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AI-Driven Climate Change Misinformation on Social Media and Its Impact on Public Beliefs

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Abstract
The rising integration of artificial intelligence (AI) into social media platforms has extensively transformed the production and visibility of climate change–related content.
The study examines the role of AI-driven mechanisms in the spread of climate change misinformation on social media, particularly focused on TikTok and X (formally twitter) and investigates their impact on public beliefs. Employing mixed-methods research design, the research combines qualitative content analysis of climate-related social media posts with a survey of users to assess exposure patterns, perceived credibility, and belief formation. The analysis focuses on AI-enabled processes such as algorithmic recommendation, automated amplification, and engagement-driven visibility that contribute to the circulation of deceptive narratives.
The findings reveal that AI-driven augmentation enhances the reach of emotionally framed and deceptive climate content, influencing public understanding, trust in climate science, and perceptions of climate risk. Frequent exposure to such misinformation is found to contribute skepticism, and polarization among audiences.
By situating these research findings within media effects and information disorder frameworks, the study contributes to scholarly debates on AI, misinformation, and climate communication. This exploration offers policy-relevant insights for platform governance, media literacy initiatives, and ethical AI practices aimed at mitigating the societal impact of climate change misinformation.

Keywords: *Artificial intelligence, Climate change misinformation, Social media, Public beliefs, Algorithmic amplification*

Introduction

Climate change relevant content on social media facing significant challenges in current years (Anno, S.; Kimura, Y.; Sugita, S. 2025). One of the leading concerns is the ease with which misinformation spreads through these platforms, often without requiring verification. As an example, a study (2022) by Climate Action Against Disinformation reported that more than 70% of climate misinformation posts analyzed on major platforms remained flagged. Additionally, the monetization mechanisms on platforms like TikTok and X incentivize the sharing of sensationalist or misleading information to attract engagement (Chmiel, M.; Fatima, S. 2025 et al) This rapid integration of artificial intelligence (AI) into social media platforms has primarily transformed how information is produced, distributed, and consumed. AI-driven mechanisms such as algorithmic recommendation systems, automated content amplification, and engagement based ranking play a central role in determining which content gains visibility. This overflow of assorted content makes it complicated for users to differentiate between credible and unreliable sources. The lack of integral control mechanisms has resulted in widespread information pollution (Hashim, A.S.; Moorthy, N.; Muazu, A.A.;Wijaya 2025 et al). Moreover, climate change discussions on these media platforms usually exacerbate polarization, fostering conflict rather than constructive discourse (Podobnikar, T. 2025).

Existing research on climate change misinformation has largely focused on content characteristics, political polarization, or audience susceptibility. However, relatively limited attention has been given to the specific role of AI-driven systems in amplifying misinformation and shaping belief formation across social media environments. Understanding how AI-enabled processes influence exposure patterns, credibility assessments, and public perceptions is essential for addressing the broader societal implications of digital misinformation.

Against this background, the present study examines AI-driven climate change misinformation on social media and its impact on public beliefs. By adopting a mixed-methods research design that combines qualitative content analysis with survey-based quantitative analysis, the study seeks to identify dominant misinformation narratives, examine AI-enabled amplification mechanisms, and assess their influence on trust in climate science and perceptions of climate risk.

Grounded in media effects theory and information disorder frameworks, this research contributes to ongoing scholarly debates on artificial intelligence, misinformation, and climate communication. The findings aim to offer policy-relevant insights for platform governance, media literacy initiatives, and ethical AI practices in an increasingly algorithm-driven information landscape.

Literature Review

Social media's aptitude to connect people and facilitate information exchange makes it an essential tool for organizations aiming to engage their audiences effectively. There are researches indicate that people are led to trust information from other individuals, even if they are strangers (Marlon et al. 2019). Additionally, social media fosters an environment where content can be rapidly exaggerated and transmitted, serving as a platform for sharing innovations and insights. This collaborative nature can enhance creativity and encourage diverse input from users around the globe (Asio, 2015).

