USE OF AI IN IMPROVING WEBSITE ACCESSIBILITY: A SYSTEMATIC LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK FOR DIGITAL INCLUSION

Lappeenranta-Lahti University of Technology LUT

Masters Programme - Digital Systems & Service Development, Masters Thesis

2025

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Examiners: Associate Professor Annika Wolff, Software Engineering

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ABSTRACT

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Master's thesis

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50 pages, 7 figures, 3 tables and 1 appendices

Examiner(s): Associate Professor Annika Wolff, Software Engineering

Keywords: Artificial Intelligence, Website Accessibility, Web Content Accessibility Guidelines (WCAG), Machine Learning, Inclusive Design, PRISMA, Digital Inclusion

The thesis examines how artificial intelligence (AI) can help in enhancing website accessibility and also bridge the gap between different established standards like Web Content Accessibility Guidelines (WCAG 2.2), and its practical implementation. Despite the legal frameworks E.g European Accessibility Act (2025), there are many websites which still fail to meet the basic accessibility requirements. The study explains how AI can help in personalizing user experiences and simplifying content for people with different disabilities.

A **Systematic Literature Review (SLR)** using **PRISMA 2020 protocol** was conducted in which 43 studies were analysed which were published between 2018 - 2025. Findings group AI applications into 5 categories: computer vision, speech technologies, natural language processing (NLP), AI-based accessibility testing and, adaptive and personalized interfaces. These techniques help improve accessibility in different ways explained in this thesis.

Results indicate that AI adds personalization, scalability, and innovation to accessible web design. This thesis produces a taxonomy of artificial intelligence (AI) techniques and also shows a direction for policymakers, researchers and developers. It concludes that AI should accompany but not replace human centered evaluation and design to make sure technology improves digital inclusion instead of superficial compliance.

ACKNOWLEDGEMENTS

I would like to extend my sincere gratitude to my supervisor **Associate Professor Annika Wolff** for her guidance during the early phase of my thesis. Our meetings on streamlining the research plan, refining the research topic and research questions gave me a clear roadmap and were also very helpful in structuring and developing the entire thesis.

I would like to thank **LUT University** for providing great digital resources, academic environment, and research materials that made this work possible.

I thank my family for their constant motivation, and understanding, during this journey. And finally, I would also like to thank my peers / friends as they also provided valuable feedback, and support, which kept me motivated throughout this process.

Sincerely,
Muhammad Ali

ABBREVIATIONS

AI	Artificial Intelligence
BLV	Blind and Low Vision
CV	Computer Vision
EAA	European Accessibility Act
HCI	Human Computer Interaction
LLM	Large Language Model
ML	Machine Learning
NLP	Natural Language Processing
POUR	Perceivable, Operable, Understandable, and Robust
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
SLR	Systematic Literature Review
STT	Speech-to-Text
TTS	Text-to-Speech
UI	User Interface
UX	User Experience
WCAG	Web Content Accessibility Guidelines
WHO	World Health Organization

Table of contents (Todo: Update this section when the document is ready)

Appendices

All figures:

Tables

DECLARATIONS

Turnitin

The originality of this thesis has been reviewed with the Turnitin similarity checking service.

AI usage

The author of the thesis, Muhammad Ali, used the following AI-tools during the preparation of the thesis:

1. AI tool name: ChatGPT
    a. Purpose of use: To improve clarity of some sentences making sure that the meaning of sentences does not change.
    b. Explanation of the use of the tool: ChatGPT was used for improving sentence structure and improving text at some places. All suggestions have been refined and improved before adding to this document to make sure the purpose and meaning of content does not change.

Responsibility

The author, Muhammad Ali, takes full responsibility for the content of this thesis and has reviewed and edited the content generated by the possible use of AI tools.

1 Introduction

1.1 Background and Motivation

For most people, the web is simply how things get done, pay a bill, book an appointment, message a friend. For most of the people with disabilities, routine online tasks like booking appointments, paying bills, or completing online forms, can still be frustrating, slow, and inaccessible, depending on complexity and design of application (W3C, 2023; WHO, 2022). The World Wide Web Consortium (W3C) developed the Web Content Accessibility Guidelines (WCAG) to reduce these barriers, with the most recent update published as version 2.2 in October 2023 (W3C 2023). WCAG offers a solid baseline; even so, a large share of websites still fall short of basic requirements in everyday practice (European Accessibility Act 2025).

Artificial Intelligence (AI) is often positioned as part of the remedy. Methods drawn from natural language processing, computer vision, and speech recognition can generate on-the-fly image descriptions, rephrase dense passages into plainer language, check pages for compliance during use, and tailor interfaces to different needs (Naayini et al. 2025; Yu et al. 2025). Recent prototypes and products, such as generative features that work alongside screen readers (Yu et al. 2025) and systems that automatically flag and repair common violations (Huang et al. 2024) suggest practical gains for everyday accessibility.

This promise actually comes with different caveats. Different automated tools can probably be biased or inaccurate, and “overlay” quick fixes might create an compliance illusion while the core issues may remain (from FT 2024; Guardian 2024). Different commercial offerings similar to AccessiBe have been criticized many times for overclaiming about what AI can actually deliver, bringing reputational risk and legal exposure (from AccessiBe 2025). These tensions actually make it more essential to test claims against the distinguish genuine improvements and evidence from marketing hype.

1.2 Problem Statement

Proofs on accessibility and AI have actually spread around products, research papers, and platforms. This scatter makes it difficult for designers, policymakers, and researchers to see what works, what fails, and under which conditions (Chemnad 2024; Vera-Amaro 2025).

Without a structured way to organize these findings, efforts risk duplication, wasted resources, and reliance on tools that do not reliably improve access or equity.

1.3 Objectives of Research & Questions

This thesis addresses gaps in current knowledge by carrying out a **systematic literature review**, structured according to the PRISMA protocol, and using a conceptual–analytic method (Järvinen, 2004) to interpret the findings. Main objectives include:

1. For classifying and identifying different AI techniques which were discussed in academic literature for enhancing website accessibility.
2. For examining reported limitations and advantages of these approaches.
3. For proposing conceptual frameworks which can actually inform future development, research, and policy in this field.

Based on these objectives, the study asks the following research questions:

Which AI techniques have been proposed in the literature to improve website accessibility, and how can they be categorized?

What are the reported benefits and limitations of using AI to enhance website accessibility, according to existing research?

1.4 Scope and delimitations

The research scope is limited to systematic and detailed examination of technical and secondary academic literature on use of artificial intelligence in website accessibility. This research has main focus on sources E.g conference papers, journal articles, and authoritative reports which are published between the years 2018 and 2025, covering the during which artificial intelligence applications in accessibility have advanced most rapidly. Different databases E.g ACM Digital Library, Google Scholar, IEEE Xplore, and SpringerLink, were chosen for searching the literature due to their coverage related to accessibility research and computer science.

This research does not include the primary data collection, no surveys, interviews, or experimental usability tests are conducted. Instead, it includes a conceptual-analytic approach (Järvinen 2004) and systematic literature review (SLR) to classify, identify, and interpret different findings from existing studies. The analysis is therefore interpretive and integrative, not empirical.

This thesis is focused on web based accessibility and does not cover mobile-only accessibility, physical assistive devices, or general AI ethics outside the accessibility context. While different references to generative AI and LLMs are included where they are relevant, the focus of study remains on their application to website testing, design, and adaptation instead of on development of AI models itself.

AI technology has evolved quickly, some of the studies might become outdated in a few years; so, these findings reflect current state of knowledge instead of long term generalizations. These things make sure that the analysis remains rigorous, focused, and also relevant to different contemporary discussions on AI-driven web accessibility.

1.5 Thesis Structure

The structure of thesis is arranged as below,

- **Chapter 1 (Introduction):**
  Introduction chapter introduces the topic of research, explains the context and motivation, outlines the research questions and objectives, and describes the scope and structure of study.
- **Chapter 2 (Theoretical Background & Literature Review):**
  Chapter 2 describes existing AI applications specifically in accessibility, also explains different accessibility standards E.g the European Accessibility Act (2025) and WCAG 2.2.
- **Chapter 3 (Research Methodology):**
  This chapter explains the framework of study, which includes search strategy, systematic literature, criteria for both inclusion and exclusion, synthesis approach, and data extraction. It also discusses limitations in and reliability of the chosen methods.
- **Chapter 4 (Findings):**
  This chapter explains results of literature review, which also includes a taxonomy of different AI methods and techniques which are used for improving the accessibility and also mapping them across different possible domains of disability. It also provides a summary of the limitations and the benefits which are reported in reviewed studies.
- **Chapter 5 (Discussion):**
  This chapter explains findings, about highlighting their ethical, technical, and societal implications. The chapter also describes the research gaps which were actually identified during this entire process and also discusses the practical and theory based contributions of the study.
- **Chapter 6 (Conclusion and Future Work):**
  Concludes the research by giving a summary based on key insights, while

highlighting different contributions to the field, and also suggesting directions for the future technological development and the studies in artificial intelligence driven accessibility.

