100,000 reported cases, thereby reaching an unprecedented level (Bhowmik et al., 2023). The country has just seen another dengue outbreak. The number of confirmed cases surpassed 200000, and there were over 1000 dengue-related fatalities. The number of reported dengue infections this year has surpassed all previous records since the officially reported outbreak in 2000 (The Daily Star, 2023).

The dissemination of incorrect information, deception, and misinformation during a disease outbreak can alter people's perceptions of the illness and how public health measures should be implemented. Although misinformation has always existed, it has gained popularity in recent decades due to the rise in social media and internet-based information worldwide. Disinformation can undermine the credibility of public health organizations, governments, and scientists, making it more challenging to adopt evidence-based interventions. The population's health is at risk due to a growing

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mistrust of government agencies and authoritative persons (Gagnon-Dufresne et al 2023).

Conspiracy theories and misinformation are common during times of crisis. Conspiracy theories abound during social crises. During these times, conspiracy theories and false information are prevalent. Despite realizing the unpredictability of conspiracy theories, many Americans hold such beliefs (van Prooijen & Acker, 2015). Similar influences can be seen in the dengue outbreak despite disinformation increasing significantly during the COVID-19 pandemic (Gagnon-Dufresne et al 2023). According to research done by Brennen et al. (2020), fact-checkers have shown that a significant amount of information is created on social media platforms. The frequency of erroneous information reminds us that accepting false information is not only related to delusions or certain medical conditions. Diverse socio-demographic groups have differing attitudes about false information and conspiratorial beliefs (Agley, 2020). Academic credentials and socioeconomic standing have a significant impact on people's conspiratorial ideas (Douglas et al., 2019; Freeman & Bentall, 2017; Galliford et al., 2017). In order to persuade people of false information, political viewpoints are also essential (Guess, Nyhan, & Reifler, 2020).

Conspiracy theories are associated with disbelieving scientific discoveries (Lobato & Zimmerman, 2019). Sometimes misunderstandings of preliminary research results lead to the dissemination of false information about the illness. People who spread false information, though, might not mean any harm. On social media, people may spread false information for a variety of reasons. They might wish to encourage dialogue and bolster the false information (Lobato et al., 2020).

Artificial intelligence is a complex term. John McCarthy first used the term in 1956 to define it as the science and engineering to develop intelligent machines (McCarthy, 2007). There are numerous definitions and explanations for artificial intelligence. However, most people have hazy beliefs regarding AI (Elish & Hwang, 2017). Before delving more into the main topic, we must address what AI is. In a simple sense, AI is a machine whose behavior would be considered intelligent if it were a person. In a comprehensive sense, the study of means that take principles from their environments and conduct performance that affect those environments is known as AI (Russell & Norvig, 2010). However, AI is not limited to a specific notion. Attempts to understand more about AI are met with instant difficulties, and with the decrease of

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ignorance and uncertainty, it is paradoxical that the term "AI" needs to be clarified and may be employed in various ways in different contexts (Kok et al., 2009).

According to the Merriam-Webster Dictionary, AI can be defined as a subfield of computer science concerned with the reproduction of intelligent behavior in computational systems. Cambridge Dictionary defines AI as the study of creating machines with some characteristics of human cognition, like the ability to comprehend language, recognize images, resolve issues, and learn. The Oxford Dictionary considers AI to be the study and improvement of computer systems capable of mimicking intelligent human behavior. The capability of a computer program to acquire and apply knowledge is known as artificial intelligence. According to Mitchell (2019), everything a computer does that a human being would typically be expected to assume requires intellect, a form of artificial intelligence. However, Miller (2019) noted that defining "AI" using either a singular definition or a pluralistic approach is difficult. The term "Artificial Intelligence" can refer to the various ways in which non-human structures can be programmed to learn from experience and model their actions after those of humans with higher levels of intelligence.This study mainly attempted to explore the performance of generative AIs in detecting dengue-related misinformation.

Literature review

Dissemination of Information During Dengue Outbreak

Information dissemination is sending information to its intended users while adhering to specified constraints such as punctuality and authenticity. Various tactics can be utilized to distribute knowledge (Wu et al., 2016). Though information dissemination is generally thought of as information exchange, it is more sophisticated and not a one-way process. A message is sent, and the recipient decides how to respond. People contribute their thoughts, facts, opinions, observations, and beliefs (Ifukor, 2013). The broadcast of credible information during the dengue outbreak is critical since it is critical in guaranteeing the outbreak's effective management and control. This is a critical period for accurate health information to be distributed swiftly (Singh et al., 2007). Social networking sites are effective and quick communication tools for disseminating and acquiring information, particularly health-related information (Kudchadkar & Carroll, 2020).

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People living in both urban and rural areas need help in obtaining correct information and resources. They frequently use various channels, such as social media, to receive and distribute information. Unfortunately, the information transmitted through these channels is frequently untrustworthy. In contrast, library staff and information professionals can obtain material from reliable sources and must disseminate this useful information as far as possible. They must actively engage with user groups and meet their need for up-to-date and relevant information (Okike, 2020).