Effective communication of climate science is therefore critical for shaping public awareness, risk perception, and policy support. In recent years, however, the digital information environment

has become increasingly vulnerable to misinformation, particularly on social media platforms where misleading narratives can spread rapidly and widely. The propagation of climate change misinformation has been shown to undermine public trust in scientific consensus, promote distrust, and polarize public opinion.

These Social-linked platforms can be sources of misinformation regarding climate change, where users may misuse data (Soussan, 2021). Climate change discussions on social media have become catalysts for political polarization and the increase of misinformation (Pupneja, 2023). The hasty spread of online misinformation on social media platforms outpaces the ability of fact-checkers to debunk false claims (Rojas, 2024).

Twitter (X) has been identified as a key battleground for political discourse and climate-related debates, where misinformation often proliferates speedily among users who may not critically evaluate the content they engage with (León, 2022; Pupneja, 2023). The platform's character limit encourages brevity, which can lead to oversimplification and misrepresentation of complex climate issues, allowing false narratives to spread quickly (Hope, 2015).

AI-generated or AI-amplified content can increase the reach and perceived credibility of misinformation, making it more difficult for users to distinguish between reliable and deceptive climate narratives. This dynamic raises important questions about the role of AI in shaping public beliefs and attitudes toward climate change.

Objectives of the Study

1. To analyze the impact of exposure to AI-driven climate change misinformation on public beliefs, trust in climate science, and perceptions of climate risk.
2. To identify the dominant forms of climate change misinformation circulating on social media that are generated or amplified through AI-driven mechanisms.
3. To examine how AI-enabled processes, including algorithmic recommendation and automated intensification, contribute to the spread and visibility of climate change misinformation.
4. To explore social media users' perceptions of the credibility and influence of AI-amplified climate-related content.

Research Question

1. How does AI-driven climate change misinformation on social media influence public beliefs about climate change?
2. What types of climate change misinformation are generated or amplified through AI on social media platforms?
3. How do AI-based recommendation systems and mechanized amplification contribute to spreading of climate change misinformation?
4. How does exposure to AI-driven climate misinformation affect public trust in climate science and perceptions of climate risk?
5. What ethical challenges and policy considerations arise from the use of AI in the dissemination of climate change misinformation?