The main structure of this research is explained in **Figure 1.1**, which shows how AI techniques like NLP, computer vision, and speech based models contribute to the outcomes of accessibility through different disability domains. This conceptual linkage serves as the foundation for methodological and theoretical discussions in subsequent chapters.

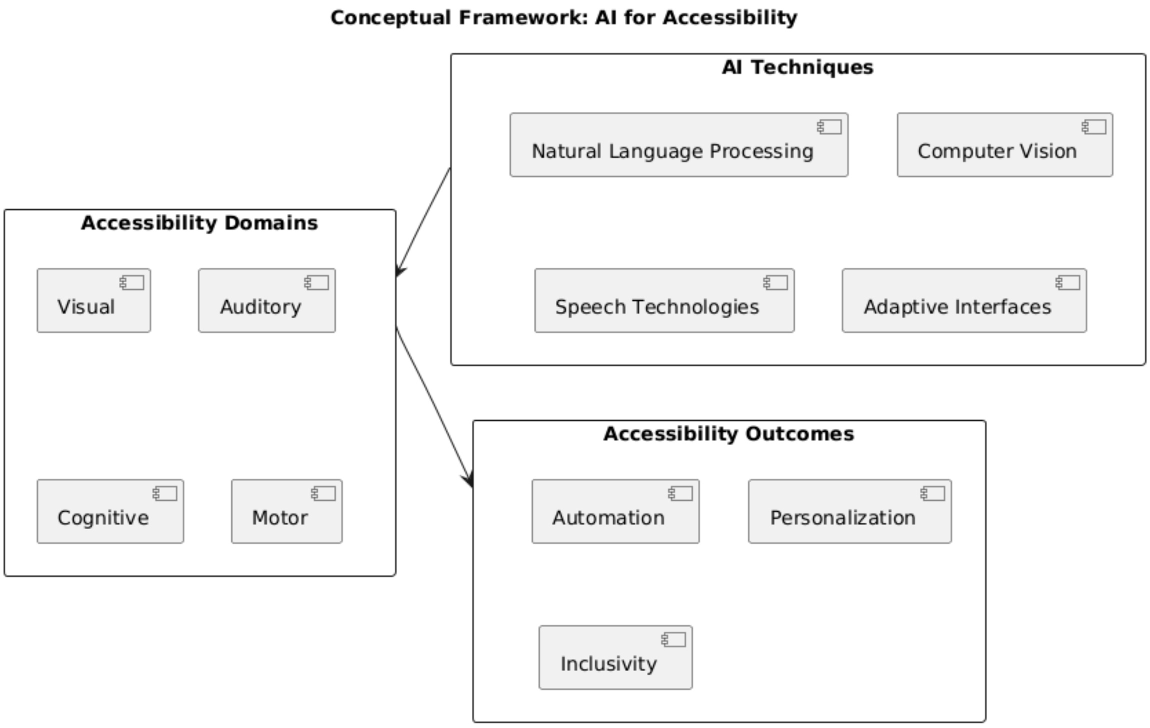


Figure 1.1 - Conceptual Model Diagram / Research Framework

This chapter explained a little about the objectives and background guiding the present study. The following chapter will build on this foundation by reviewing theoretical frameworks and existing literature that connect AI with digital accessibility.

2 Literature Review & Theoretical Background

This chapter does a deep examination of the theoretical foundations and existing research related to the AI in web accessibility. It also does a review of the main accessibility standards, identifies the major gaps in research that are related to the current study, and also explores different AI techniques which are applied to the accessibility related challenges.

2.1 Overview of AI in Accessibility

The use of AI has notably transformed the approaches related to web accessibility. Accessibility in different digital systems also refers to the practice of developing and designing applications and websites which can be utilised in a good way by the users with different kind of disabilities, including auditory, visual, cognitive, etc. When history is discussed, accessibility has majorly relied on manual compliance with different standards e.g *WCAG* and also relied on the awareness of developers and testing by users. Nevertheless, complexity of the digital ecosystems, also combined with fast technological change, has also produced different challenges in maintaining proper accessibility around platforms and devices (Chemnad 2024).

Artificial intelligence provides a good opportunity for addressing these challenges by automating the correction, detection, and adaptation of different accessibility barriers. Machine learning (ML) based algorithms can also identify different inaccessible components, natural language processing models can also generate different alternative text for the images, and also computer vision can identify different visual elements for assisting low-vision or blind users (Naayini et al. 2025). Generative AI tools E.g *Be My AI* and *Be My Eyes* (2025) uses multimodal systems and large language models for describing different complex visual environments, to empower users for interpreting web interfaces and real world scenes independently.

Artificial intelligence can actually improve user interfaces dynamically depending on the assistive device usage patterns and user preferences. Adaptive systems can also adjust the layout, color contrast, or content density based on a user's visual or cognitive needs. Artificial intelligence based testing tools such as *ACCESS* (Huang et al. 2024) and *Evinced* (2024) help the developers in automatically detecting different violations and also apply corrective measures in real time. These kinds of advancements also have the potential in making accessibility processes more cost-efficient, advanced, and also data driven in comparison to the manual methods.

Despite the benefits, literature also indicates different concerns related to the inclusivity and reliability of artificial intelligence driven accessibility. Tools E.g *AccessiBe* (2025) indicate that the automated overlays can also introduce new issues related to accessibility, generating inconsistent or misleading results which fail to meet WCAG standards. Similarly, *The Guardian* (2024) and *The Financial Times* (2024) reports that different blind users have also experienced inaccurate Artificial intelligence generated descriptions, which highlights risk of extra reliance on the automation. These kinds of cases also suggest that artificial intelligence should not replace human judgment but instead it should help complement it by augmenting different accessibility efforts. Thus, scholarly the debate has now shifted from whether artificial intelligence can improve accessibility to how it can be used responsibly to make sure that ethics, inclusivity, and transparency actually remains central to its design.

2.2 Accessibility Standards: WCAG and the European Accessibility Act

AI-driven approaches to accessibility need to be assessed in relation to well-established international standards. Among these, the Web Content Accessibility Guidelines - WCAG, created by the World Wide Web Consortium - W3C, form the core foundation for accessible website design. The latest version i.e WCAG 2.2 (2023) is now based on four important principles which are Perceivable, Operable, Understandable, and Robust (POUR). They make sure that the online interface elements and information can be utilized by everyone, regardless of its ability. In addition to these guiding principles, WCAG outlines measurable success criteria that allow developers to test and confirm whether a website meets accessibility expectations through consistent benchmarks.

Along with WCAG, European Accessibility Act (EAA), which actually takes effect in June of 2025, provides a proper legal framework for the accessibility compliance across the European Union. It demands that digital products and services ranging from different e-commerce portals and websites to public sector applications, now also follow minimum accessibility standards to avoid facing any potential penalties. It promotes a design-for-all kind of approach which can urge organizations to use accessibility into their own digital experiences from the start instead of treating it as an optional thing.

WCAG and the EAA together create both the regulatory and ethical foundation for the next generation of artificial intelligence based accessibility tools. They define the boundaries within which innovation should occur, helping ensure that artificial intelligence contributes to genuine inclusion instead of offering only surface-level compliance. Judging the AI techniques from the lens of these standards is why it is important for determining their effectiveness, credibility, and long-term value.

2.3 AI Techniques for Accessibility

A broad spectrum of Artificial Intelligence (AI) techniques has been explored to tackle the many challenges of web accessibility. These methods generally fall into five key categories based on their purpose and functionality: computer vision (CV), natural language processing (NLP), speech technologies, adaptive and assistive interfaces, and AI-supported testing tools.

2.3.1 AI Techniques for Accessibility

Computer vision also allows the machines to interpret and recognize the visual information, which makes it an important tool for helping people who have low vision or are blind. By generating alternative text (alt-text) or audio descriptions for images and videos, CV systems make visual content more accessible. Naayini et al. (2025) also describes different assistive technologies that also use image captioning and object detection models for giving users the real-time feedback related to their surroundings. Similarly, Be My AI (2025) also applies multimodal LLMs for describing the complex scenes using the conversational exchanges while helping the users understand visual environments in a better way. Even after these advancements, accuracy still remains a concern. As it is also highlighted by The Financial Times (2024), descriptions which are generated by artificial intelligence sometimes don't properly identify objects or people which actually raise valid questions about user trust and reliability.