Dengue Misinformation

Credible information is crucial for disease outbreak containment during public health crises such as the dengue outbreak. Accurate and timely information can aid in the direction of preventative measures and improve health outcomes (Voeten et al., 2009). It has been discovered that efficient information transmission to the general public can decrease reactions induced by a negative mentality (Hall et al., 2003). People's knowledge is influenced by the information sources they use, which influences their health views. Different characteristics, such as residence, education, and ethnicity, might influence information source selection and dissemination (Ifukor, 2013; Voeten et al., 2009).

Social media platforms are web-based services allowing user communities to produce, interact with, and share content. There are multiple platforms for various media types, each with its features. They enable users to communicate in real-time, allowing them to participate actively in a public conversation. In contrast to traditional media, social media enables individuals to readily develop and share content worldwide without the need for editorial supervision or approval (Puri et al., 2020). While social media has improved interpersonal communication, it has also aided in the spread of disinformation (Wilson & Wiysonge, 2020). Social networking is becoming increasingly popular all over the world, especially in low- and middle-income countries. It alters the exchange of information and exposes people to misinformation, such as fake news. This has far-reaching implications for global health. Fake news has the ability to obstruct evidence-based solutions and undermine scientific understanding (Gagnon-Dufresne et al 2023).

During times of crisis, social media can have both direct and indirect effects on the general public (Austin et al., 2012). People use social media more than usual in

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times of crisis (Princeton Survey Research Associates International for the Pew Internet & American Life Project, 2006), and they may regard it as a more trustworthy source of information than traditional media (Procopio & Procopio, 2007). Since 2000, social media misinformation has been pervasive in many facets of infectious disease epidemics, including disease control and prevention (Chowdhury, Khalid, & Turin, 2023). For example, false news and conspiracy theories about COVID-19 vaccines induced vaccine hesitation among the general public, causing confusion and panic among the population and impeding government efforts to contain the viral outbreak (Mahmud, Reza & Ahmed, 2023).

Efficiency of Generative AIs

The emergence of Generative AI technologies has been both rapid and disruptive. Its effective application necessitates the acquisition of new abilities. The abilities required to exploit the potential of AI platforms fully are currently being researched, as situational and contextual use of such platforms is critical (Vaswani et al., 2017). It is also true that AI-generated content can be distinguished from human outputs because such systems rely heavily on information obtained from such platforms, which can be quite beneficial in many corporate processes, but their risks should not be ignored (Malik et al., 2023). It is also believed that while Generative AI technologies will not completely replace humans, they will improve human intelligence (Mariani, 2022). It is difficult to dismiss the potential of generative AI technologies, yet LLM-based models may only sometimes perform well when confronted with complicated real-world issues (Deng and Lin, 2022).

It is commonly acknowledged that Generative AI platforms cannot complete a task. ChatGPT was once queried about computer skills at the University of Liverpool's computer science department (Huang et al., 2023). It failed to deliver suitable responses. ChatGPT was found to perform pretty well against science and legal exams (Shen et al., 2023). ChatGPT fared well in the essay section of a law exam. It was unable to maintain that level of performance when answering multiple-choice questions. The performance was significantly lower in math questions. ChatGPT was also discovered to frequently relate to real-world cases depending on the prompt definition (Choi et al., 2023). When the performance of ChatGPT and ChatGPT plus was compared in an ophthalmology exam, ChatGPT plus outperformed ChatGPT in

The Indonesian Journal of Communication Studies, Volume 17 / Nomor : 01 / 2024
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many circumstances because ChatGPT plus could go beyond the probabilistic feature of ChatGPT. In most cases, the regenerated responses likewise provided consistent answers (Antaki et al., 2023).In a medical evaluation in the United States, ChatGPT surpassed GPT 3 and InstructGPT. Though such platforms could not get all of the answers correct, they were able to answer a large number of questions. It was also discovered that the performance of such platforms degraded when confronted with complicated issues (Gilson et al., 2023). A similar pattern was discovered in a neurosurgery and oral surgery evaluation. GPT 4 or ChatGPT Plus outperformed GPT 3.5 and Google Bard on similar queries. Though GPT 3.5 did not outperform ChatGPT Plus, it did outperform Google Bard. However, when it came to addressing image-related inquiries, both ChatGPT and Google Bard performed admirably (Ali et al., 2023). Nowadays, generative AIs can recognize numerous types of misinformation. Using AIs in detecting fake news is a novel approach in this modern world (Patil et al., 2024).

