

A Hero Or A Killer? Overview Of Opportunities, Challenges, And Implications Of Text-To-Video Model SORA

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Abstract

SORA is a text-to-video model that can create videos based on simple user prompts. The model promises to revolutionize the way content is created. When SORA is released to the general public, it may transform a wide array of industries but also pose significant challenges and risks. This research aims to provide a comprehensive understanding of SORA's opportunities, challenges, and implications. It explores its potential applications in film-making, education, gaming, advertising, accessibility, healthcare, and social media content creation. Additionally, it delves into its potential challenges and risks, including misinformation, privacy concerns, bias, regulatory complexities, and dependence on technology. This research provides important recommendations to promote responsible deployment of the AI model.

Keyword: SORA; Opportunities; Challenges; Risks; Recommendations.

1. Introduction

The rapid advancements in artificial intelligence (AI) have catalyzed the emergence of innovative AI tools that are revolutionizing how people approach tasks, solve problems, and interact with technology. Among these groundbreaking developments is the advent of text-to-video models, such as SORA, designed to understand and simulate the physical world in motion (Leffer, 2024). With its ability to generate videos up to a minute long while maintaining high visual quality and fidelity to user prompts, SORA represents a significant advancement in AI-driven visual content (OpenAI, 2024a)

Although SORA is not yet available to the general public, its capabilities have sparked widespread interest and anticipation (Leffer, 2024). One of the most notable aspects of the AI tool is its potential to generate high-quality, realistic videos and imaginative scenes from text instructions. However, this potential is also a serious concern. A recent study conducted on 1000 US consumers by HarrisX, a market research firm, revealed that most respondents could not

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identify SORA-generated content as distinct from human-created content (Schomer, 2024). This finding underscores the challenges posed by the potential of deepfakes, misinformation, and manipulation in the media landscape. The widespread adoption of SORA may have profound implications for individuals and society at large, as well as for industries reliant on visual media, where distinguishing between authentic and AI-generated content is paramount (Roth, 2024; Schomer, 2024). These challenges arise because when unveiled to the general public, SORA can be extensively used to generate media content, engendering both positive and negative impacts.

With this background, the overarching research question guiding this article is:

RQ1: What are the opportunities, challenges, and implications of SORA?

By exploring these themes, we aim to provide a comprehensive understanding of the potential benefits and risks associated with the widespread adoption of AI-driven content generation tools like Sora.

This study contributes to the fields of information systems and human-AI interaction by offering a comprehensive understanding of the opportunities, challenges, and risks associated with SORA. We identify numerous opportunities across diverse sectors, including education, healthcare, and social media. Additionally, we pinpoint potential challenges and risks associated with SORA's usage and offer practical recommendations to mitigate them. From a managerial perspective, stakeholders can embrace the recommendations outlined in this study to harness the transformative potential of SORA while safeguarding against potential risks. By providing a detailed review of its capabilities and potential outcomes, we aim to contribute to the conversation about how AI technologies should be ethically developed and used in an increasingly digitized society.

2. Understanding SORA

SORA is a text-to-video model developed by OpenAI, the parent company of ChatGPT. It can create complex videos with multiple subjects, detailed backgrounds, and specific kinds of motion (Sulit, 2024). OpenAI (2024a) states that Sora “understands not only what the user has asked for in the prompt, but also how those things exist in the physical world.” It is at the forefront of text-to-video models, representing a significant advancement in AI-driven visual content generation. At its core, SORA is designed to understand and simulate the physical world in motion, leveraging

state-of-the-art AI techniques to produce high-quality videos that closely adhere to user prompts (OpenAI, 2024a). Similar to how ChatGPT has transformed communication dynamics (Mvondo et al., 2023; Niu & Mvondo, 2024), SORA is heralded as a game-changer in the way visual content is created.

A couple of years ago, text-to-image generators like Midjourney were at the forefront of models' ability to turn words into images. However, recently, video has begun to improve at a remarkable pace (Roth, 2024). While SORA represents a significant leap forward in text-to-video models (Williams, 2024), it is important to note that it is not the first of its kind. Earlier models, including Emu by Meta, Gen-2 by Runway, Stable Video Diffusion by Stability AI, and recently Lumiere by Google, have paved the way in this domain (Roth, 2024). Lumiere, in particular, was released in January 2024 and claimed to produce better video than its predecessors. However, Sora appears to be more powerful than Lumiere in some respects. Sora can generate videos with a resolution of up to 1920×1080 pixels and in various aspect ratios, while Lumiere is limited to 512×512 pixels (Pouryousef & Besançon, 2024).

