

From Compliance to Comprehension: Making Image Descriptions Useful in Online Retail

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Short abstract

The paper examines how alternative text (“alt-text”) shapes the accessibility and usability of e-commerce websites. Because online shopping is now a primary mode of commerce, accessibility is a practical requirement of inclusive design. Prior research has documented that effective alt-text is often missing or underdeveloped on e-commerce platforms. As a result, persons with visual impairment(s) may be unable to fully access product information and details, contributing towards dissatisfaction and reduced task success. This paper investigates the effectiveness of alt-text in e-commerce and asks how current standards and guidance support the generation of effective alt-text. The primary finding is the absence of a detailed, actionable standard for writing high-quality alt-text in common e-commerce contexts. Existing standards emphasize the importance of text alternatives but provide limited practical direction that publishers and content producers can apply when writing appropriate, user-friendly alt-text. In response, the paper examines how Artificial Intelligence (AI) tools, used in conjunction with human review and validation, may improve the speed, consistency, and accuracy of alt-text in image-rich websites and platforms. Overall, integrating AI-assisted alt-text workflows within e-commerce platforms has the potential to improve usability for screen reader users, streamline content workflows, and support a more inclusive digital shopping environment, with potential secondary benefits for search visibility.

Keywords: alt-text, user testing, machine vision, inclusive design, semantic relevance.

1. Introduction and background

Digital technologies mediate everyday routines across work, education and consumption. E-commerce has become one of the default channels for purchasing goods and services, making the accessibility of online shopping interfaces a practical requirement rather than an optional enhancement. The accessibility of digital content has become an increasingly prevalent focus of digital media and website production, particularly as technology is transforming the ways and frequency that individuals interact with information, businesses and organizations. One of the key aspects of this drive toward broader accessibility is the effective use of meaningful and appropriate alternative text (“alt-text”) for images. Alt-text applied within a website, or app, provides a text substitute for a visual media resource, which is used in place of or in combination with the non-textual content, including images, charts, and graphics. Users with visual impairments can access the alt-text associated with a media resource as a way to obtain additional information about that resource with the help of screen readers and other assistive technologies. Alt-text descriptions of images in e-commerce environments should be accurate and informative, to ensure a detailed explanation is being provided to those using such assistive technologies. Despite its benefits, alt-text remains poorly implemented across most e-commerce platforms (Ferraz, 2015).

The study reviews current practices in generating and evaluating the quality of alt-text, encompassing automated and human-centred methods of evaluation. The current standards underline the importance of alt-text, yet they do not give examples of what a high-quality alt-text would look like or guidance and frameworks to help content publishers provide accurate, meaningful alt-text information. There is a need for guidance and examples here to help content publishers understand that alt-text helps promote the more general practice of using it to create an inclusive web, which will be useful for impaired users and other users who use alt-text daily. Ensuring a high-quality alt-text that describes product images with accuracy and sufficient detail for all users is important to ensure that users understand the product that is being sold. Integrating existing literature, this research provides insights to help provide a framework to developers, businesses, and accessibility advocates to implement mechanisms through which online platforms can be made accessible and user-friendly, improving both usability and accessibility for users.

2. Materials and methods

A literature review is used to collate summaries of existing studies on the efforts toward accessibility to identify gaps, trends, and themes. The paper reviews relevant peer-reviewed articles on alt-text in e-commerce, web accessibility, screen readers and assistive technology, WCAG guidelines, and automated evaluation tools. Sources are critically analyzed to comprehend the different methods and technologies being used to improve access, and which are effective and which remain limited in practice.

3. Results and discussion

3.1 Standard in Alternative Text

One of the key initiatives to improve the accessibility of websites is the publication of the Web Content Accessibility Guidelines 2.0 (WCAG) in 2009. WCAG has been used as a standard or benchmark by many countries to achieve an accessible website. WCAG guides developers in creating sites that work with assistive technologies (Termens et al., 2009). It provides recommendations on how to increase accessibility, which have been incorporated into regulations in various countries. These outlines also help content publishers and digital asset managers with accessibility standards on websites. Moreover, other institutions have published their own guidelines underlining accessibility, such as Accessibility and Usability at Penn State, Diagram Center, and CFPB (Jung et al., 2022). It addresses the needs of users with impairments in the digital setting. Despite the existence of these standards and their adoption in many government regulations, accessibility is often overlooked due to limited awareness, training and resources among developers and publishers.