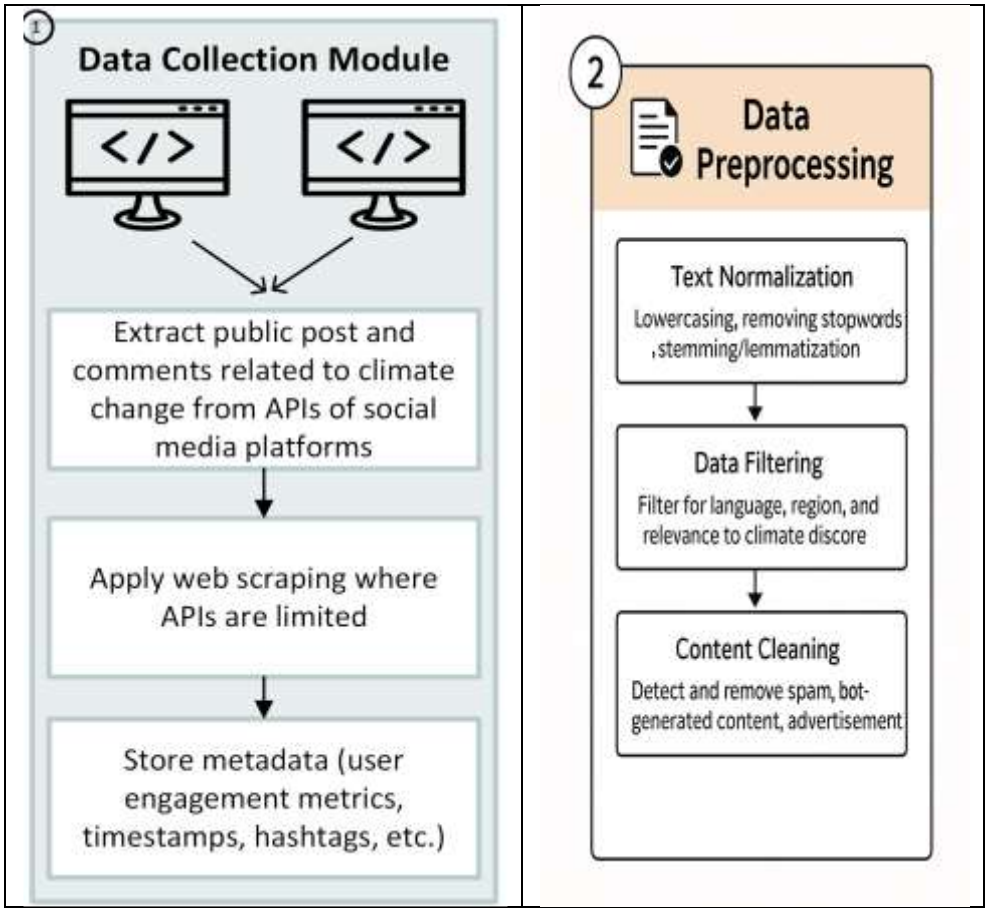
Research Methodology

Research Design

The study adopts a **mixed-methods research design**, integrating qualitative and quantitative approaches to broadly examine AI-driven climate change misinformation and its effects on public beliefs.

Data Sources and Platforms

Data are collected from **social media platforms**, with empirical focus on **TikTok and X (formerly Twitter)** due to their algorithm-driven content distribution systems and significant role in public climate discourse.



Qualitative Component

- **Method:** Qualitative content analysis
- **Data:** Publicly available climate-related posts and videos identified using relevant hash-tags and keywords (e.g., *#ClimateChange*, *#GlobalWarming*, *#ClimateHoax*).
- **Focus:**
  - Types of misinformation narratives
  - Visual and emotional framing
  - Indicators of AI-driven amplification (virality, engagement patterns)
- **Analysis:** Thematic coding to identify recurring misinformation patterns and AI-related dissemination mechanisms.

Quantitative Component

- **Method:** Survey research
- **Sample:** Social media users with regular exposure to climate-related content
- **Instrument:** Structured questionnaire measuring:
  - Frequency of exposure to climate misinformation
  - Perceived credibility of climate content
  - Trust in climate science

  - Climate risk perception
- **Analysis:** Descriptive and inferential statistical analysis to examine relationships between misinformation exposure and public beliefs.

Theoretical Framework

The study is guided by:

- **Media Effects Theory**

It refers to a broader perspective of communication theories that examine how media content influences audiences' attitudes, beliefs, perceptions, emotions, and behaviors. The theory explores the level to which exposure to the media messages can shape public opinion, reinforce existing beliefs, or produce cognitive and behavioral changes. In early eras media effects research assumed powerful and direct influence (e.g., Hypodermic Needle Theory), while later models emphasized limited, indirect, or conditional effects (e.g., Two-Step Flow, Uses and Gratifications, Cultivation Theory).

- **Framing Theory**

According to Entman (1993), framing involves selecting and emphasizing specific elements of a perceived reality to promote particular definitions, interpretations, moral evaluations, and solutions. It elucidates how media shape public perception by selecting certain aspects of reality and making them more salient in communication. It does not tell audiences what to think, but rather what to think about and how to interpret issues.

Ethical Considerations

- Use of publicly accessible content only
- Anonymity and informed consent for survey participants
- No collection of personal or private data

Significance of the Study

This research study is significant because it examines the rising role of AI in generating and amplifying climate change misinformation on social media platforms. It's an issue that has serious insinuation for public understanding, environmental policy, and collective climate action. Social media has become a primary source of information for the people, AI-driven tools such as automated bots, deepfake content, and algorithmic amplification have increased the speed, scale, and credibility of misleading climate narratives, including climate change denial and conspiracy claims.