2.3.2 Natural Language Processing - NLP

The NLP has these days become an important element in making the online information more easier and accessible to understand. It is actually useful for individuals with learning or cognitive disabilities, as it also helps to transform highly technical or complex text into a simplified and much more readable form. The common techniques E.g text simplification, summarization, and the semantic analysis are normally applied a lot to make web content clearer and more approachable. Yu et al. (2025) also found that the plugins built using generative AI integrated into the e-commerce websites can also make the product descriptions easier and simplified to read while also helping in improving the navigation for users who depend on the screen readers. If we go beyond, NLP highlights many different interactive systems which include the voice-based assistants and chatbots, which actually offer personalized explanations and guidance to help the users engage with the digital platforms in a more effective way. Despite these facts a constant challenge still remains which is that the models which are trained on biased or using limited data can easily overlook certain cultural contexts or linguistic styles, which can reduce fairness and inclusivity in user experience.

2.3.3 Speech Technologies

Text-to-Speech and Speech-to-Text based systems have been essential tools for a long time for the people with different visual or hearing impairments, which help in reducing the communication gaps in the digital environments. The addition of artificial intelligence has actually made these technologies much more responsive and accurate than the earlier versions. For example, AI based transcription and captioning tools can now actually deliver very close to real time results, while at the same time advances in the voice synthesis also allow computer generated speech to sound conversion more expressive and natural (Bercaru 2024). These developments have notably improved the accessibility and user experience which allows the individuals to engage with the digital content more comfortably and independently . Even so, external factors such as background noise, varied accents, and contextual ambiguity can still limit their consistency and usability across different environments.

2.3.4 Adaptive and Assistive Interfaces

Artificial intelligence can actually personalize the user interfaces dynamically for accommodating the specific accessibility related needs. Adaptive systems use reinforcement predictive or learning algorithms for modifying font size, visual contrast, or layout depending on the assistive device inputs and user behavior. This kind of adaptive design can help the users with motor or cognitive impairments which actually require customization based interaction patterns. Todorov (2024) indicates that AI driven adaptation mechanisms help in improving inclusivity and engagement but they also raise privacy concerns because of frequent data collection about the user behavior.

2.3.5 AI-Powered Testing and Compliance Tools

AI based testing tools are these days widely used for spotting accessibility related problems during the web development process. Different platforms like ACCESS (Huang et al. 2024) and Evinced (2024) apply the deep learning related techniques for identifying issues in the structure of websites, including color contrast errors, Document Object Model, and the keyboard navigation flaws. These tools can now automatically highlight and even fix the different problems, which can also help minimize the manual effort and also reduce the time used in accessibility reviews. However, if we talk about AccessiBe (2025), It explains that relying more on automated corrections can be of high risk. When AI based fixes are not based on WCAG standards, they can also give a false impression of accessibility. Due to this reason, human oversight still remains important to confirm the accuracy of results generated by AI and maintain accountability throughout the testing process.

2.4 Gaps in Existing Research

Despite major progress in recent years, research on the use of AI for accessibility is still fragmented and uneven across different disability groups, research methods, and application areas. Systematic reviews by Chemnad (2024), Vera-Amaro (2025), and the HighTech and Innovation Journal (2025) show that most studies focus heavily on visual and auditory impairments, while cognitive, motor, and multiple disabilities receive far less attention. This imbalance limits how broadly the findings can be applied and leaves important segments of the disabled community without adequate consideration.

Moreover, most of the research has been based on the technical level feasibility instead of on the user based evaluation. For example, many of the AI driven accessibility tools are checked in the laboratory environments but they lack the real world check which should involve different diverse user groups. As Bernard (2025) and Park (2025) observe that even the AI tools which were designed to support the systematic reviews also introduce different errors and risks of bias if they are not guided by the expert oversight which is a lesson which applies equally to the accessibility research.

Another visible gap concerns legal and ethical dimensions of the artificial intelligence use in accessibility. Studies infrequently address the issues e.g data privacy, algorithmic bias, or transparency, even when these factors are very important to make sure to have compliance and trust under the frameworks like EAA (2025). Lack of proper evaluation metrics also complicate further comparisons around studies, which makes it a little complicated to check the real impact of AI driven solutions.

Finally, literature also does not contain a unifying conceptual framework which maps the AI techniques to the accessibility based outcomes. Existing classifications actually emphasize more on the independent level technologies in place of their own integrated contribution towards the inclusive design. This research addresses these differences by developing a proper structured taxonomy that actually categorizes the AI methods according to their function, implementation context, and disability domain. Because of this synthesis, the research participates towards building a better understanding of how artificial intelligence can ethically and effectively advance digital accessibility.

This chapter synthesized previous research on artificial intelligence based accessibility, indicating main technological standards, approaches, and the research gaps. The next chapter explains methodological design of study, including the PRISMA driver detailed review process and the data extraction strategy utilized to address the gaps which are identified.

3 Research Methodology

This chapter highlights the methodological framework used for study. It elaborates overall research approach, design, and the systematic literature review (SLR) process utilized for looking into how the AI participates towards web accessibility. This chapter explains search strategy, data sources, criteria for inclusion and exclusion, and different methods of data synthesis and extraction. It also explains ways used to make sure the research validity and reliability, along with the limitations in the chosen methodology.

3.1 Research Design

This study uses a Systematic Literature Review (SLR) approach to explore how Artificial Intelligence (AI) has been applied to improve website accessibility. The SLR method offers a clear and replicable way to bring together existing research, highlight patterns, and identify gaps in current knowledge (Chemnad 2024; Vera-Amaro 2025). It was selected as the purpose of this research is not to test or design a new system, but it is to interpret and organize a wide range of existing studies in this field.

For maintaining the transparency and consistency, review uses PRISMA 2020 instructions PRISMA provides a structured process for locating, screening, and selecting studies, ensuring that each step can be traced and reproduced. The detailed flow of this process is shown in Figure A1 in the Appendices, which illustrates how many records were found, examined, excluded, and finally included in the analysis.

In addition, the review incorporates the conceptual–analytic approach described by Järvinen (2004). This perspective focuses on connecting and interpreting concept based insights instead of having focus only on number based data. Combining PRISMA's procedure along with Järvinen's framework helps study to be both theoretically reflective and methodologically rigorous, offering a detailed understanding of the way in which AI techniques relate to different principles of web accessibility.

3.2 Research Approach

This research uses an interpretive and qualitative approach. Instead of running experiments or collecting new data, it checks already existing peer reviewed technical reports and studies for understanding how AI has been utilized for improving web accessibility. By comparing and reviewing this body of work, study focuses on how different artificial intelligence tools can help remove different barriers for the users and also what these developments actually mean for policymakers, designers, and accessibility practitioners.

Because this method is interpretive, it also considers more than only the technical side, E.g accuracy, algorithms, or automation. It also reflects on broader ethical and social issues, including fairness, inclusivity, and user empowerment. The aim is to build a conceptual framework that captures both the technical possibilities of AI and its real impact on people who rely on accessible digital design.

3.3 Data Sources and Search Strategy

All data used in this review were gathered from recognized academic databases which include ACM Digital Library, ScienceDirect, IEEE Xplore, Google Scholar., and SpringerLink. These platforms were chosen because they provide reliable and comprehensive access to research in fields such as computer science, human–computer interaction (HCI), and digital accessibility.

The search process took place between January and May 2025, focusing on studies published from 2018 to 2025, a period that marks significant growth in the use of the AI for website accessibility. To cover the maximum range of the related work, search used a combination of targeted keyword groups and Boolean operators. Few examples of main search keywords etc used are mentioned below:

- ("AI" OR "Artificial Intelligence" OR "Deep Learning" OR "Machine Learning") AND ("Digital Accessibility" OR "Web Accessibility" OR "Inclusive Design")

- (“Computer Vision” OR “Natural Language Processing”) AND (“Accessibility Tools” OR “Assistive Technology”)

- (“LLM” OR “Generative AI”) AND (“Usability for Disabled Users” OR “Website Accessibility”)

Repeating records were filtered automatically, and other studies were then imported into a proper reference management system for the screening.

3.4 Inclusion and Exclusion Criteria

For making sure that review remains relevant. and focused, a set of exclusion and inclusion criteria was created in the screening process.