Additionally, while Lumiere's videos are typically around 5 seconds long, SORA surpasses this limitation by generating videos up to 60 seconds long, offering users greater flexibility in content duration. Unlike Lumiere, SORA can create multiple-shot videos, allowing for more dynamic and visually engaging content (Pouryousef & Besançon, 2024). Additionally, SORA is equipped with video-editing functionalities, enabling tasks such as generating videos from images or other videos, combining elements from different videos, and extending videos in time (OpenAI, 2024a). These features enhance SORA's versatility and make it a formidable contender in text-to-video generation.

Advanced AI techniques and architectures underpin SORA's impressive capabilities. Like generative pretrained transformer (GPT) models, SORA utilizes a transformer architecture, enabling superior scaling performance and processing complex textual prompts (OpenAI, 2024b). Additionally, SORA represents videos and images as collections of smaller units called patches, akin to tokens in GPT (see Figure 1). This unified representation of data allows for training diffusion transformers on a broader range of visual data spanning different durations, resolutions, and aspect ratios. Furthermore, SORA builds upon past research in DALL-E and GPT models, incorporating techniques such as the recaptioning technique from DALL-E 3 to generate

descriptive captions for visual training data (OpenAI, 2024b). This integration enhances the ability of SORA to faithfully follow user instructions and produce visually compelling content.

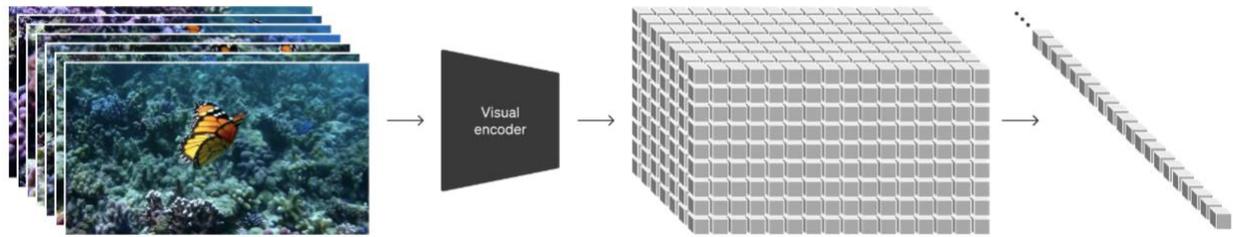


Figure 1 Process of converting videos to lower dimensions and dividing them into patches
Source: SORA’s technical report (OpenAI, 2024b)

3. Opportunities of SORA

3.1. *Film-making and Entertainment Industry*

SORA’s potential to benefit the entertainment industry will extend beyond simply reducing time and resources for conceptualization and pre-production. Its potential impact will be profound and multifaceted, fundamentally altering the creative landscape for filmmakers, visual artists, and designers (Morrison, 2024). The traditional barriers to bringing ideas to life will be dismantled with SORA. Written scripts will be seamlessly transformed into visually compelling videos, eliminating the need for extensive storyboarding and manual visualization. This will accelerate the production timeline, lower costs, and enhance the creative vision’s precision and fidelity (Pouryousef & Besançon, 2024). Pre-production in Hollywood can be a lengthy and costly process. Storyboarding, location scouting, concept art – a mountain of work goes into before the cameras roll. Sora could change that (Wanguba, 2024).

In addition to making individual scenes easier to produce, SORA will allow the development of whole short films and animations straight from scripts (Ying, 2024). This democratization of video production will allow producers at all levels to fulfill their artistic visions with unprecedented simplicity and efficiency (Ying, 2024). Furthermore, visual effects are the backbone of many modern blockbusters. However, they are expensive and time-consuming. Sora could assist visual effects artists by simplifying their work. Establishing shots, background elements, and even basic crowd scenes might be generated in a flash, saving precious time and resources (Wanguba,

2024). such a collaboration setting will promote synergy and invention, producing richer and more engaging entertainment material.

