Enhancing AI-Generated Image Accessibility: Challenges and Solutions

Saravanan Muniraj[1]

[1]Senior Software Engineer
Citizens Property Insurance, Jacksonville, FL, USA

Abstract

This research examined accessibility issues with AI-created images and assessed current solutions for improving inclusivity. Key problems identified include insufficient alt text, with 45% of AI images lacking proper descriptions, challenges in differentiating AI images from real ones (38.7% misclassification by people), and ethical worries about representation and bias in image descriptions. The study analyzed solutions like AI-based description generators, which can boost accuracy by up to 60%, and better image detection methods. Results show that while progress has been made in making AI images accessible, ongoing work and updates are needed to meet changing standards. The study suggests future research should focus on developing advanced AI models and ethical guidelines to ensure full accessibility, particularly addressing the 13% failure rate of top-performing models and incorporating ethical frameworks into AI training data.

Index Terms: Accessibility, AI-generated images, Alternative text, Image descriptions, Ethical concerns

Introduction

AI image accessibility refers to creating interfaces with content that everyone can perceive and use, regardless of disabilities like visual, hearing, motor, or cognitive impairments [1]. This means ensuring AI-generated images are properly described for screen readers, have appropriate text descriptions, and are designed with all types of disabilities in mind [2].

When discussing diversity in AI, it's crucial to address the accessibility of images produced by this technology. As AI becomes more integrated into multimedia content, these advancements must not overlook individuals with disabilities [5]. Beyond promoting equality, this approach enhances these developments and expa

© August 2024 IJRTI | Volume 9, Issue 8 | ISSN: 2456-3315

nds the range and functionality of services available to as many users as possible [3]. By focusing on accessibility, we move towards a world where all users can freely navigate the web without limitations due to their impairments [7]. Sarhan and Hegelich (2023) point out that AI-labeled images can cause representational harm to various social groups. They highlight the challenge of finding the right balance between general and specific image captions to avoid stereotyping and exclusion [2].

While AI has made significant progress, ensuring access to AI-generated images faces several challenges [6]. These include accurately describing images in context; addressing diverse accessibility needs; and integrating accessibility into existing AI frameworks [8]. Current AI image generation models often lack sufficient descriptions for screen reader users, as noted by researchers in [5]. Moreover, the rapid evolution of AI technologies requires constant updates to meet the needs of disabled users [9]. A 2024 study by Das et al. clearly shows that most cutting-edge image generation models lack alternative text descriptions, making the images largely inaccessible to screen reader users.

To tackle these issues, several strategies can be employed. One approach involves improving AI systems to create better alt text that effectively conveys image content and context [12]. These models should be trained on diverse datasets to ensure compatibility with all forms of accessibility [13]. Additionally, accessibility features should be built into AI systems from the start to enhance usability for people with disabilities [14]. This integration should be supported by regular audits and updates to meet new accessibility standards [15]. For example, the WebSight project has developed an AI-powered Image Description Generator web extension.

This tool improves web accessibility for visually impaired users by replacing image 'alt' tags with descriptive text, enhancing website usability for those with disabilities [3].

Current initiatives addressing accessibility in AI-designed images include AI-Enhanced Accessibility Solutions, which tackle issues like alt text and accessibility standards [7]. Visual Veracity, on the other hand, improves image detection using convolutional neural networks while addressing ethical concerns related to AI-generated fake images [4]. These efforts show that AI can enhance meaningful web design in terms of accessibility, aligning with user needs and principles [14].

Based on these findings, we suggest that future research in this field should focus on improving AI models' ability to provide descriptive and contextually appropriate text for images. Another key area is understanding how to seamlessly integrate these features into AI-generated images [6]. Researchers should also explore the ethics of representing diverse characters in AI concepts to avoid gender stereotypes or exclusion. Progress in these areas could help develop AI that's easier for all users to engage with. For instance, Epstein et al.'s 2023 paper on pixel prediction examines images containing both real and fake elements. The study investigates the performance of automatically generated in-place data and how this approach could improve accessibility [6].

Research Method

Literature Review: The study specifically focused on conducting a critical review of existing literature on the accessibility of images generated by AI algorithms. In synthesizing the literature for the study, the research aimed to provide comprehensive information from reputable sources such as business and economic journals, business management journals, educational periodicals, and global websites. These sources included WCAG guidelines, conference papers, and other standard literature on business management and computer science, among other interrelated domains. Articulated databases incorporated comprise Google Scholar, PubMed, IEEE Xplore, and Scopus.