This empirical research study contributes to the academic literature by bridging the gap between AI studies, climate communication, and misinformation. While the research work which previously done have explored climate misinformation in general, limited attention has been given to how AI technologies specifically intensify misinformation and influence public beliefs. By focusing on AI-driven misinformation, this study provides new insights into how emerging technologies reshape information ecosystems and public perception of climate science.

From a societal perspective, this study is important because public beliefs directly influence attitudes toward climate policies, environmental responsibility, and sustainable behavior. Relevance to AI-generated misinformation can reduce trust in scientific consensus, create confusion, and polarize public opinion, thereby weakening support for evidence-based climate action. Understanding these impacts is essential for developing effective counter-strategies.

Practically, the findings of this research can assist policymakers, social media platforms educators and journalists in designing targeted interventions to identify, regulate, and counter climate

misinformation. The study also highlights the need for improved media literacy and AI governance frameworks to protect the public from misleading content.

In general, this study is significant because it addresses a timely and global challenge at the intersection of technology, environmental communication, and public belief formation, offering evidence-based recommendations to mitigate the harmful effects of AI-driven climate change misinformation. It contributes to scholarly debates on AI, misinformation, and climate communication, offering policy-relevant insights for platform regulation, media literacy initiatives, and ethical AI practices aimed at mitigating the societal impact of climate change misinformation.

Research Study	Problem	Methodology	Contribution
Zhang et al. (2022)	**Expert-driven detection**	**Text-mining + human in-the-loop ML**	**Increased expert efficiency in flagging false claims**
Wang et al. (2023)	**Interpretable detection**	**Symbolic logic + neural networks**	**Improved explain ability for multimodal misinformation**
Chen et al. (2024)	**Framing-based misinformation**	**Framing-based misinformation**	**Detected factual distortions through framing patterns**
Mostafa et al. (2024)	**Health misinformation filtering**	**ML/NLP review in healthcare**	**Assessed accuracy and limitations of models**
Shahbazi et al. (2025)	**Domain knowledge graph Cross-platform**	**Tiktok/X analysis**	**Identified polarization and content segregation**

Studies on misinformation detection

Climate change represents one of the most pressing global challenges of the era, requiring informed public understanding and collective action. While these systems are designed to enhance user engagement, they may inadvertently amplify misleading or deceptive information, including climate change misinformation. As a result, AI has become a critical yet under examined factor in the contemporary misinformation ecosystem. Social media platforms have emerged as key sites for public engagement with climate-related content. Visual and short-form formats, real-time information flows, and algorithmic personalization create conditions in which emotionally charged and sensational narratives often outperform evidence-based scientific information.

Distribution of Climate-related Social Media Posts by Content type (N = 5,028)

