

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

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## **Abstract**

SORA is a text-to-video (T2V) model that can generate realistic video content based on simple user prompts. Upon its release to the general public, SORA has the potential to revolutionize numerous industries while also presenting significant challenges. This research aims to provide a comprehensive understanding of SORA's opportunities, challenges, and implications. It explores its potential applications in filmmaking, education, gaming, advertising, accessibility, healthcare, and social media content creation. Additionally, it investigates potential challenges such as misinformation, erosion of privacy, bias, regulatory complexities, and technological dependence. Moreover, this research identifies key research directions and offers important recommendations to promote the responsible deployment of T2V models.

**Keywords:** Opportunities; Challenges; Implications; SORA; Text-to-video model.

## **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 (T2V) models, such as SORA, designed to understand and simulate the physical world in motion (Leffer, 2024). With its ability to generate high-quality, realistic videos and imaginative scenes from simple 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 concerns (Leffer, 2024). A recent study conducted on 1000 US consumers by HarrisX, a market research firm, revealed that most respondents could not distinguish SORA-generated content from human-created content (Schomer, 2024). This implies that upon its release to the general public, the lines between AI-generated and human-created content will be blurred,

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raising significant questions about authenticity, accountability, and the potential misuse of this technology.

This research aims to provide a comprehensive understanding of SORA's opportunities, challenges, and implications. This study is necessary because the existing literature lacks a holistic exploration of these aspects, limiting our understanding of the potential benefits and risks associated with the widespread adoption of the T2V model. The overarching research question guiding this article is:

### **RQ1: What are the opportunities and challenges brought about by SORA?**

This study contributes to the fields of information systems and human-AI interaction by providing a comprehensive understanding of the opportunities, challenges, and implications associated with SORA. We identify numerous opportunities across diverse domains, including filmmaking and entertainment, education, gaming, advertising and marketing, accessibility and inclusion, healthcare, and social media content creation. Additionally, we pinpoint potential challenges associated with SORA's usage, such as misinformation, erosion of privacy, bias and discrimination, regulatory and ethical challenges, and technological dependence. Moreover, this research identifies key research directions and offers important recommendations to promote the responsible deployment of T2V models. 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.

## **2. What is SORA?**

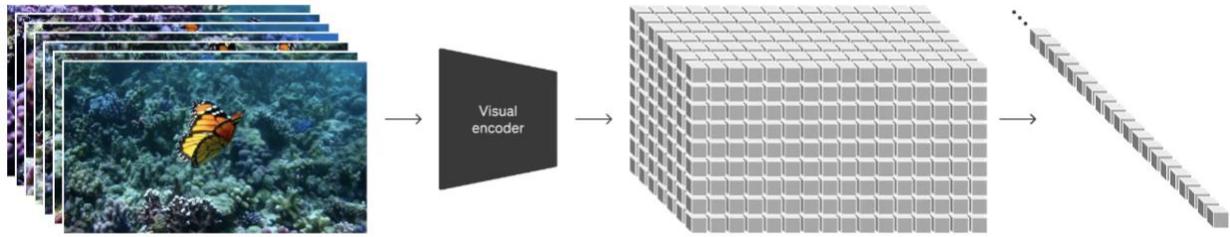
A T2V model is a type of AI model designed to generate video content from text inputs. SORA is a T2V model developed by OpenAI, the parent company of ChatGPT. It can create complex videos with multiple subjects, detailed backgrounds, and specific kinds of motion (Sulit, 2024). OpenAI (2024a) states that 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 T2V 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, video generation has recently advanced rapidly (Roth, 2024). While SORA represents a significant leap forward in T2V 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  $1920 \times 1080$  pixels and in various aspect ratios, while Lumiere is limited to  $512 \times 512$  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). Moreover, 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 the T2V 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. What are the Opportunities presented by SORA?

#### 3.1. *Filmmaking 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 marketing and advertising, offering unparalleled opportunities (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*

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). The T2V model 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. What are the challenges brought about 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. Erosion of privacy*

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, 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 (Dhunoo, 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. Technological dependence*

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 technology replaced workers in 2023. Meanwhile, 44% report that there will be layoffs in 2024 resulting from AI efficiency (Curry, 2023). Additionally, if individuals rely heavily on T2V models 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. Discussion and implications**

The emergence of SORA presents unprecedented opportunities across various sectors, such as filmmaking 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, including misinformation, erosion of privacy, bias and discrimination, regulatory and ethical challenges, and technological dependence.

### *5.1. Future research directions*

This study raises several questions for future research endeavors (see Table 1).

**Table 1** A roadmap for future research

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<b>Thematic areas</b>	<b>Research questions</b>
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<b>Technology adoption/ willingness to use</b>	<p>What are the factors influencing user willingness to use Sora? Do perceived realism and novelty value play a crucial role in influencing user adoption of the T2V model?</p> <p>What factors contribute to users' trust in the accuracy and reliability of content generated by SORA, and how do these factors collectively shape users' adoption intentions towards the platform?</p> <p>What are the benefits and risks of SORA, and how do they influence user adoption intention?</p> <p>What factors influence the intention of educational institutions to adopt SORA into their academic programs and learning environments?</p>
<b>Human-AI collaboration</b>	<p>What are the optimal strategies for promoting effective human-AI collaboration in creative processes, ensuring that AI tools like SORA complement rather than replace human creativity?</p> <p>“What new business model can be created using SORA to create economic value?”</p>
<b>Educational effectiveness</b>	<p>What are the most effective methods for integrating SORA into educational settings to optimize learning outcomes and engagement across diverse student populations?</p>
<b>Enhanced simulation realism</b>	<p>How can AI-driven simulation technologies like SORA be further developed to enhance realism and accuracy, particularly in medical training and gaming applications?</p>
<b>Ethical considerations</b>	<p>What ethical frameworks and guidelines should be established to govern the responsible use of AI technologies like SORA in content creation and dissemination?</p> <p>How can regulatory frameworks be adapted to address AI-generated content's legal and ethical challenges, particularly in copyright infringement and misinformation contexts?</p>
<b>Bias mitigation strategies</b>	<p>How can bias mitigation strategies be effectively implemented in AI models like SORA to reduce discriminatory outcomes in educational, healthcare, and advertising applications?</p>
<b>Long-term societal impact</b>	<p>What are the long-term societal impacts of SORA's adoption, particularly in terms of trust in digital media, cultural diversity, and employment dynamics?</p>
<b>Addressing misinformation</b>	<p>How can AI technologies like SORA be leveraged to combat misinformation and disinformation, particularly during critical events like elections or public health crises?</p>

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## *5.2. Implications for practice and policy*

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. Conclusion**

SORA represents a groundbreaking advancement in AI technology with profound implications for various industries. It offers unparalleled opportunities in filmmaking, education, gaming, advertising, accessibility, healthcare, and social media content creation. However, these opportunities come with significant challenges related to misinformation, privacy concerns, bias, regulatory complexities, and technological dependence. To ensure the responsible deployment of SORA, there is a critical need to develop robust ethical guidelines and regulatory frameworks. Implementing the measures recommended in this study will be vital in maximizing the benefits of SORA for organizations, societies, and individuals alike.

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

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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