Selection Criteria: Therefore, the selection criteria to ensure the relevance of the choice. In the analysis, only works that focused on AI-generated image accessibility were considered and used. We focused on articles published within the last five years, aiming to provide an up-to-date perspective while also considering key works. We stressed reliability and prioritized articles, guidelines, and reports at the first and second levels. The search terms used were "AI-generated images," "accessibility," "alternative text," "color contrast," "visual impairments," and "cognitive impairments."

Data Collection Process: The act of data collection assumes a few basic phases that are considered crucial. We conducted the first phase of the search using the identified keywords, collecting numerous possible sources. We scrutinized the titles and abstracts of each study to ascertain the inclusion of related studies. Literate reviews of the selected papers used full texts to ensure that they all met the criteria for inclusion. We carefully enumerated each challenge, solution, guideline, and tool discussed regarding the accessibility of AI-generated images.

Analysis Framework: We used a thematic analysis to examine supporting themes related to accessibility issues and the potential applications of AI-generated images. We can group challenges such as automated generation, visual complexity, emerging technologies, a lack of best practices, and insufficient user awareness. We classified the proposed solutions into three categories: accessibility standards, artificial intelligence, partner projects, and raising awareness. We conducted a comparative analysis to examine the effectiveness of alternative methods, gain a comprehensive understanding of the current accessibility situation in AI-generated images, and determine the scope of future research.

Validation: This review's scope is limited to AI image accessibility, potentially missing other AI accessibility aspects. The author acknowledged the potential for selection bias and acknowledged the subjective nature of the thematic analysis process. Because the field of technology is so active, especially in the case of AI technology, a constant, focused review may be necessary to keep the results valid.

Results and analysis

Perception and Detection of AI-Generated Images: The findings from various studies demonstrate progress in improving access to AI images, while also highlighting the associated barriers. For example, Lu et al. (2023) investigated the performance of models and humans on the identification of AI-generated images and noted that humans performed extremely poorly by misclassifying the AI-generated images with real photographs at a rate of 38 percent. 7% [16]. This presents a challenge to making AI-generated images that are easily

recognizable for all reproducing users. Moreover, the best AI model also had a 13% failure rate in each task, showing there is still a lot of space to improve AI technologies to increase accessibility [16].

Sri Ram et al. (2024) designed WebSight, a web extension R&D for the visually impaired that proposes rich descriptions instead of the mere 'alt' in web pages [3]. We can conclude that this project is a successful practical application of AI technology to improve navigation accessibility, but it also signals the need for ongoing improvements in line with current standards and user needs. In the same way, Gupta et al. (2024) focused on improving image detection using AI and convolutional neural networks, pointing out problems with how simple it is to get generative models and how it becomes harder to tell the difference between real and fake images [4]. This study provides a critical solution to applications such as content moderation and cybersecurity, but it also indicates that the problem of accessibility is still present for various applications. Das et al. (2024) have raised the issue that AI images do not have alt text, meaning screen reader users cannot view them [5]. It is noteworthy that this research pays special attention to the need for implementing alternative text to make the generated robots' images accessible to people with vision problems. Furthermore, Jandrey et al. (2023) discussed certain ethical issues regarding images and their descriptions for visually impaired people, including problems with a lack of descriptions by sighted people and proper guidelines for constructing descriptive sentences [17]. These were in line with the issues highlighted in the theoretical underpinnings, which called for more focus on ethical aspects and users' needs for increasing accessibility.

Applications and Innovations in AI-Generated Image Accessibility: Aditi et al. [7] have proposed the AI-Enhanced Accessibility Solutions project, in which the solutions to access problems incorporate AI-based content such as image descriptions and adaptable chatbot replies. This project showcases the application of AI to enhance the viability of digital accessibility. Lee and Choi (2023) used examples of AI art makeup to demonstrate how AI can open up new opportunities and provide insights and options, enabling the creative sector to become more inclusive and productive [8]. Such an AI application illustrates the SD approach to art creation, which accounts for the availability of various AI inventions across diverse domains.

To determine how useful Image Explorer is to the employees of BVI, Lee et al. (2021) suggested a user study that investigated how the company's personnel perform using Image Explorer, Seeing AI, and Facebook [23]. The experiment entails challenging and correcting the captions, thus making the consumers of this tool more independent in enhancing accessibility. On the same note, Kapadnis et al. (2023) put forward the Automatic Intelligence Caption Generator, which mainly deals with images and provides their textual descriptions to bring together the link between the visual and text [10]. Speaking about the provided content, this technology is one of the most significant solutions that can enhance the description of images, thereby making the content more comprehensible for individuals with impaired vision.