3.2. *Education*

SORA is poised to play an increasingly significant role in shaping the future of education (Agarwal, 2024). By potentially enabling users to convert text prompts into photorealistic videos, Sora offers a glimpse into a future where creating complex educational content could become as simple as typing out a lesson plan. While the exact capabilities of SORA are still under wraps, the power of this technology to generate detailed scenes, demonstrate processes, and visualize abstract concepts could be a game-changer for educators and learners alike (Agnone, 2024). SORA could revolutionize traditional learning materials by seamlessly converting textual descriptions into rich, immersive educational content, such as historical reenactments and scientific simulations. One of the most significant advantages Sora brings to education is the ability to tailor content to the individual needs of learners (Özbek, 2024). Educators can leverage SORA's adaptive capabilities to tailor content delivery to individual preferences, ensuring that complex concepts are presented in a manner that is both accessible and engaging (Carballo, 2024; Özbek, 2024). Whether through visually stunning reenactments or interactive simulations, SORA will empower educators to captivate students' interest and deepen their understanding of academic subjects.

Moreover, SORA's proficiency in simulations and reenactments will provide educators with powerful pedagogical tools to enhance the effectiveness of their teaching methods (Özbek, 2024). Educators can foster deeper engagement and facilitate experiential learning by immersing students in dynamic, hands-on learning experiences. Whether exploring historical events or conducting virtual science experiments, SORA will enable educators to transcend the limitations of traditional teaching approaches and pave the way for a new frontier in education (Carballo, 2024).

3.3. *Gaming*

Thanks to SORA, the gaming industry stands on the brink of a significant transformation (Levine, 2024). Developers can use SORA to generate dynamic backgrounds, character interactions, or even entire cutscenes, enhancing the storytelling aspect of video games and virtual reality experiences (Ryu, 2024). Unlike other AI video generators, SORA distinguishes itself through its unique approach, described as a "data-driven physics engine" by Nvidia Senior

Researcher Dr. Jim Fan (Zeff, 2024). SORA performs thousands of calculations to predict how an object interacts with its environment. This creates a “world model,” which makes it perfect for generating video games (Zeff, 2024). While OpenAI acknowledges that these are still in the early testing stages, the results demonstrate promising capabilities for AI simulators in physical and digital domains. However, it is crucial to note that SORA presently encounters limitations, particularly in accurately modeling the physics of basic interactions (OpenAI, 2024b). Consequently, some videos generated by SORA may display peculiarities or anomalies that require addressing before deploying the model in video game development (Zeff, 2024). Despite these challenges, SORA’s advancements signify a substantial leap forward in integrating AI technology into the gaming landscape, paving the way for more immersive and dynamic gaming experiences in the future.

3.4. Advertising and marketing

SORA emerges as a game-changer in the marketing and advertising landscape, offering unparalleled opportunities for creating highly realistic and personalized video content from textual descriptions (Ryu, 2024). Generating custom videos based on textual prompts will allow for greater creativity and personalization, possibly helping brands stand out in a crowded market (Fares, 2024). With SORA, marketers can gain access to a versatile tool capable of rapidly generating customized videos tailored to specific target demographics, market trends, and campaign objectives. Furthermore, SORA’s integration into marketing workflows will streamline content creation, enabling marketers to allocate resources more efficiently and focus on strategic campaign planning and optimization (Cotton & Crabtree, 2024). This shift towards a more strategic and data-driven approach to marketing will unlock new avenues for creativity and collaboration, setting a new standard for content creation and advertising (Fares, 2024).

3.5. Accessibility and inclusion

SORA offers an innovative solution for enhancing accessibility in the visual domain by converting textual descriptions to visual content. This capability can empower individuals with visual impairments to actively engage in content creation and interact with others more effectively (Anakin.ai, 2024). This can promote inclusivity and allow for a more diverse range of ideas and perspectives to be shared through videos. By democratizing video creation, SORA will open doors

for diverse communities, including those with limited access to traditional multimedia production tools or those with varying levels of technical expertise. This democratization fosters a more inclusive creative ecosystem where individuals from all walks of life can contribute their unique perspectives and narratives through video content.

3.6. Healthcare

Healthcare professionals can benefit from using SORA in medical training, surgical simulations, and diagnostic imaging interpretations. Videos created by AI, such as exercise demos and visual explanations of complex medical concepts or treatment plans, can also be used in patient education and care (Sulit, 2024). With the ability to make realistic videos, healthcare teams can aid patients in better understanding their condition. Videos could depict the progression of their condition and the impact of adequate medication and lifestyle changes (Dhunnoo, 2024). By leveraging SORA's virtual simulations, healthcare professionals can rehearse complex procedures, refine diagnostic skills, and explore innovative treatment approaches in a risk-free environment (Dhunnoo, 2024; Smith, 2024). This enhances the competency and confidence of healthcare practitioners and fosters a culture of continuous learning and improvement within healthcare organizations.