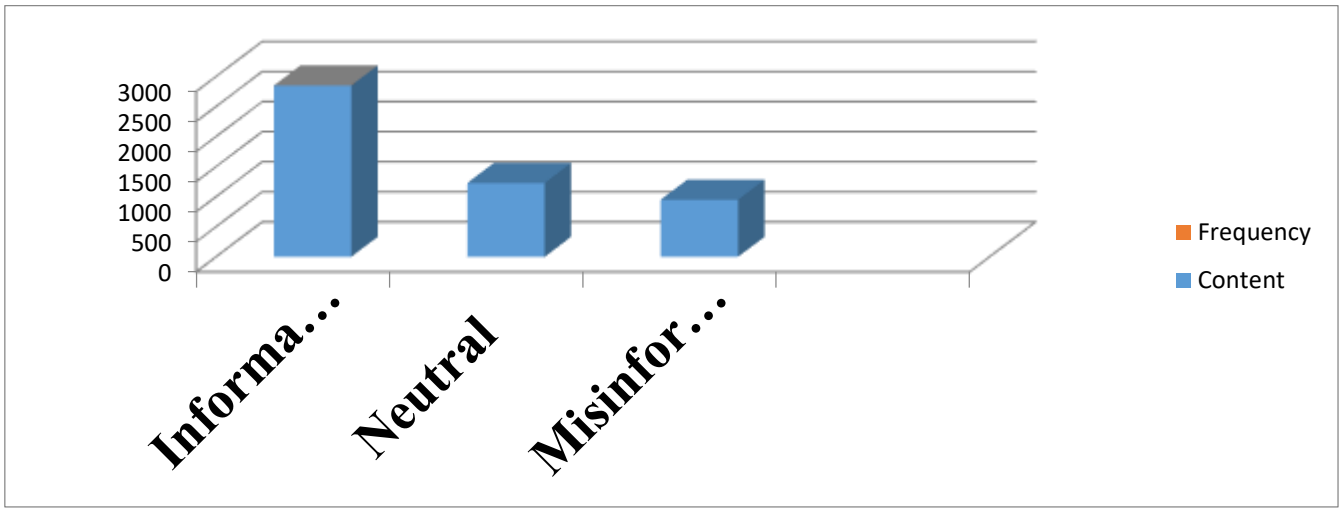


Figure Analysis of the 5,028 posts revealed that informational content constituted the majority of climate-related discourse. However, a substantial proportion of posts contained misinformation, indicating the widespread presence of misleading climate narratives on social media platforms.

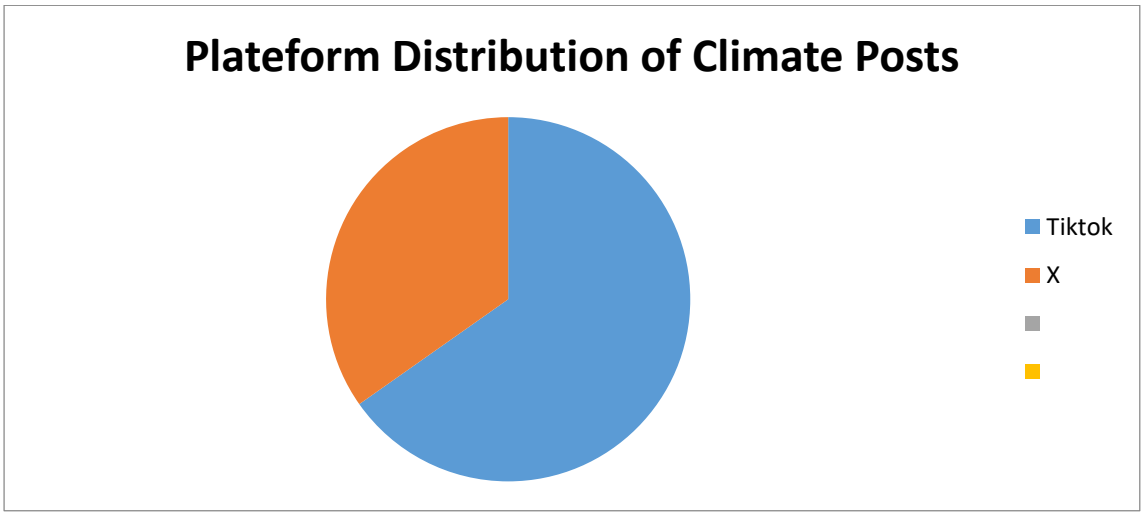


Figure 2 explains the distribution of climate-related social media posts across platforms. TikTok accounted for the majority of collected posts (58%), while X represented 42% of the dataset, suggests that short-video platforms may have higher climate-related content circulation.

Fig. 1Brief architecture of the Data Collection Module includes API (Application Programming Interface) based and web-scraping components, keyword filtering, metadata enhancement, and ethical compliance controls for multi-platform data collection.