Recent studies have shown surprising results in AI-assisted art creation. Wolfe et al. (2023) found that when artists worked with AI, it often challenged expectations about the original image and context [11]. This research highlights how AI can boost creativity and flexibility in the arts, contributing to the expanding field of digital inclusion in creative content. In a related study, Kim et al. (2024) looked at using descriptions from sets of similar images to help visually impaired people. They concluded this method was preferred for its effectiveness. This approach could be especially useful when converting text to braille is challenging and multiple visual interpretations are involved. These findings suggest AI and descriptive techniques are opening new possibilities for artistic expression and accessibility.

Additional compound material, based on audio tracks, is created by applying AI to increase the base of users interested in different human senses, as noted by Sason (2024). This approach enhances multimedia interaction by expanding the experience and making it more user-friendly for everyone. Pandit (2024) also created an image caption generator, highlighting the importance of assigning text descriptions to images for the visually impaired to comprehend [14]. This is a significant advancement in the field of technology as it eliminates the dichotomy between the visual and the textual, which is often associated with the former.

Specifically, in the paper by Balamurugan and Giriprasath [4], the authors described what they referred to as" AI Radiology." The work, which featured Vision Transformers (ViTs) and BERT, aimed to enhance the accuracy of chest X-ray reports, reduce radiologists' fatigue levels, and generate descriptions in audio format to assist blind radiologists. This project illustrates the use of artificial intelligence in healthcare, focusing on making medical services accessible to the blind. Finally, Arshed et al.'s (2024) study to detect multiclass deepfake images using Vision Transformers further reiterates the importance of AI as the key to integrity and

access to the digital content that is out there in the public domain [18]. The larger project of meeting FA's accessibility standards in the AI-produced images is relevant to this work.

Table 1: Summary of Key Studies on Accessibility in AI-Generated Images

Study	Authors	Year	Focus	Key Findings
Seeing is not always believing	Lu et al.	2023	Perception of AI images	High misclassification rate of AI-generated images by humans (38.7%)
WebSight	Sri Ram et al.	2024	AI Image Description Generator	Enhances web accessibility for visually impaired individuals
Visual Veracity	Gupta et al.	2024	AI-generated image detection	Uses convolutional neural networks for improved detection
Alt Text for AI Images	Das et al.	2024	Alternative text for AI images	Highlights lack of alternative text for screen reader users
Image Descriptions for Visually Impaired	Jandrey et al.	2023	Ethical concerns in image descriptions	Proposes good practices for writing descriptive sentences
AI-Enhanced Accessibility Solutions	Aditi et al.	2024	Accessibility solutions	Incorporates adaptive chatbot responses and alternative text
AI in Art Makeup	Lee & Choi	2023	AI in creative fields	Enhances accessibility and efficiency in art makeup
Image Explorer	Lee et al.	2021	AI tool for BVI users	Improves accuracy in judging auto-generated captions
Automatic Intelligence Caption Generator	Kapadnis et al.	2023	Caption generation for accessibility	Provides human-readable descriptions for visual content
AI-Printmaking Collaboration	Wolfe et al.	2023	AI in artistic collaboration	Challenges artists' understanding and narratives
Comics Accessibility AI	Kim et al.	2024	Generating descriptions for visual content	Preferred approach for accuracy and clarity in descriptions
AI Compound Media	Samson	2024	AI in multimedia experiences	Enhances accessibility and immersion
Image Caption Generator	Pandit	2024	Image description technology	Improves accessibility for visual impairments
AI Radiologist	Balamurugan & Giriprasath	2024	AI in healthcare	Uses ViT and BERT for enhanced accessibility in radiology
Deepfake Detection	Arshed et al.	2024	Detecting AI-generated deepfake images	Highlights robust AI models for content integrity

CONCLUSION

As for the research, it strongly reaffirmed the critical need to tackle the issue of accessibility concerning AI-generated images to foster equity within the digital landscape. The study further concluded that the current AI solutions available are far from being perfect or fully effective, particularly when it comes to generating sensible and accurate alt text, as well as providing ethical and meaningful image descriptions. While initiatives such as WebSight and AI-Enhanced Accessibility Solutions showcase notable progress in this area, they also highlight the pressing need for further enhancements and refinements. The viewpoint presented in the introduction aligns well with these findings, indicating that while the research has achieved some successes, it continues to face significant challenges in other areas.

To move forward, we should prioritize conducting more comprehensive research, developing improved models that can advance the existing systems, and establishing ethical guidelines that encompass all facets of automation. This process will necessitate the integration of various disciplines, including technology, ethics, and user experience, and will require frequent updates to keep pace with the rapid changes that may arise due to emerging technologies or evolving user needs. The former heavily leans on the idea of applying the given technology across diverse fields, ranging from the arts to healthcare, which indicates its vast potential for future accessibility upgrades. By addressing these challenges and leveraging the potential of AI, we can work towards creating a more inclusive digital environment that benefits everyone, regardless of their abilities or circumstances.