Additionally, the ability of SORA to offer real-time feedback and insights will empower clinicians to identify areas for improvement and adapt their practices accordingly, ultimately leading to better patient outcomes and a higher standard of care (Dhunnoo, 2024). Generating videos could assist in training healthcare professionals. Through such visualizations, trainees could better understand rare conditions, visualize complex procedures, and even simulate challenging conditions (Dhunnoo, 2024). As healthcare embraces digital transformation, SORA stands at the forefront of innovative technologies poised to revolutionize medical education, training, and patient care delivery.

3.7. Social media and content creation platforms

With its ability to create short-form videos from textual descriptions, SORA will unlock new possibilities for content creators on social media platforms. By enabling the seamless creation and sharing of videos on platforms like TikTok, Instagram Reels, and YouTube Shorts, SORA will

empower content creators to engage with their audiences more effectively (Cotton & Crabtree, 2024). Sora will be suitable for content generation, especially those that are impossible or difficult to capture on camera. This technology streamlines the content creation, making it easier for creators to produce captivating videos and reach wider audiences. SORA's integration with social media platforms signifies a new era of content creation driven by AI-powered video generation (Fares, 2024). SORA will empower content creators to push the boundaries of storytelling and visual communication, fostering a new era of dynamic and immersive content on social media platforms.

4. Implications and challenges brought by SORA

4.1. Misinformation and disinformation

The use of SORA will pose significant challenges and risks concerning the proliferation of misinformation and disinformation. The AI model may worsen things in a world already plagued by disinformation (Pouryousef & Besançon, 2024). With its unparalleled capabilities, SORA could be exploited to fabricate deepfake videos—convincing fake content that spreads swiftly and effortlessly, resulting in confusion and division among people (Dhunnoo, 2024; Fares, 2024; Leffer, 2024). When this content is presented as truth, either accidentally (misinformation) or deliberately (disinformation), it can cause problems (Cotton & Crabtree, 2024). This undermines societal trust and cohesion, particularly during an election year. Convincing but fake AI videos of politicians or adversaries of politicians have the power to strategically disseminate false narratives and target legitimate sources with harassment, aiming to undermine confidence in public institutions and foster animosity towards various nations and groups of people (AP, 2024; Cotton & Crabtree, 2024). For example, a fake robocall impersonating President Joe Biden's voice discouraged individuals from voting in the New Hampshire primary in January 2024 (Zahn, 2024).

Furthermore, the potential for SORA's exploitation in scams and fraudulent activities is deeply troubling, potentially inflicting financial and psychological harm on victims. For instance, Fake, sexually explicit AI-generated images of pop star Taylor Swift went viral on social media in January 2024, garnering millions of views (Zahn, 2024).

4.2. Privacy issues

SORA's potential to generate highly realistic video content raises alarms regarding the potential misuse of personal data and images, especially concerning privacy and consent, as it could facilitate the creation of realistic videos featuring individuals who may not have granted permission (Dhunnoo, 2024; Williams, 2024). This could result in grave consequences such as identity theft, impersonation, and the creation of fraudulent accounts. Moreover, the extensive data collection and analysis performed by SORA prompts concerns regarding consent, transparency, and the potential for abuse or misuse of sensitive information (Williams, 2024). The unparalleled capabilities of SORA also render it an enticing target for malicious actors intent on exploiting its functionalities for nefarious purposes, further heightening privacy apprehensions. In the healthcare context, for example, as SORA relies on training data to generate medically relevant videos, it will have to be trained on similar content. This can raise well-founded concerns over patient privacy. Most people will not take it lightly to be filmed during a medical consultation or surgery, only to have that video used to train an AI (Dhunnoo, 2024).

4.3. Bias and discrimination

The advent of SORA brings forth numerous challenges and risks related to bias and discrimination. According to Ohlheiser (2023), humans create computers. As these systems are created, the biases of their human creators are reflected in them. Like human bias, AI bias becomes discrimination when translated into decisions or actions. Like many forms of discrimination, AI bias disproportionately impacts communities that historically or presently face oppression. Similar to many AI systems, SORA is prone to biases inherent in the data it is trained on (Cotton & Crabtree, 2024; Williams, 2024). Without vigilant oversight and mitigation strategies, these biases may persist or exacerbate societal inequalities, leading to discriminatory outcomes in critical areas such as hiring, lending, and law enforcement (Williams, 2024).