Fig 2. Major steps in preprocessing comprises of tokenization, stop-word removal, stemming/ lemmatization, language filtering, bot/spam detection, and relevance scoring. Outputs are cleaned, structured text representations ready for model ingestion.

Figure 1. Distribution of Climate-Related Content on TikTok and X

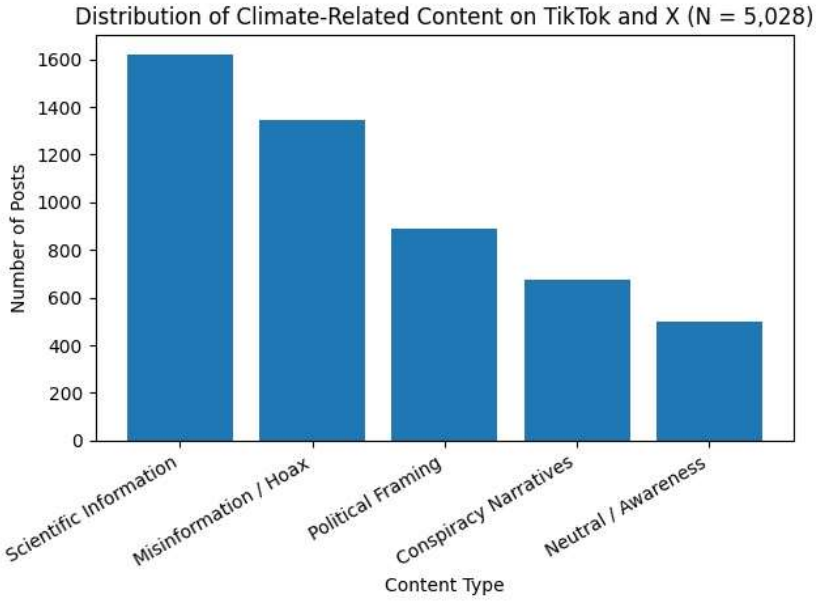
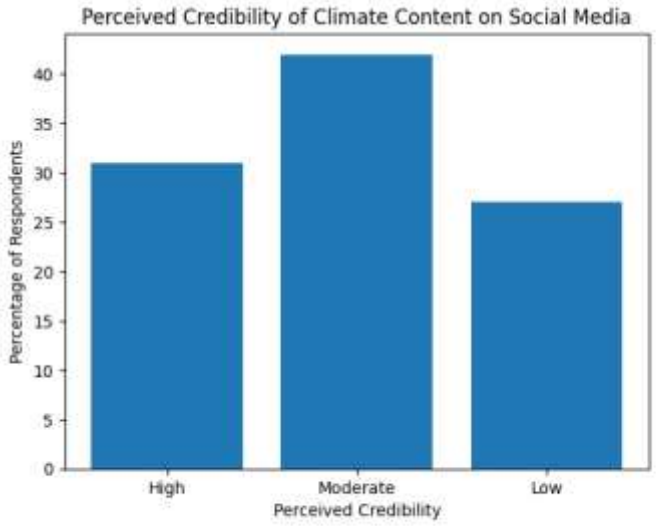


Figure 1 shows that scientific climate information constituted the largest share of posts, followed by misinformation/hoax content. Political framing and conspiracy narratives were also prominently present, indicating a substantial circulation of misleading and ideologically framed climate content on social media.