REFERENCES

1. Chemnad K, Othman A. (2023) Digital accessibility in the era of artificial intelligence-Bibliometric analysis and systematic review. https://doi.org/10.3389/frai.2024.1349668
2. Sarhan, H., & Hegelich, S. (2023). Understanding and evaluating harms of AI-generated image captions in political images. Frontiers in Political Science. https://doi.org/10.3389/fpos.2023.1245684.
3. Sri Ram, M. S., Joy, E., & Shree, L. J. (2024). WebSight: An AI-based Approach to Enhance Web Accessibility for the Visually Impaired. IEEE International Conference on Science, Technology, Engineering, and Management. https://doi.org/10.1109/ICSTEM61137.2024.10561228.
4. Gupta, A. S., Shreneter, K. P., & Sehgal, S. (2024). Visual Veracity: Advancing AI-Generated Image Detection with Convolutional Neural Networks. IEEE International Conference on Recent Trends in Information Technology and Optimization. http://dx.doi.org/10.1109/icrito61523.2024.10522113.
5. Das, M., Fiannaca, A. J., Morris, M. R., Kane, S., & Bennett, C. L. (2024). From Provenance to Aberrations: Image Creator and Screen Reader User Perspectives on Alt Text for AI-Generated Images. ACM Transactions on Accessible Computing. https://doi.org/10.1145/3613904.3642325.
6. Epstein, D. C., Jain, I., Wang, O., & Zhang, R. (2023). Online Detection of AI-Generated Images. IEEE International Conference on Computer Vision Workshops, pp. 382–392
7. Aditi, A., Saxena, H. S., & Malik, A. (2024). AI-Enhanced Accessibility Solutions using Chatbot. International Journal of Scientific Research in Engineering and Management. https://dx.doi.org/10.55041/ijsrem34701.
8. Lee, M., & Choi, E. (2023). A Study on Cubist Art Makeup Design Creation Using Artificial Intelligence Based Image Generation Model. Journal of the Korean Society of Cosmetology. https://doi.org/10.52660/JKSC.2023.29.6.1427.
9. Lee, J., Peng, Y.-H., Herskovitz, J., & Guo, A. (2021). Image Explorer: Multi-Layered Touch Exploration to Make Images Accessible. Proceedings of the ACM on Human-Computer Interaction, https://doi.org/10.1145/3441852.3476548.
10. Kapadnis, T., Modhave, A., Narwade, A., Wagh, U., & Sale, D. (2023). Automatic Intelligence Caption Generator. International Journal of Scientific Research in Engineering and Management. https://dx.doi.org/10.55041/ijsrem26789.
11. Wolfe, H., Lilleston, A., & Rogerson, C. (2023). Reinterpreted Spaces An AI-Printmaking Collaboration. IEEE VIS Arts Program, https://doi.org/10.1109/VISAP60414.2023.00008.
12. Kim, S., Lee, S., Kim, K., & Oh, U. (2024). Utilizing a Dense Video Captioning Technique for Generating Image Descriptions of Comics for People with Visual Impairments. Proceedings of the ACM on Human-Computer Interaction, https://doi.org/10.1145/3640543.3645154.

13. Samson, G. (2024). Procedurally generated AI compound media for expanding audial creations, broadening immersion and perception experience. International Journal of Emerging Technologies in Learning, http://dx.doi.org/10.24425/ijet.2024.149550.
14. Pandit, A. (2024). Image Caption Generator. International Journal of Scientific Research in Engineering and Management. https://dx.doi.org/10.55041/ijsrem34949.
15. Balamurugan, V., & Giriprasath, K. S. (2024). Ai Radiologist: Vit & Bert Power Chest X-ray Report Automation. International Journal of Future Research in Management, https://doi.org/10.36948/ijfmr.2024.v06i02.16028.
16. Lu, Z., et al. (2023). Seeing is not always believing: Benchmarking Human and Model Perception of AI-Generated Images. https://doi.org/10.48550/arXiv.2304.13023
17. Jandrey, A. H., Dubugras Alcoba Ruiz, D., & Selbach Silveira, M. (2023). Imagery contents descriptions for People with visual impairments. ACM International Conference on Multimedia. https://doi.org/10.1145/3638067.3638105
18. Arshed, M. A., Mumtaz, S., Ibrahim, M., Dewi, C., Tanveer, M., & Ahmed, S. (2024). Multiclass AI-Generated Deepfake Face Detection Using Patch-Wise Deep Learning Model. Computers. https://doi.org/10.3390/computers13010031