Inclusion Criteria

- Studies which were published between years 2018 and 2025.
- Conference papers, peer reviewed journal articles, or systematic reviews which have examined use of artificial intelligence in digital accessibility or web.
- Research having at least 1 accessibility domain, E.g auditory, visual, cognitive or motor impairments.
- Publications written in English.
- Papers that explicitly discussed AI-based methods, frameworks, or systems related to website or digital accessibility.

Exclusion Criteria

- Studies limited to non-web contexts, including robotics, autonomous vehicles, or industrial applications.
- Articles that did not establish a direct link between AI and accessibility (for example, general discussions on AI ethics).
- Editorials, blog posts, or opinion pieces that were not peer-reviewed.
- Duplicate studies that offered no new insights or methodological contributions.

Applying these criteria produced an initial pool of 3,706 articles across all databases. After screening titles and abstracts, 186 papers were reviewed in full, and 43 studies met the inclusion standards for detailed qualitative analysis. These values are the ones which were also reported in the earlier systematic reviews based on accessibility and artificial intelligence (Chemnad 2024).

3.5 Data Extraction & Synthesis

A structured data extraction template was developed to organize and record essential information from each of the studies selected for review. For every paper included, the following key details were collected:

1. Bibliographic information like author name, title, publication year, and type of publication.
2. Artificial intelligence method used, E.g natural language processing, computer vision, adaptive interface design, or speech recognition.
3. The domain of Accessibility mentioned in the study, including auditory, visual, motor or cognitive impairments.
4. Research context, which highlights whether work directed towards framework development, evaluation, or development of a practical tool.
5. Limitations and benefits of artificial intelligence approach as mentioned by the authors.
6. Any reference to compliance, such as links to WCAG or EAA accessibility standards.

Data synthesis took place in two key stages.

1. Thematic Analysis

Extracted data was first utilized for identifying recurring themes and ideas. Common topics, E.g automation in the adaptive user experiences, accessibility testing, and AI-driven remediation, were gathered into broader conceptual categories for revealing shared insights.

2. Conceptual Integration

These categories were then examined through Järvinen's (2004) conceptual–analytic approach, which was used to identify relationships between concepts and to build a taxonomy that connects specific AI techniques with accessibility challenges and domains.

The aim of this process was to go beyond simple classification, uncovering underlying patterns, connections, and overlaps among AI methods and their outcomes for accessibility. The PRISMA flow diagram shown in Figure 3.1 provides an overview of this process, illustrating how the initial pool of 3,706 studies was refined to a final set of 43 papers included in the qualitative analysis.

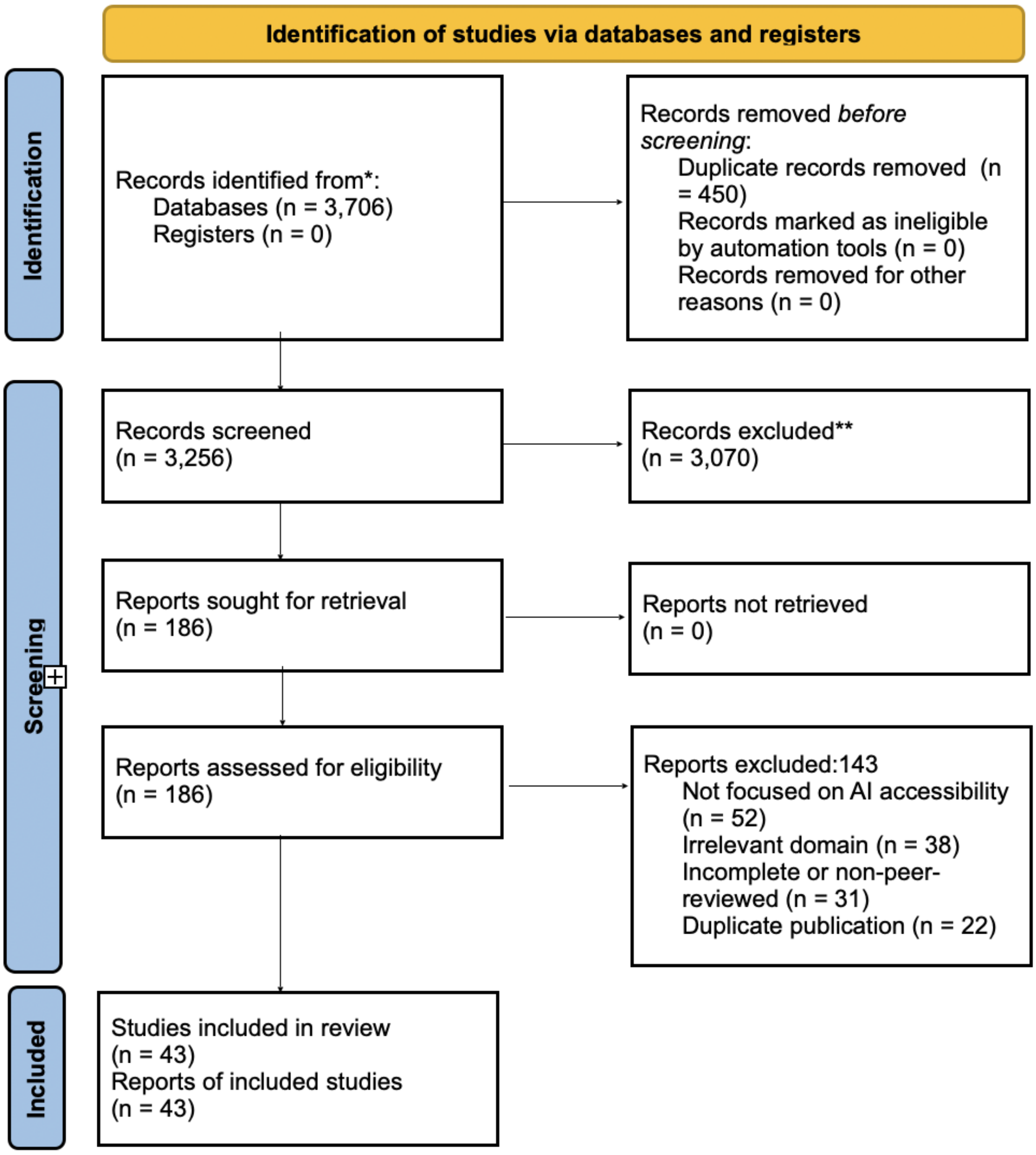


Figure 3.1. PRISMA Flow Diagram

Different exclusion and inclusion parameters utilized for filtering the studies are summarized in **Table 3.1**. They will make sure that only relevant and peer reviewed, English based research which were published between the years 2018 and 2025 were considered relevant for the reviews.

Criterion Type	Included If	Excluded If
Time Range	2018 - 2025	Before 2018
Topic Relevance	Has focus on artificial intelligence techniques for web accessibility	Has focus on AI topics which are not relevant or not related to accessibility.
Publication Type	Conference papers or reviewed journals	Blog posts, non peer reviewed or preprints.
Language	English	Non-English

Table 3.1. Explanation for Inclusion and Exclusion Criteria

The data extraction process used a structured and standardized template to keep the evaluation of all selected studies consistent and comparable. This approach helped maintain both accuracy and reliability throughout the review. Layout of template is shown in Table B1 in the Appendix B, which indicates the main fields which are used for recording types of AI methods applied, bibliographic information, reported advantages and limitations, accessibility domains explored, and any possible references to the established accessibility standards.

3.6 Research Reliability and Validity

Making sure that reliability and rigor was a main priority in research design. Different steps were taken for maintaining high standard of the methodological consistency and quality:

- **Transparency:** PRISMA method was used carefully, while documenting every stage of review process, from starting search around databases to final selection of studies.
- **Reproducibility:** All Boolean operators, search terms, and inclusion criteria were also defined clearly, to allow other researchers in replicating the study if required.
- **Peer Reviewed Sources:** Publications only from the conference proceedings and peer reviewed journals were added to ensure academic reliability and credibility.
- **Cross-Verification:** Findings were actually compared from other systematic reviews (Chemnad 2024; Bercaru 2024; HighTech and Innovation Journal 2025) to minimize the risk and ensure alignment of selection bias.

It is actually worth noting that reliability of a proper systematic review usually depends on the accessibility and quality of existing body of research. Some of the studies may not have been added due to publication bias and access restrictions, particularly when only the positive results were reported. In addition, because AI technology evolves very fastly, new frameworks and tools can emerge that usually make older studies less relevant. While the chosen methodology provides a solid and credible overview of the field during the period studied, it also acknowledges that this is a rapidly changing area of research.