4.4. Accountability and control

Similar to ChatGPT, the ability of SORA to make decisions autonomously raises profound questions about accountability and control. Paramount among these concerns is the possibility of unintended consequences or even malicious behavior arising from SORA's independent interpretation of objectives and priorities (Williams, 2024). As the model is independent in its

decision-making, questions arise about who is ultimately responsible for the outcomes of those decisions. Should it be the AI assistant itself, the developers who created it, or the users who interact with it? (Tomorrow Bio, 2023). The limited human oversight in its operation poses a considerable risk, as unchecked actions could potentially result in adverse outcomes (Williams, 2024).

4.5. Regulatory and ethical challenges

One of the main concerns is the potential for SORA to exacerbate existing difficulties in regulating and controlling the use of generative AI. As SORA's capabilities continue to advance, it may become increasingly difficult for regulators to keep up and ensure that its use meets ethical standards (Cotton & Crabtree, 2024). Another concern pertains to creating and disseminating SORA-generated content that may infringe upon existing copyrights (Pouryousef & Besançon, 2024). Since SORA can autonomously produce various forms of content, there is a risk that it could inadvertently reproduce copyrighted material without proper authorization. This could lead to legal disputes and liabilities for OpenAI and the users who deploy it to generate content. Furthermore, the rapid advancement of AI technology like SORA outpaces the current legal framework's ability to adequately adapt and address emerging challenges. Existing copyright laws may not fully account for the nuances of AI-generated content or provide clear guidelines for determining liability and enforcing copyright protection in this context.

4.6. *Dependence to technology*

AI models like SORA could be seen as shortcuts rather than assistants, with significant implications, particularly concerning creativity and its role in various industries (Cotton & Crabtree, 2024). While AI-driven tools can undoubtedly streamline processes and enhance productivity, there is a risk that they may be viewed as substitutes for human creativity rather than complementary aids. According to a recent report of 750 business leaders, 37% say the technology replaced workers in 2023. Meanwhile, 44% report that there will be layoffs in 2024 resulting from AI efficiency (Curry, 2023). One immediate concern with the advent of SORA is the potential devaluation of human creativity and expertise (Cotton & Crabtree, 2024). If individuals rely heavily on AI tools like SORA to generate content or make decisions, there is a risk of diminishing

the perceived importance of human creativity and ingenuity in fields such as content creation, design, and problem-solving (Tran, 2024). This could have profound implications for professionals who rely on their creative skills as a core aspect of their work, potentially leading to job displacement or devaluation of their expertise (Tran, 2024).

Moreover, the reliance on AI-driven shortcuts may foster a culture of mediocrity or uniformity in creative outputs. People may produce average content with no effort of creativity, and mediocrity may become the norm. If everyone relies on the same AI tools to generate content or solve problems, there is a risk of homogenization in the products and services offered across various industries. This could stifle innovation and diversity, limiting the range of ideas and perspectives available to consumers and hindering the evolution of creative fields.

4.7. Unanticipated consequences

One potential unforeseen consequence of SORA's widespread adoption is the reshaping of societal perceptions and trust in digital content. As SORA's capabilities advance and its use becomes more prevalent, there may be a gradual erosion of trust in the authenticity of digital media. Users may become increasingly skeptical of the veracity of videos and other content, leading to a heightened sense of uncertainty and skepticism in online interactions. This could have far-reaching implications for various sectors, including journalism, entertainment, and social media, where trust in digital content is paramount. Additionally, the proliferation of sophisticated deepfake content generated by SORA could undermine public discourse and exacerbate societal divisions as discerning truth from fiction becomes increasingly challenging. From unforeseen ethical dilemmas to existential risks to humanity, the full extent of SORA's impact remains uncertain (Williams, 2024).

5. Recommendations

It is recommended that robust detection and verification systems be developed to address misinformation, disinformation, and privacy concerns. For instance, building tools such as detection classifiers that can accurately identify content generated by SORA or similar AI systems can help mitigate the spread of misleading or false information (AP, 2024). By analyzing various attributes of the content, such as linguistic patterns, visual cues, and metadata, these detection classifiers could determine the authenticity and origin of the content.

Additionally, implementing transparency measures within AI systems like SORA can help alleviate privacy concerns and promote accountability (Williams, 2024). For example, incorporating features that provide users with insights into how the AI-generated content was produced, including the data sources used and the algorithms employed, can enhance transparency and build trust with users. This transparency can build trust with users and empower them to make informed decisions about the content they consume and share. Additionally, it can foster accountability among developers and users of AI tools.