McEwan and Weerts (2007) used Bobby/WebXact to survey common barriers to web accessibility and to show both the value and limits of automated testing. The researchers' findings indicate that, in many cases, either the web developers were not knowledgeable about how to incorporate the existing guidelines into their development, or they simply did not prioritize accessibility in the development process. Their findings supported that most websites did not even meet the lowest threshold to support those who required assistive technologies to access and navigate content. While the utilization of an automated testing tool was highly effective in determining technical problems, the researchers believe that automated testing cannot replace real-world testing by end-users. The researchers suggested that automated evaluation techniques should be utilized in combination with user-based simulations and testing to further examine how persons with

disabilities (phrased “disabled people” in the United Kingdom, and “people with disabilities” in the United States) interact with digital content to ensure alt-text and other access features are implemented purposefully and functionally (McEwan and Weerts, 2007).

Termens et al. (2009) describe WCAG 2.0 as a shift toward more usability-centred and inclusive design. Guidelines go further to reiterate the relationship that exists between usability and accessibility; the researchers believe that it is not good enough for one to follow standards. A developer has to understand what people with disabilities go through to be able to create an accessible and usable experience. As the researchers suggest, while WCAG may provide critical grounding in approaches toward more accessible design, successful execution depends on developers' determination and thoughtful application of consistent standards throughout digital platforms (Termens et al., 2009).

Alt-text is particularly vital in e-commerce environments where product images are heavily employed to help convey size, colour, features, and functionality. Even with the available studies and various tools that can be utilized to assess website accessibility, no website was fully accessible. Common issues that users encounter are poor navigation and low readability, while developers encounter tight time constraints. Though various tools are available to support accessibility evaluation, human oversight will always be required (Acosta-Vargas et al., 2022).

3.2 Generating alt-text

Creating effective alternative text is limited by the time-consuming processes developers must follow to ensure high-quality results. As e-commerce and digital platforms extend their reach, the challenge of scaling solutions to generate accurate, meaningful, and contextually correct alt-text has reached an urgent point. Results of accessibility analyses show that those e-commerce sites that are older and more established on the web tend to present a relatively smaller number of critical accessibility problems, which can be associated with long-term web development practices rather than an adequate solution to accessibility (Acosta-Vargas et al., 2022).

Jain (2025) proposed an intelligent chatbot system that would improve the accessibility of a website by coupling automated navigation support with AI-powered image description. The system relies on the Google Vision API to make a first draft of alt-text content by analyzing visual information, while a context engine refines it to fit within the structure and purpose of the website. This gives the chatbot the ability to issue more contextual and relevant descriptions, thereby improving the browsing experience of visually impaired users.

Haque and Csallner (2025) note that developers, especially junior and visually impaired programmers, often struggle with icons because alt-text is added late in development. With that, the authors introduce AltIcon, a tool that generates alt-text during the early stages of development. AltIcon activates when a developer adds a new icon to the Document Object Model (DOM) tree. This tool would support developers in generating alt-text while they work on the development, to help visually impaired programmers continue to work in an informed manner without having to wait until the alt-text is added later on in the development cycle.

Automation tools like these not only save time but can also help ensure the accuracy of the alt-text with the additional help of workflow and human review. These tools could independently help generate text or work as an assistant to make steps more efficient and responsive in the development process. As much as it is helpful to use an automation tool, it is important to remember that the accuracy of an automatically generated alt-text description is not consistently error-free. When time and resources permit, human-generated alt-text has been shown to be a more consistently effective choice.

3.3 Quality Checking

Various researchers have extensively studied the challenges and opportunities associated with creating high-quality alt-text for people with visual impairments. As noted by Santoki and Patvardhan (2021), users of e-commerce who have visual impairments often attribute low informational value to commonly provided alt-text. Most participants rated their experience with current alt-text online as inadequate to their understanding of the relevant web content. Their findings indicated a need for more descriptive explanations in alt-text assigned to media items and stronger involvement of users in contributing to accessibility strategies. This implies a general mismatch between existing industry practice and guidelines and user expectations and experience. Other studies also support this criticism, emphasizing how currently available alt-text typically seen online has failed to achieve the key accessibility purpose it was intended to address (Pascual-Almenara et al., 2021).