3.7 Methodological Limitations

Although the systematic literature review method offers both depth and breadth, it does have some limitations. First, the research depends entirely on secondary data, meaning that the insights drawn are influenced by the quality and completeness of previous studies. Second, while the PRISMA framework makes sure of having transparency, at the same time, it can not totally eliminate the subjective interpretation during the synthesis and coding stages. Inevitably, a researcher's opinion can affect how themes are emphasized or organized, despite the best efforts to remain neutral.

For addressing this, a process of two phase validation was executed. Lead researcher first executed thematic categorization and data extraction, then re-evaluated a subset of studies for verifying consistency of the results. This iterative technique helped in strengthening the stability and reliability of final taxonomy.

Another limitation is the lack of a quantitative meta-analysis, which would have made it possible to statistically compare outcomes between studies. However, because accessibility research encompasses a wide range of methods and evaluation models, such statistical aggregation was not appropriate. Finally, the fast-paced development of AI presents an ongoing challenge, algorithms, tools, and standards evolve faster than the publication cycle of academic research. So, as a result, even a detailed review can also quickly become just outdated.

These limitations are further discussed and acknowledged in the later chapters for providing transparency and balance. The step by step process used for the systematic literature review is explained in **Figure 3.2** in summary, which shows main stages, from screening and database search to taxonomy creation, thematic coding, and synthesis. This properly structured workflow actually aligns with PRISMA 2020 framework, reinforcing the study's reliability, transparency, and methodological traceability.

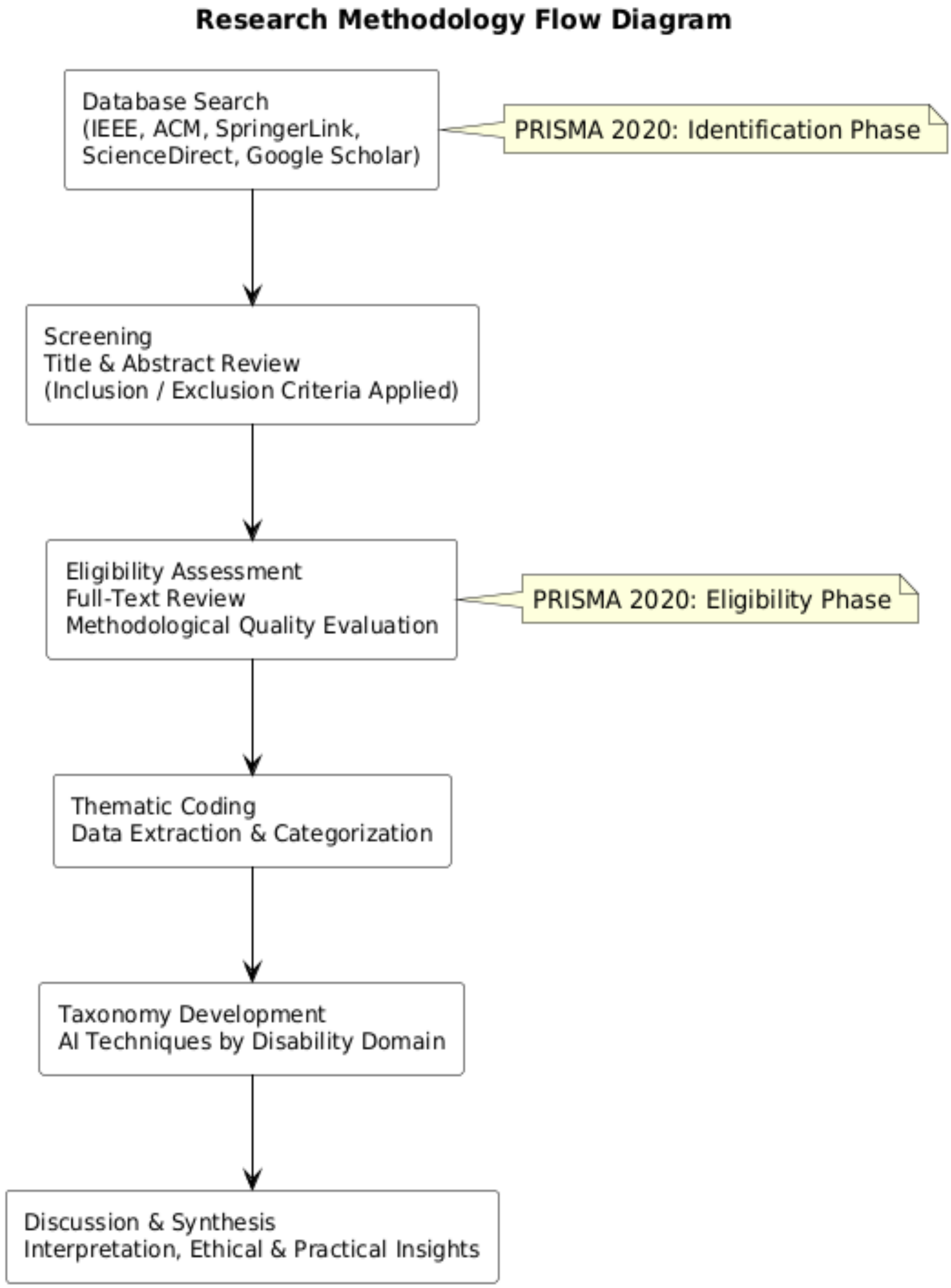


Figure 3.2. Research Methodology Flow Diagram

This chapter described the overall research design, outlining the inclusion and exclusion criteria and the systematic procedures followed to maintain transparency, consistency, and reliability throughout the study. The next chapter presents the key findings that emerged from this process, including the creation of a taxonomy that links different AI techniques to specific accessibility domains.

4 Findings

This chapter analyzes and presents main findings of the systematic literature review.

4.1 Research Design

This chapter explains what was found during literature review related to ways AI is being used for improving websites to make them more accessible for users with disabilities. The review is based on 43 peer reviewed studies which were published between 2018 and 2025, all of which were collected and examined using the PRISMA method discussed in Chapter 3.

The chapter is divided into three main parts.

1. The categorization of artificial intelligence techniques used for improving web accessibility,
2. Taxonomy of artificial intelligence applications which are mapped across disability domains
3. Benefits and limitations identified in the reviewed literature.

Collectively, these sections give a balanced and clear view of how artificial intelligence contributes to accessibility, explaining which approaches seem most beneficial and where more progress is still required.

4.2 Categorization of AI Techniques

The review identified five main groups of Artificial Intelligence - AI techniques that are commonly used to improve web accessibility. These include Computer Vision - CV, Natural Language Processing - NLP, Speech Technologies, Adaptive and Assistive Interfaces, and AI-based Accessibility Testing Tools. Each group serves a different purpose, addressing particular accessibility challenges discussed across the reviewed studies (Naayini et al., 2025; Yu et al., 2025; Huang et al., 2024; Todorov, 2024).

testing tools.

4.2.1 Computer Vision (CV)

Computer Vision methods are mainly used to interpret and describe visual elements for people with visual impairments. In the past few years, captioning technologies and image recognition have actually become much more advanced. For example, Naayini et al. (2025) describe artificial intelligence based systems which can now create meaningful text and recognize people, objects, and scenes almost instantly. In a similar way, Be My AI (2025) applies large multimodal models to provide conversational image descriptions that help blind and low-vision (BLV) users understand visual content more independently.

Even with these improvements, such systems still make errors, especially when context or subtle visual details are involved. Misleading descriptions and inaccurate labeling still remain the common issues. Different reports from The Guardian (2024) and The Financial Times (2024) have indicated that users often get frustrated when the automated overlays fail to provide consistent results. These findings show importance of keeping the humans involved in process to refine and verify AI outputs.

4.2.2 Natural Language Processing (NLP)

NLP methods are normally utilised to simplify, analyse, and generate the text in methods that make the online content easier to understand and read. Tools which rely on NLP, for example generative AI based plugin examined by Yu et al. (2025), have actually made it much easier for the screen readers in navigating e-commerce websites by rephrasing complicated text and reorganising page structure. NLP systems are also applied to add semantic tags to web pages and create automatic captions, which actually improves accessibility for people with hearing or cognitive impairments.

Even with these improvements, there are still different concerns about bias found in the data used in training such models (Chemnad, 2024). When training material lacks cultural or linguistic diversity, the output can actually include insensitive or inaccurate wording, which in turn can harm the user's inclusivity and trust. This highlights need for more representative and broader data during the model development.

4.2.3 Speech Technologies

Text-to-Speech (TTS) and Speech-to-Text (STT) technologies remain important for reducing the communication barriers in the digital spaces. Research by HighTech and Innovation Journal (2025) and Bercaru (2024) indicates that recent artificial intelligence driven speech systems have actually improved the clarity of the audio captions, the overall responsiveness of user interactions, and accuracy of voice commands. These systems now support the adaptive voice output and real-time transcription, offering the clear benefits to both deaf and blind users. However, performance can still be affected by different factors such as different accents, background noise, and computational demands of processing the speech data. Some studies have also indicated that the STT systems which are trained majorly on English data, struggle with multilingual websites, which still continues to limit the global accessibility.