Moreover, addressing concerns related to bias and discrimination requires a multifaceted approach. First, it is essential to integrate robust bias detection and mitigation techniques into SORA's development and training processes. This includes thoroughly examining training data to identify and rectify biases and ongoing monitoring of SORA's outputs for discriminatory patterns. Secondly, fostering diversity within the development teams responsible for SORA is crucial. This will ensure that various perspectives and experiences are considered, thus minimizing the risk of perpetuating biases.

Furthermore, regulatory policies must keep pace with the rapid advancement of AI technologies to effectively overcome regulatory and ethical challenges. As AI capabilities progress quickly, regulatory frameworks must remain flexible and adaptable to address emerging concerns and ensure ethical use. Proactive engagement with policymakers and regulatory bodies is critical to inform the development of regulatory frameworks that can effectively balance innovation with ethical considerations in deploying AI technologies.

Finally, regarding concerns about dependence on technology, it is crucial to foster a balanced approach that acknowledges the value of AI tools like SORA while preserving the importance of human creativity and expertise. Rather than viewing AI as a replacement for human ingenuity, it should be seen as a complementary tool to enhance and augment human capabilities. Encouraging a culture of responsible and ethical use of AI technologies is essential to prevent overreliance and mitigate potential negative consequences. This involves promoting education and training initiatives to help individuals understand how to effectively integrate AI tools into their work while maintaining the integrity of their creative processes.

6. Contributions of the study

This study contributes significantly to the fields of information systems and human-AI interaction.

Firstly, it utilizes the RAG model and thoroughly analyzes SORA's opportunities in various sectors, such as film-making, education, gaming, advertising, healthcare, accessibility, and social media. By exploring these diverse applications, the study offers insights into the wide-ranging impact of AI technology on different aspects of society and the economy. Second, the study conducted a thorough analysis of the challenges and possible risks associated with the use of SORA. It highlights crucial issues such as misinformation, privacy concerns, bias, discrimination, accountability, regulatory challenges, and dependence on technology. The study's identification of these risks aims to increase awareness of the ethical and societal implications of AI technology adoption.

Third, the study provides practical recommendations to mitigate the risks associated with SORA. These recommendations include developing detection and verification systems, promoting transparency, initiating diversity initiatives in development teams, implementing regulatory reforms, and promoting responsible technology use. Policymakers, developers, and stakeholders can use these recommendations to navigate AI deployment's ethical and regulatory complexities. Finally, the study examines the influence of SORA in various sectors, such as entertainment, education, healthcare, and social media. It offers interdisciplinary insights into how AI technology intersects with different fields, promoting a holistic understanding of the opportunities and challenges of AI adoption.

7. Conclusion

In conclusion, the emergence of SORA presents unprecedented opportunities across various sectors, such as film-making and entertainment, education, gaming, advertising and marketing, accessibility and inclusion, healthcare, and social media content creation. Its ability to convert textual descriptions into visually compelling content opens new possibilities for creativity, collaboration, and engagement. However, these opportunities come with significant challenges and risks, including misinformation, erosion of privacy, bias and discrimination, regulatory and ethical challenges, and dependence on technology. Recommendations have been proposed to address these risks. These include developing robust detection and verification systems, implementing transparency measures, addressing bias and discrimination through diverse development teams

and bias detection techniques, advancing regulatory policies to keep pace with technological advancements, and fostering a balanced approach to technology use that preserves human creativity and expertise. By embracing these recommendations, stakeholders can harness the transformative potential of SORA while safeguarding against potential risks. Ultimately, this will contribute to a more inclusive, innovative, and ethically driven future.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the authors constructed a retrieval-augmented generation (RAG) model and fine-tuned its internal knowledge with information from several news websites. The implementation process of RAG began with gathering information from various sources on the internet. We conducted searches for articles and reliable news websites discussing the opportunities, challenges, and implications of SORA using Google Search and Google Scholar. However, the search on Google Scholar did not yield studies on the topic. Therefore, we focused solely on news websites. RAG is useful for knowledge-intensive tasks as it allows obtaining state-of-the-art results on open-domain QA (Lewis et al. (2020)). It facilitated clear insights into the ongoing discussion about SORA, aiding in creating the research structure and key points.

Additionally, the authors utilized Grammarly's generative AI to enhance the structure of the paragraphs, language, and readability. Following the use of the tool, the authors reviewed the content as necessary.

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