Jung et al. (2022) show that alt-text for data visualizations often omits key details such as chart type, axes, and overall trends. The results of their study indicate a preference for straightforward, objective, non-technical language and for alt-text with the capacity to provide both an overall summary and detailed information. This research also identifies inconsistencies between how writers adhere to guidelines from WCAG, Accessibility at Penn State, and the Diagram Center to demonstrate that adherence to these guidelines does not equal effective communication. Overall, users reported that the descriptions judged to be more complete enabled them to better understand the data visualizations, whereas incomplete or vague alt-text made the visual media more difficult to interpret.

Next to manual authoring practices, several researchers have explored the potential for automation to evaluate or even generate alt-text. Bigham (2007) describes a classifier that assesses the contextual similarity of alt-text and uses a Naive Bayes model to classify the description as either high or low quality. While the classifier achieved relatively high accuracy, the authors note that automated systems still fail to identify many problems that exist in poorly written alt-text. Gonçalves et al. (2018) confirm this observation by showing that automated accessibility tools commonly yield false positives and false negatives and are hence untrustworthy on their own. The multistage evaluation they performed, which combined automated assessment, expert heuristic review, and user testing with blind participants, shows that effective accessibility evaluation requires real-user involvement, not just technological solutions.

More modern approaches attempt to fill in some of these gaps through semantic analysis. Duarte et al. (2019) developed the SCREW v2 algorithm, which evaluates alt-text for relevance and completeness against a comparison of semantic descriptors, domain-specific features, and metadata. Although this model provides a far more subtle approach compared to simple detection of presence, restrictions of language, domain specificity, and overall context reduce its effectiveness. These findings show that semantic software is promising but not yet a replacement for human consideration.

This is further supported by broader issues found with complex graphic alt-text. McCall and Chagnon (2022) indicated that users often receive generic, too-long, or otherwise unrelated descriptions, which decrease rather than enhance understanding. Their results also showed continued difficulties with functionality, inconsistent tagging practices, and the need for industry-wide standards in writing the text alternatives. As accessibility needs go beyond visual impairment to a wider set of possible disabilities, the authors maintain that education for content creators has to be provided in conjunction with clearer and richer writing guidelines.

Taken together, these studies illustrate that while automated tools and new semantic technologies have the potential to support efficiency and meaningful user involvement, contextual understanding, and well-set standards for writing are more important when creating high-quality

and effective alt-text. The cumulative evidence from these studies points toward a hybrid approach, which merges automation with expert assessment and user involvement in the pursuit of accurate, descriptive alt-text that is truly accessible to visually impaired users.

3.4 Metadata

Alt-text is a standard form of metadata, meaning descriptive information embedded within digital content that helps to identify, organize and interpret an image for both users and systems. Automated accessibility evaluation tools play an increasingly important role in improving alt-text quality, particularly in multilingual web settings. Rodríguez Vázquez (2016) investigated how automated tools can enhance alt-text quality during web content translation. He found that translation software often ignores alt-text and leaves it untranslated, creating barriers for screen readers. In this study, participants translated a mock English website into French while evaluating image accessibility using Acrolinx, an authoring tool sensitive to vague or inaccessible alt-text, and Automated WAE tools aligned with WCAG standards, including IBM-developed aDesigner. Subsequent screen reader testing revealed improvements in alt-text quality when translators applied automated feedback from both tools. The study demonstrated that embedding accessibility checks within localization workflows can support diverse user needs in multilingual contexts.

Moreno and Martinez (2013) found that while good Search Engine Optimization (SEO) does not mean a site is accessible, the two disciplines share common principles. Referencing WCAG 2.0, they identified problems that negatively affect both accessibility and SEO, such as poor navigation, inaccessible scripts, and design practices that hamper screen reader interpretation. Their suggested best practices, including descriptive keywords in alt-text, meaningful anchor text, and language attributes, show that increased accessibility can also strengthen SEO. They concluded that greater recognition of this overlap might encourage more ethical, user-centred digital design while also improving search visibility.