Method

For this study, two popular generative AIs were selected to investigate the performance of generative AI in detecting dengue-related misinformation, i.e., ChatGPT and Google Bard. Some widely spread misinformation regarding dengue was given to these AI platforms, and they were asked to answer whether the information was true or false. The false information was selected by a content analysis of various news stories regarding the dengue outbreak, especially circulating on social media platforms. After receiving replies from generative AIs, the answers were cross-checked with fact-checkers such as fact-checker.in (https://www.factchecker.in/myths-facts/world-mosquito-day-7-myths-around-mosquito-borne-illnesses-debunked-831538), Boom Fact Check (https://www.boomlive.in/explainers/common-dengue-myths-debunked-drangonfruits-to-papaya-leaves-23202) and public health databases such as WHO and CDC to determine whether the answers are correct or not.

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Finding and Discussion

Table 1: Responses of Generative AIs Regarding Dengue-Related Misinformation

Misinformation	Response of ChatGPT	Response of Google BARD
Dengue is a contagious disease	Dengue is not considered to be a contagious disease	Dengue is not contagious in the traditional sense,
Dengue only occurs in rural areas or developing countries	Dengue can occur in both rural and urban areas and in developing and developed countries.	Dengue can occur in both rural and urban areas and developing and developed countries.
Only children and adults get infected with dengue.	Dengue can affect individuals of all age groups, not just children and elderly persons.	Dengue can infect people of all ages
Any mosquito bite causes dengue	Not all mosquito bites can cause dengue.	Dengue fever is transmitted through the bites of infected Aedes mosquitoes; not all mosquito bites will lead to Dengue.
Dengue mosquitoes only bite during the day.	Aedes mosquitoes are known to be primarily active during the day, especially in the early morning and late afternoon. However, their activity can vary depending on the specific species and environmental conditions.	Dengue mosquitoes are most active and likely to bite during the day, but they can also bite at night.

The Indonesian Journal of Communication Studies, Volume 17 / Nomor : 01 / 2024
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Dengue only happens once in a lifetime.	Individuals can experience multiple episodes of dengue over their lifetime.	One can get dengue multiple times throughout their life.
Dengue is cured by drinking the milk of goats and juice from papaya leaves	No scientific evidence supports the claim that drinking goat's milk or papaya leaf juice can cure dengue.	There is no scientific evidence to support their effectiveness in curing dengue.
Low platelets in the body mean that he/she has been infected with dengue	It is not exclusive to dengue and can also occur in various other medical conditions.	A low platelet count alone cannot definitively diagnose dengue
Platelets should be taken immediately after dengue infection	It is not exclusive to dengue and can also occur in various other medical conditions. Platelet transfusions are generally not recommended for all patients with dengue fever, but in most cases, they can be managed with careful monitoring and supportive care, including adequate fluid intake to prevent dehydration.	Randomly taking platelets without proper medical supervision can be dangerous and is not recommended.

The Indonesian Journal of Communication Studies, Volume 17 / Nomor : 01 / 2024
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Platelet transfusion is the only way to increase platelets	Platelet transfusion is not the only way to increase platelet count.	While platelet transfusion is an effective way to rapidly increase platelet counts, it's not the only way.

This study revealed the performance of three AI systems (ChatGPT and Google Bard) in responding to 10 commonly circulated misinformation regarding dengue, especially on social networking sites. Based on the statements of public health databases (e.g., WHO, CDC) and fact-checker responses, both platforms, i.e., ChatGPT and Google BARD, showed promising results in detecting misinformation and providing accurate information. Generative AI platforms such as ChatGPT and Google Bard have shown promise in a variety of applications. They have been tested in various domains, including physics, law, medical, and image-related issues, with various degrees of success. These platforms demonstrated their promise in the field of public health in the context of this study. This discovery is noteworthy because previous research has shown that ChatGPT outperforms other conversational AI systems, particularly in scientific and medical fields. However, the findings of this investigation match previous conclusions that Google Bard performs well as well as ChatGPT, as proven by multiple studies (Koga, Martin, and Dickson, 2023; Lim et al., 2023).

Conclusion

This study investigated the effectiveness of two popular conversational AI systems, ChatGPT and Google Bard, in answering dengue-related inquiries. The results showed that these AI systems performed admirably by answering most questions correctly and spotting misinformation. Both ChatGPT and Google Bard performed similarly in terms of being able to answer questions appropriately. When the responses of ChatGPT and Google Bard were compared overall, there were no significant differences, showing that their performance has not varied. While it is acknowledged that generative AI systems have inherent limits and may not always excel at handling complicated real-world situations, they have demonstrated promise in producing consistent responses and performing well in the public health sector. More research in

The Indonesian Journal of Communication Studies, Volume 17 / Nomor : 01 / 2024
Page : 44-57
P-ISSN 1978-323X, E-ISSN 2685-5259
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this area is required to realize the full potential of these AI chatbots in such sectors. Further study should be conducted to investigate the practical ramifications of these results for real-world applications, paving the way for transformative advances.

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The Indonesian Journal of Communication Studies, Volume 17 / Nomor : 01 / 2024
Page : 44-57
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