4.2.4 Adaptive and Assistive Interfaces

AI-based adaptive interfaces adjust layout, typography, and the overall presentation of content to better fit individual user needs. These systems actually rely on the machine-learning models that actually observe how the users make interaction with a website and then modify different elements such as colour contrast, font size, or navigation structure accordingly. As Todorov (2024) notes, adaptive design can also make websites more inclusive by reducing the cognitive strain and then allowing for personalised accessibility settings. At same time, this level of personalisation also raises privacy issues, as technology depends on the ongoing user profiling and data collection. Ethical frameworks like the European Accessibility Act (2025) stress the need for openness and responsible data handling when developing such systems.

4.2.5 AI-Based Accessibility Testing Tools

Automated testing tools represent one of the fastest-developing areas in accessibility research. Different programs such as Evinced (2024) and ACCESS (Huang et al., 2024) use artificial intelligence for spotting accessibility problems in Document Object Model (DOM), evaluate Accessible Rich Internet Applications (ARIA) labels, and check colour contrast. These tools can also identify or even correct different issues automatically, which saves considerable auditing time for developers. However, the dependability of these automated corrections remains uncertain. For example, AccessiBe (2025) has been criticised for promoting full compliance while delivering incomplete or misleading fixes. The overall view in the literature is that automation should support, rather than replace, human evaluation to ensure full compliance with WCAG 2.2 standards.

4.3 Taxonomy of AI Applications by Disability Domain

To organise the results of the review, a taxonomy was developed to show how different AI techniques correspond to particular disability categories, visual, auditory, cognitive, and motor. The main findings drawn from the selected studies are presented in Table 4.1. Each entry summarises the AI approach, the type of disability addressed, and the study's key outcomes, providing a clear overview of the evidence supporting the taxonomy.

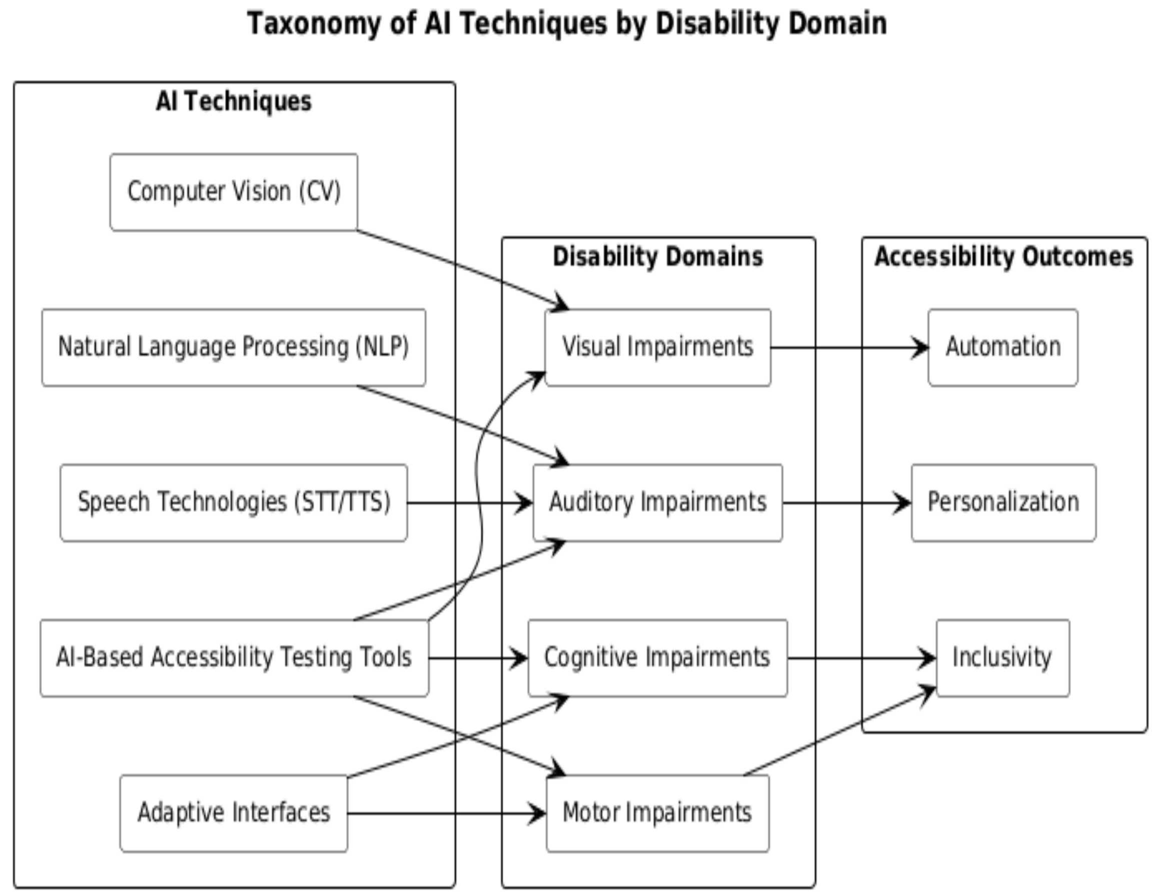
Table 4.1. Key Findings from Selected Studies

Disability Domain	Primary AI Techniques	Applications and Examples	Representative Studies
Visual Impairments (Blind and Low Vision – BLV)	Computer Vision (CV), NLP, Speech Technologies	Automated image captioning, alt-text generation, voice-based navigation, scene interpretation	Naayini et al. (2025); *Be My AI* (2025); Yu et al. (2025)

Auditory Impairments	NLP, Speech-to-Text (STT), Text Summarization	Automated captioning, transcript generation, sign language recognition	Bercaru (2024); HighTech and Innovation Journal (2025)
Cognitive Impairments	NLP, Adaptive Interfaces	Text simplification, structured page layouts, reduced visual complexity	Chemnad (2024); Todorov (2024)
Motor Impairments	Adaptive Interfaces, Voice Control (TTS/STT)	Voice-based command systems, gesture recognition, keyboard-free navigation	Huang et al. (2024); Ara (2025)
Multiple Disabilities	Multimodal AI Systems	Integrated solutions combining visual, auditory, and cognitive adaptation (e.g., conversational assistants)	Vera-Amaro (2025); Evinced (2024)

Figure 4.1 shows how the different AI techniques are grouped and linked to specific disability categories. The taxonomy illustrates the way various AI methods, like natural language processing, computer vision, speech technologies, adaptive interfaces, and testing tools, help address accessibility needs across visual, auditory, cognitive, and motor domains.

Figure 4.1. Taxonomy of AI Techniques by Disability Domain



This taxonomy indicates that artificial intelligence has made most progress in improving accessibility for auditory and visual disabilities, whereas its use for motor and cognitive impairments is still relatively limited. Approaches that combine different AI methods, like natural language processing, computer vision, and speech technologies, seem to hold the most promise for the inclusive design, as they can present and adjust content through different sensory channels.

4.4 Benefits Identified in the Literature

Different studies which were actually reviewed in this research show different recurring benefits of using the AI in improving web accessibility.

4.4.1 Automation of Accessibility Tasks:

AI can actually reduce the cost and time which is involved in fixing and testing accessibility issues. Automated tools are capable of scanning large websites much faster than manual audits and can detect common problems with a high level of accuracy (Huang et al., 2024; Evinced, 2024).

4.4.2 Enhanced User Independence:

Applications such as Be My AI (2025) and Be My Eyes give different visually impaired users real time, AI generated descriptions, which help them navigate the online spaces with greater independence and confidence.

4.4.3 Improved Content Adaptation and Personalization:

Through NLP models and adaptive interfaces, artificial intelligence can simplify text, adjust layouts, and personalise the content according to individual needs of users (Todorov, 2024).

4.4.4 Scalability and Standardisation:

AI driven systems make it easier to apply accessibility improvements consistently across different platforms and websites, supporting the compliance with different established standards like WCAG 2.2 (WCAG, 2023; EAA, 2025).

4.4.5 Contribution to Inclusive Innovation:

By embedding accessibility into mainstream AI development, researchers and designers are promoting more inclusive innovation that aligns with global goals for digital equity (Vera-Amaro, 2025; Chemnad, 2024).