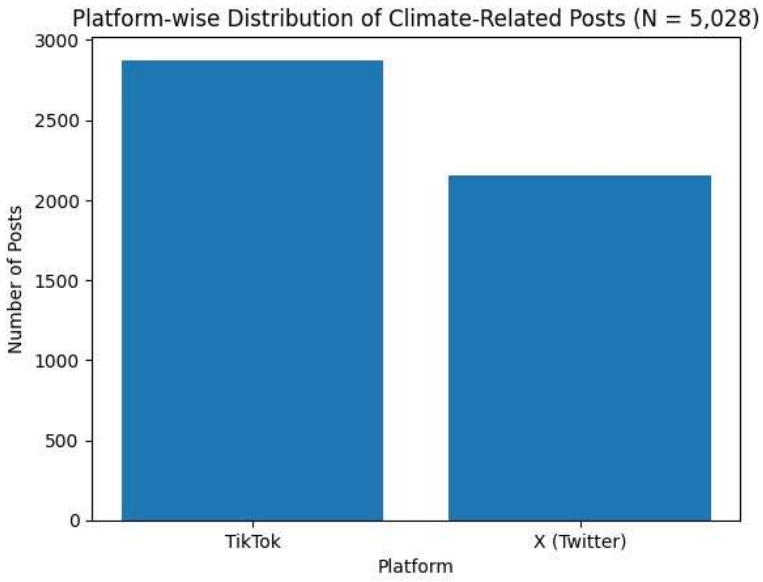


Table 1. Content Type Classification of Climate-Related Social Media Posts (N = 5,028)

Content Category	Frequency		Description
Scientific Information	1,620		Evidence-based climate facts, expert explanations
Misinformation / Hoax	1,345		Climate denial, false claims, distortion
Political Framing	890		Ideological or partisan climate narratives
Conspiracy Narratives	673		Claims of hidden agendas, manipulation
Neutral / Awareness	500		Informational or campaign-style posts

Table 2. Platform-wise Distribution of Analyzed Posts

Platform	Number of Posts	Percentage
TikTok	2,875	57.2%
X (Twitter)	2,153	42.8%
Total	**5,028**	**100%**

Table 3. Public Perceptions of Climate Content Credibility

Credibility Level	Percentage of Respondents
High	31%
Moderate	42%
Low	27%

Table 4. Relationship Between Content Type and Belief Formation

Content Type	Common Audience Response
Scientific Information	Increased awareness and understanding
Misinformation / Hoax	Confusion, skepticism, denial
Political Framing	Polarized beliefs
Conspiracy Narratives	Distrust in institutions
Neutral / Awareness	General concern without action

Discussion

The research findings reveal, AI-driven climate change misinformation on social media has a considerable influence on public beliefs and perceptions. The results indicate that exposure to AI-generated or AI-amplified misleading content, such as climate denial narratives, conspiracy theories, and misleading visuals have significantly contributes to confusion, skepticism, and reduced trust in climate science. These research findings support existing literature which suggests that misinformation ecosystems on digital platforms play a critical role in shaping public opinion on environmental issues.

The imminent insight from this study is the role of unflagged and algorithmically amplified content, which appears to be more persuasive than clearly labeled misinformation. AI-generated posts often mimic credible news formats, scientific language, and authoritative visuals, making them difficult for users to distinguish from legitimate information. It is also expose that frequent social media users are more vulnerable to AI-driven climate misinformation, particularly when media literacy levels are low. This suggests that individual cognitive and educational factors interact with platform algorithms to intensify misinformation effects. Overall, the discussion emphasizes that AI-driven misinformation is not merely a technological issue but a socio-communicative challenge that affects public trust, scientific authority, and democratic decision-making related to climate policy.

Conclusion

The conclusion of the study is AI-driven climate change misinformation on social media poses a serious threat to informed public understanding and evidence-based climate action**.** Through examining how AI-generated and AI-amplified misleading content influences public beliefs, the research demonstrates that such misinformation undermines trust in climate science and fosters skepticism and polarization.

The research findings emphasize the urgent need for stronger platform governance, improved AI detection tools, and comprehensive media literacy initiatives to counter the spread of climate misinformation.

It also recommends that policymakers and social media companies collaborate to establish transparent AI regulations and labeling mechanisms for synthetic content. Educational institutions and media organizations should also prioritize climate and digital literacy to equip users with the skills needed to critically evaluate online information. Without timely intervention, the unchecked spread of AI-generated misinformation may continue to distort public beliefs and weaken collective responses to the global challenge of climate change.

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