Pascual-Almenara et al. (2021) evaluated eight e-commerce websites using both usability heuristics and WCAG-based accessibility inspection. Their findings showed that high usability does not necessarily correlate with high accessibility. Usability and accessibility scores were consistently high and low, respectively, especially regarding the effective use of alt-text. Missing or poorly written description labels were identified as a major barrier for users with disabilities. The authors suggest combining usability and accessibility indices with user testing, particularly involving participants with disabilities, to better assess auxiliary connector (AUX) and support more inclusive online shopping environments (Pascual-Almenara et al., 2021).

3.5 Gaps

Although progress continues to be made concerning accessibility standards, automated tools, and artificial intelligence solutions, gaps remain concerning the consistent implementation and assessment of alt-text within online shopping platforms. This section will assemble key, recurring deficiencies that have been identified concerning studies associated with this topic.

First, there are noted challenges with complex visuals. The current guidelines available have struggled to translate complex visual elements such as charts, graphs, infographics and maps (Jung et al., 2022) into accessible formats for those with visual impairments. Key concerns with these complex and data-rich visuals are that the alt-text is often too short to be able to explain the content of the visuals in a fulsome manner, or too vague to impart the same knowledge, or that the alt-text is simply missing key details. For instance, chart types, data trends or clustering, or axis labels can all act as important factors to help viewers understand what the data visualization is trying to convey about the information. This limits the screen reader users' ability to fully

understand the detailed visual information that is trying to be portrayed in these visual elements. In terms of e-commerce, a study by Jain (2025) shows that e-commerce product images have low-quality or inaccurate alt-text with significant frequency. One limitation is that e-commerce platforms often feature extensive use of both decorative and complex images, which require significant contextual understanding for impactful alt-text. Future work should also explore multi-language support and ensure compatibility across different e-commerce websites.

Tools such as WATAA and AltIcon can generate or flag missing alt-text, but they cannot ensure that it is meaningful, accurate, or useful to screen reader users (Jeong et al., 2023). Their primary evaluative measure is whether alt-text has been applied or not. As a result, low-quality, misleading or erroneous alt-text often goes unchecked, undermining accessibility. Although advances have been made in the generation and evaluation of alt-text, there is a general lack of user involvement from screen reader users in the process. Without their direct involvement, research may miss key usability issues that automated checks cannot detect, such as effects on comprehension, navigation, or task success.

Additionally, the current developer awareness and practices remain largely unchanged, often treating alt-text and accessibility as an afterthought rather than a project goal. Research indicates that many developers often postpone adding alt-text until late in the project, due to limited training, time constraints, or a lack of awareness (Haque & Csallner, 2025). McEwan & Weerts (2007) concluded that the two most common problems facing website accessibility in their testing are that web developers are not completely aware of or prioritizing accessibility, and that impaired users have differing difficulties using the provided websites. While automated tools are helpful to save time in terms of the process of adding alt-text, having additional user simulations can help developers and publishers better understand how different users interact with their content and thus better identify ways to support them. Addressing this would help empower developers to create more widely accessible websites.

4. Conclusions

Alt-text remains inconsistently applied and often untested across digital platforms and e-commerce sites. Automated tools to assess the presence of alt-text are common but often fail to assess the quality and/or context of the alt-text that is present, and studies on the issue rarely involve users with disabilities, limiting the efficacy of feedback. Guidelines like WCAG offer a base but lack detail for complex visuals and remain inconsistently applied by publishers and developers. Accessibility is often deprioritized due to low awareness and training, leaving major gaps in inclusive design. It is important to continue to advance this field for the growth of accessibility. Future work should develop tools that assess not only the presence of alt-text but also its quality, context, accuracy, and usefulness to screen reader users. This process obliges the involvement of visually impaired users to ensure authentic feedback and effectiveness. Additionally, improving accessibility guidelines to address complex visual and multilingual content in a clear and actionable way, especially in e-commerce websites that use significant amounts of complex visuals. Finally, training and integrated tools should support accessibility from the start of design and development rather than as a late-stage addition.

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