In general, literature shows a strong sense of optimism about the role of artificial intelligence in improving human efforts toward accessibility. It also suggests that artificial intelligence can actually help make inclusion a proactive and continuous process instead of something addressed only when problems arise.

4.5 Limitations Identified in the Literature

Although Artificial Intelligence (AI) shows great potential for improving digital accessibility, the reviewed studies also point out several ongoing challenges that limit its overall effectiveness.

4.5.1 Accuracy and Reliability Issues:

Automated tools can still make many mistakes when they try labelling images, while generating captions, or identifying web elements. As reported by The Financial Times (2024), inaccurate descriptions can actually cause confusion for users and also reduce user trust in these systems.

4.5.2 Ethical and Legal Concerns:

Different reports and researches, specially the ones from The Guardian (2024) and AccessiBe (2025), have highlighted different concerns related to privacy risks, algorithmic bias, and also different claims which are related to accessibility compliance. These issues highlight the need for clearer accountability and stronger oversight when deploying the AI technologies.

4.5.3 Limited Coverage of Disability Types:

Many of current studies focus on visual disabilities, where very less attention has been granted to motor, cognitive, or multiple disabilities (Chemnad, 2024; HighTech and Innovation Journal, 2025). Many important accessibility needs are insufficiently addressed due to this lack of balance.

4.5.4 Dependence on Data Quality and Diversity:

Artificial intelligence models usually depend on some specific datasets which lack cultural or linguistic diversity some times. When this happens, systems might unintentionally implement exclusionary patterns, specifically for the underrepresented or non-English speaking user groups (Yu et al., 2025).

4.5.5 Lack of Standardised Evaluation Metrics:

There is still no common framework for assessing the performance of AI-based accessibility tools. Many studies use incompatible or subjective kinds of measures, which actually make it difficult to compare the results between different systems (Vera-Amaro, 2025).

4.5.6 Overreliance on Automation:

As AccessiBe (2025) and The Financial Times (2024) note, full automation often overlooks the real user experience. Human evaluation remains vital for ensuring that accessibility improvements are both meaningful and ethical.

4.6 Summary of Findings

The overall synthesis of the reviewed studies shows that AI is becoming a key driver of digital accessibility, mainly through automation, personalisation, and multimodal interaction. However, significant challenges remain in terms of accuracy, inclusivity, and ethical responsibility. These findings indicate the importance of balancing technological efficiency with ethical governance and human judgement. Table 2 shows a summary of the main findings which were organised by the AI technique category.

Table 4.2. Summary of main findings

AI Technique	Primary Benefits	Key Limitations

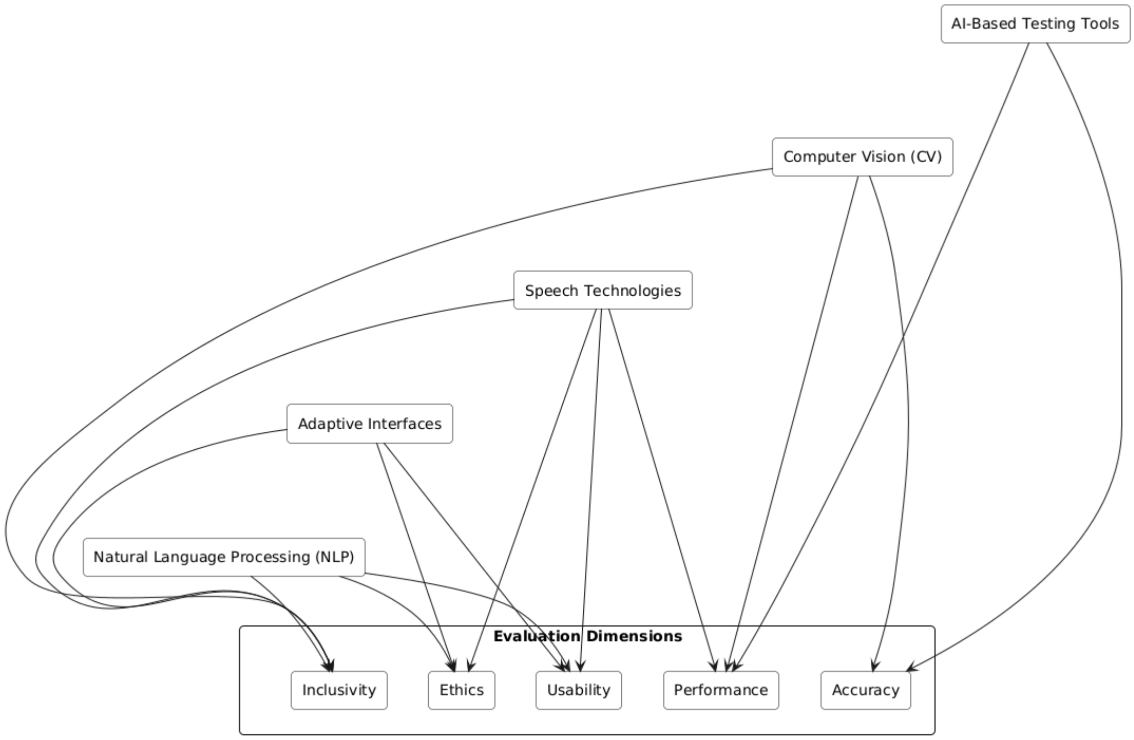
Computer Vision (CV)	Generates image descriptions; assists BLV users in content interpretation	Misidentification, contextual errors, and lack of nuance
Natural Language Processing (NLP)	Simplifies complex text; enhances readability; supports cognitive accessibility	Linguistic bias; inconsistent tone or terminology
Speech Technologies (STT/TTS)	Facilitates communication for auditory and visual impairments; enables real-time transcription	Noise sensitivity; accent bias; limited multilingual capability
Adaptive Interfaces	Personalizes design; adjusts layout and color contrast for user needs	Privacy concerns; requires extensive user profiling
AI-Based Testing Tools	Automates accessibility compliance; identifies violations efficiently	Overreliance on automation; incomplete remediation; compliance gaps

The findings show that Artificial Intelligence should be taken as a supportive tool that helps in enhancing, instead of replacing, human expertise in accessibility work. When utilised responsibly, AI can actually speed up progress toward innovation and compliance, but this is only effective when it follows strong ethical guidelines, and stays grounded in the human centred design.

Figure 4.2 shows main drawbacks and benefits identified in reviewed studies. It also shows a summary of the strengths of AI driven accessibility tools, like personalisation and automation, while also highlighting the challenges related to reliability, bias, and ethical responsibility.

Figure 4.2. Summary of Benefits and Limitations

The findings show a deep picture of how the different artificial intelligence techniques are being used for supporting different disability groups, showing both their challenges and benefits discussed in the reviewed literature. Next chapter builds on these results by analysing them from technical, ethical, and social perspectives.



5 Discussion

5.1 Overview

This chapter interprets and explores findings from systematic literature review, and links them to wider technical, ethical, and social aspects of using the AI in web accessibility. While Chapter 4 explained key classifications and patterns found in research, this chapter takes a broader view, inspecting how AI driven accessibility methods align with the standards like WCAG 2.2 and European Accessibility Act - EAA, 2025.

Discussion also explains research's practical relevance, theoretical value, and the areas where more research is required. Overall, it focuses that AI should not replace human expertise in accessibility, but instead serve as a tool which improves fair, inclusive, and effective digital experiences when used in a responsible manner.

5.2 Interpretation of Findings

The review revealed a growing body of work showing how AI has the potential to reshape web accessibility. Five main areas, Natural Language Processing - NLP, Computer Vision - CV, Speech Technologies, AI-Based Testing Tools, and Adaptive Interfaces, make up the foundation of current research and development in this field.

Even with these advances, the findings point to uneven progress across different disability domains. Most developments focus on auditory and visual impairments, while motor and cognitive accessibility remains less developed (Chemnad, 2024; HighTech and Innovation Journal, 2025).

Synthesis shows that AI's role in the accessibility can be understood from three main perspectives:

1. Automation of accessibility maintenance
2. Adaptation to individual user needs
3. Augmentation of assistive interactions

Each of these three perspectives is explained in detail below,

5.2.1 Automation of accessibility maintenance

Automation explains how the AI can fix and identify different accessibility issues on big scale. Different tools like ACCESS (Huang et al., 2024) and Evinced (2024) indicate that deep learning systems can actually detect the accessibility issues in real time, offering scalable ways to maintain compliance. This lines up with Robustness principle of WCAG, which makes sure that the web content can be adapted and interpreted by different assistive technologies. However, only automation cannot guarantee proper accessibility. The AccessiBe (2025) case actually explains this point very well that relying too much on the automated overlays without using proper human input in combination can cause superficial compliance which does not meet the real user requirements (Financial Times, 2024). Therefore, automation should be viewed as a way to support human work in accessibility, not as a replacement for it.

