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Leveraging AI to Address the Alt Text Gap in Healthcare Websites

Ashim Gautam Upadhaya

[1]Software Engineer at American Specialty Health Inc.
Email: *asimupdgtm[at]gmail.com*

Abstract: ***Web accessibility remains a significant challenge in the healthcare sector, where missing or inadequate alternative text (alt text) on images can impede access to critical information for individuals with visual impairments. This study investigates the potential of artificial intelligence (AI) to automate and enhance alt text generation on healthcare websites, with a particular focus on the role of contextual information in improving the relevance and quality of AI-generated descriptions. Ten major healthcare websites were analyzed, and images were sampled and processed using a context-free and a context-enhanced AI approach. Results indicate that AI-generated alt text, especially when supplemented with up to 1500 characters of surrounding webpage context, consistently outperformed both developer-written and context-free AI alt text in terms of relevance, completeness, and alignment with accessibility standards. Context-aware AI was able to connect images to specific health topics, use appropriate medical terminology, and avoid redundancy, thereby improving both accessibility and user experience. However, the study also highlights the continued need for human oversight to ensure accuracy in complex cases. These findings suggest that integrating context-aware AI tools with editorial review can help healthcare organizations efficiently address accessibility gaps, comply with legal standards, and provide equitable information access. Limitations include the reliance on AI model capabilities and the need for further validation across broader website samples. Practical implications point to the feasibility of scalable, hybrid AI-human workflows for web accessibility, with significant social benefits for populations dependent on assistive technologies.***

Keywords: Web accessibility, alternative text, healthcare websites, artificial intelligence, context-aware AI

1. Introduction

Alternative text (alt text) is a critical component of web accessibility that provides textual descriptions of images for users who rely on screen readers or in situations where images fail to load. Despite its importance, most websites continue to struggle with proper implementation. When measured against Web Content Accessibility Guidelines (WCAG), approximately 95.9% of websites fail to meet compliance standards [1]. Furthermore, over 50% of websites are entirely missing alt text, creating significant barriers to information access [1].

This problem is particularly concerning in the healthcare sector, where access to accurate information can directly impact health outcomes and decision-making. Healthcare websites serve diverse populations, including the approximately 2.2 billion people worldwide living with vision impairment [2]. Without proper alt text, these users are effectively excluded from critical visual information about medical conditions, treatments, and services.

2. Background and Review of Literature

2.1 The Dual Importance of Alt Text

Alt text enables users with visual impairments to understand images through screen readers and other assistive technologies. This ensures equitable access to digital health information regardless of ability status [3]. For users who rely on these technologies, the absence of alt text creates gaps in understanding that can compromise their healthcare decision-making
process.

Beyond accessibility, implementing proper alt text offers significant SEO advantages [4].

1) Increased organic click-through rates
2) Enhanced image search visibility, potentially increasing image clicks
3) Improved content understanding by search engines, leading to better indexing and ranking
4) Competitive advantage over the majority of websites that fail to implement proper alt text

2.2 The Challenge of Manual Alt Text Creation

Despite its importance, the creation of effective alt text remains a persistent challenge for healthcare website managers and content creators. The literature identifies several key barriers: time constraints associated with large image libraries, knowledge gaps regarding accessibility best practices, the difficulty of balancing descriptive detail with brevity, and inconsistency across different content creators [5]. These challenges are exacerbated in healthcare, where images often require precise and contextually relevant descriptions to convey their full meaning.

2.3 The Promise of AI in Accessibility

Recent advances in AI, particularly in natural language processing and computer vision, have spurred the development of automated tools for alt text generation. These tools leverage large language models and image captioning algorithms to produce descriptive text for images, offering a potential solution to the scalability and consistency challenges of manual creation. AI-powered alt text generators can process large volumes of images rapidly and with a degree of consistency that is difficult to achieve through manual effort alone [6].

3. Materials and Methods

3.1 Website Selection and Sampling

This study analyzed 10 prominent healthcare-related websites, including government health agencies (NIH, CDC, FDA), health information portals (WebMD), provider organizations (Mayo Clinic), insurers (UHC), and healthcare technology companies. Following is the complete list: "https://www.nih.gov", "https://www.cdc.gov", "https://www.fda.gov", "https://www.webmd.com", "https://www.mayoclinic.org", "https://healthy.kaiserpermanente.org", "https://www.uhc.com", "https://www.drugs.com", "https://www.cvs.com", "https://www.athenahealth.com"

From each website, up to five images were sampled, prioritizing those that appeared in prominent content areas. The analysis was done using a python script and the Open API GPT-4.1 model.

3.2 Context Extraction Approach

Two methods were employed to evaluate the impact of contextual information on AI-generated alt text:

a) **No-Context Method**: Images were processed by AI without accompanying text from the webpage.
b) **Context-Enhanced Method**: Contextual information was extracted from:
   - The parent container's text surrounding the image
   - Text from previous and next sibling elements
   - Immediate textual content before and after the image
   - Context was limited to 1500 characters to ensure relevance

3.3 AI Prompt Design

Place illustrations (figures, tables, drawings, and photographs) throughout the paper at the places where they are first The AI system (GPT-4.1) was prompted with specific guidance on generating accessibility-focused alt text that would:

1) Provide context on the image's relationship to page content
2) Accurately represent content and function
3) Be succinct while maintaining accuracy
4) Avoid redundancy with nearby text
5) Exclude phrases like "image of..." or "graphic of..."
6) Don't provide additional information other than that conveyed by the image, but still consider the context

3.4 Evaluation Framework

Alt text quality was evaluated against established accessibility standards and best practices, examining:

1) Contextual relevance to the surrounding content
2) Accuracy in describing the image content
3) Conciseness and efficiency of description
4) Avoidance of redundancy
5) Fulfillment of the image's function on the page

4. Results & Discussions

We analyzed 47 images in total. The resulting HTML file from the analysis is linked with context and without context. AI-Generated Alt Text Performance

4.1 Without Context

When processing images without surrounding context, the AI system:

1) Successfully identified basic elements within images (people, objects, settings)
2) Accurately described visual characteristics and arrangements
3) Failed to connect images to page's purpose or subject matter
4) Produced generic descriptions that, while accurate, lacked relevance to the page content

4.2 With Context

When provided at most 1500 characters of surrounding context, significant improvements were noticed:

1) Connected visual elements to specific health conditions, treatments, or services
2) Identified the purpose of diagrams and illustrations within medical explanations
3) Prioritized elements based on their apparent importance to the topic
4) Maintained brevity while delivering more contextually relevant descriptions

4.3 Comparative Analysis

A direct comparison between developer-created alt text and both AI approaches revealed:

1) AI without context outperformed existing manual alt text in descriptive detail, but lacked relevance
2) AI with context consistently outperformed both developer-created alt text and context-free AI in combined measures of detail and relevance
3) AI-generated descriptions (both types) were more consistent in structure and completeness than manually created alternatives

Consider this image on https://www.nih.gov.

The developer written Alt-text for the image reads Dr. Bhattacharya. AI without context described it as a smiling professional posed in front of an American flag and a blue government banner, illustrating federal agency leadership. AI with context wrote Jay Bhattacharya, new NIH Director, standing in front of American and NIH flags.

Developer's alt-text, while accurate, lacks role, context, and visual elements. It fails to convey the image's purpose or relevance to the NIH announcement. AI without context describes the visual details, but it is too generic ("professional," "government banner"). However, AI with context provides context for screen reader users to connect the image to the page's narrative. It includes the subject's full name and title along with describing the visual elements and tying the image to the NIH's institutional identity. Compared to AI without context, the AI-with-context version avoids vagueness and includes relevant details ("Dr. Bhattacharya", "NIH Director", " NIH flags").

In another instance, a developer wrote alt text that failed to describe the image and the context correctly. See this example below on https://www.cdc.gov

Developer-written alt text repeats the adjacent text 'Ways to prevent measles', which is redundant and incorrect. The Python script used couldn't gather the context around the image, however, AI-generated alt text, based on the image alone, was more accurate. It read Doctor consulting mother holding baby which is correct as well as concise.

We found similar results across multiple images we analyzed. The side-by-side comparison with images and alt texts is linked here, with context and without context.

4.4 The Impact of Context on AI Alt Text Generation

Our findings demonstrate that context plays a crucial role in generating meaningful alt text for healthcare images. The performance differential between context-free and context-enhanced AI generation highlights several key insights:

1) **Importance of Surrounding Content**: The immediate textual environment provides critical cues about an image's purpose and relevance that cannot be derived from visual analysis alone. This is particularly important for healthcare content where similar imagery (e.g., anatomical diagrams) might serve different educational purposes depending on context.
2) **Balancing Description and Function:** With context, AI more effectively balances describing what is visually present with explaining why the image appears on the page. This functional understanding is essential for healthcare images that often serve explanatory or instructional purposes.
3) **Terminology Alignment:** Context-aware AI adopts appropriate medical terminology consistent with the page, enhancing the cohesiveness of the user experience for screen reader users.

4.5 Potential for AI to Address the Accessibility Gap

The results suggest that context-aware AI tools could significantly improve accessibility compliance across healthcare websites by:

1) Addressing the volume problem through automation.
2) Improving consistency across large sites.
3) Reducing the technical knowledge barrier for content creators.
4) Ensuring new content is accessible from the moment of publication.

5. Future Scope and Recommendations

Based on our findings, we recommend the following approach to implementing AI-assisted alt text generation:

1) **Context-Enhanced Generation**: Always provide surrounding textual context to AI systems generating alt text, prioritizing the immediate container and adjacent text elements.
2) **Human Review**: Implement a hybrid system where AI generates initial alt text that is then reviewed by human editors, particularly for complex medical illustrations or critical clinical information.
3) **Continuous Learning**: Feed corrections and improvements back into the system to enhance future generation accuracy.

6. Conclusion

This case study demonstrates that AI, particularly when enhanced with contextual information, shows significant promise in addressing the persistent alt text accessibility gap on healthcare websites. While AI without context produces technically accurate descriptions, the addition of surrounding textual context dramatically improves the relevance and utility of generated alt text for users relying on assistive technologies. In almost all cases, AI did a better job of describing the elements of the image than a human-written alt text; however, without context, room for error remains.

The findings suggest that a hybrid approach combining automated generation with human oversight could help healthcare organizations more efficiently meet accessibility requirements. This has significant implications not only for compliance with legal standards but also for ensuring equitable access to health information for the millions of people with visual impairments.

All things considered, while AI offers tremendous value and potential, this case study indicates that developers still play an essential role in creating effective alt text. AI can certainly provide rich descriptions and relieve developers of the mental effort needed to accurately characterize images, but it can't yet fully replace human judgment. We recommend using AI to generate suggestions, with human review to ensure the alt-text properly fits within the broader context of the page.

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Author Profile

Ashim Upadhaya is a software engineer with over eight years of experience in full-stack development, specializing in building accessible and high-performance user interfaces and backend systems to ensure compliance with WCAG 2.0 and A11Y standards. His work focuses on creating inclusive digital health solutions that make health and wellness programs accessible to all users, including older adults and individuals with disabilities.