5.2.2 Adaptation to individual user needs

AI driven adaptive interfaces actually provide facility to personalise the user experiences by altering different elements such as layout, colour contrast, or text complexity in real time (Todorov, 2024). This strategy supports the Operable and Perceivable principles related to WCAG by helping in improving usability for different users with visual or cognitive impairments. This level of personalisation depends on collecting and analysing the user data, which raises the legitimate concerns about consent and privacy. To address these issues, ethical practice must include transparency in data use, limited profiling, and strict compliance with privacy-by-design guidelines, as outlined in the European Accessibility Act (2025).

5.2.3 Augmentation of assistive interactions

AI also enhances human ability by improving how users interact with digital information. Technologies like speech systems and Natural Language Processing enable people to access the content using different modes, text, voice, or audio (Bercaru, 2024). This multimodal access improves inclusivity by letting users engage with web content through the channel that best suits their needs. However, this benefit actually depends largely on the quality and diversity of data used for training these models. If training the data contain linguistic or cultural bias, the artificial intelligence outputs can become exclusionary or inaccurate, which is actually against the principle of the WCAG (WCAG, 2023).

To conclude, AI plays an important role most effectively in web accessibility specially when adaptation, automation, and augmentation work together in a user focused and balanced way. Relying too much on automation without proper ethical oversight or user testing risks undermining the inclusivity that accessibility efforts are meant to achieve.

5.3 Ethical Implications

Ethics have been a main issue in most of the research reviewed for this study. Although Artificial Intelligence (AI) has the power to make accessibility work faster and more efficiently, it also creates new challenges related to bias, responsibility, transparency, and privacy.

5.3.1 Bias and Fairness

Bias in AI systems remains one of the most difficult problems to solve. When computer Vision or Natural Language Processing models are trained on non-diverse or narrow datasets, they usually reproduce the same language or cultural biases already existing in the data (Yu et al., 2025). As a result, accessibility tools may end up providing only a small portion of users in an effective way. For instance, some image captioning systems have been shown to misread context or rely too heavily on Western data, which can exclude or misrepresent people from other regions. To improve fairness, developers need to use broader, more inclusive datasets and clearly document how their models are created and tested.

5.3.2 Accountability and Transparency

When the accessibility tools use automation, it actually becomes difficult to decide who is responsible when the mistakes happen. If an AI system generates the wrong alt-text or labels content incorrectly, is the fault with the programmer, the company that uses it, or the algorithm itself (AccessiBe, 2025)? Without the clear accountability, users have less protection. That is the reason why transparent development standards, like open audit trails and explainable models, are important to make sure that accountability is available throughout the deployment and design process work flows.

5.3.3 Privacy and Data Protection

Adaptive systems often rely on tracking user behaviour or collecting biometric data to adjust content automatically. While this kind of personalisation can make websites easier to use, it also risks exposing sensitive information. European Accessibility Act (2025) and also the other related privacy laws make it very clear that the accessibility improvements should even come at the cost of user privacy. That is the reason that ethical design should focus on collecting only the minimum possible data necessary and it should also ensure that users totally consent and understand how their data is being used.

5.3.4 Deceptive Design and Compliance Ethics

Another issue that appears frequently in the literature is the marketing of AI tools as "instant accessibility" solutions. Some companies, such as AccessiBe (2025), advertise one-click overlays that claim full compliance, yet investigations and reports (Financial Times, 2024; The Guardian, 2024) show that these tools often fail to meet real accessibility standards. False advertising of this kind can mislead organisations and can also damage public trust trying to follow accessibility laws. Clearer guidelines and independent validation systems are needed to prevent such misuse and ensure that AI is used responsibly in accessibility work.

5.4 Technical Implications

On a technical level, findings show both limitations and progress in applying AI to accessibility.

5.4.1 Algorithmic Performance

AI tools utilized for improving accessibility, like natural language processing systems and computer vision, have improved a lot in recent years. But still, they sometimes struggle with understanding context and accuracy. A system can probably misread what's exactly happening in an image or can also get the meaning of a sentence a little wrong, which can then easily confuse the users. This becomes a real problem in areas where safety or money is on the line. To make these tools more dependable, developers need to keep retraining their models, involve real users in testing, and build in feedback loops that include human oversight.

5.4.2 Interoperability and Standardization

One of the ongoing challenges is that a lot of these AI-based accessibility tools don't fully connect with existing assistive tech like screen readers or Braille devices. Because there aren't widely accepted APIs or data formats, systems from different platforms don't always play nicely together. Following established guidelines like WCAG 2.2 and using open standards could make a big difference, helping create a smoother, more unified accessibility ecosystem.

5.4.3 Evaluation Metrics

Another issue that keeps coming up in research is how to measure the success of AI-driven accessibility tools. There is not just one standard metric which works across the board. In contrast with typical usability measures, accessibility actually depends a lot on each person's specific requirements and the assistive technologies they rely on (Vera-Amaro, 2025). Studies in future should focus on developing the shared benchmarks, maybe some mix of user satisfaction and technical accuracy, so the results can be compared in a more justified manner and progress can also be tracked in a meaningful way.

5.5 Societal Implications

It is already evident how the social impact of accessibility and artificial intelligence reaches far beyond technology itself. When this kind of tech is developed with care, it doesn’t only make life easier, it actually helps in breaking down the barriers and also opens the doors to work, education, and everyday use for different users with disabilities. Different tools like Evinced or Be My AI are valid good examples. They show how people can use AI to navigate digital spaces on their own terms, turning accessibility from a box-ticking requirement into something that’s part of thoughtful, inclusive design from the start.

But still, not everyone has the same access to these benefits. Some of the most advanced systems sit behind paywalls or are bundled into pricey premium plans, which shuts out individuals or smaller organizations that can’t afford them. That’s basically another form of inequality, an “accessibility gap” that mirrors the broader digital divide we already know too well. Some policies similar to EAA (2025) should handle this head-on, to make sure that revolution around accessibility stays fair and open for everyone, not only for companies or people with deeper pockets.

Another society based consideration is the public trust. Wide adoption of artificial intelligence in accessibility also depends on the user's confidence in automated systems. When tools produce deceptive or inconsistent outcomes, as reported by FT (2024), users may not trust accessibility technology as a whole. Thus, fostering reliability, transparency, and user education is important to sustaining long-term engagement and trust.

5.6 Theoretical Contributions

Findings of this research make different theoretical contributions to field of human computer interaction (HCI) and accessibility,

5.6.1 Conceptual Framework for AI and Accessibility Integration:

Framework developed in Chapter 4 shows a clear way of classifying how various artificial intelligence methods connect to different disability types and few related accessibility results. This approach can help the future researchers to compare results in a more effective way and build stronger theoretical models for AI driven accessibility.

5.6.2 Extension of Human-Centered AI Theory:

This study helps strengthen ideas behind Human Centered AI (HCAI) by indicating that the accessibility innovation relies on transparent, ethical, and collaborative design. Instead of treating accessibility like an afterthought, it actually places it within wider conversation about what accountable artificial intelligence should seem to be in use.

5.6.3 Bridging the Gap Between Technical and Ethical Perspectives:

By bringing together the technical results with broader ethical and social perspectives, this research paints a more complete picture of how AI fits into accessibility. It actually goes beyond normal focus on legal compliance or algorithms and instead considers real world context in which these kinds of systems are used and designed.

5.6.4 Foundation for Future Evaluation Metrics:

The study also points out that measuring accessibility in AI systems can’t rely on automation alone. A balanced approach is needed, one that mixes automated compliance testing with feedback from actual users. Different factors like trust, usability, and UX should be part of the picture. This kind of blended framework could serve as a solid foundation for how future researchers and practitioners assess progress in the field.

5.7 Practical Contributions

From a more practical perspective, this study provides different insights for policymakers, developers, and researchers:

5.7.1 For Developers:

The analysis and taxonomy can help selection of artificial technology techniques suitable to the specific accessibility goals. Developers should also combine manual and automated evaluation ways to ensure compliance and accuracy.

5.7.2 For Policymakers and Regulators:

The findings help enforcement of ethical and transparent AI standards within digital accessibility legislation such as the EAA (2025). Policymakers can use this verification to update the compliance frameworks for including the AI specific guidelines.

5.7.3 For Accessibility Advocates and Educators:

There’s also a clear takeaway for people working in advocacy and education. The study can be used as teaching material, something that explains what AI can genuinely do for accessibility and where its limits still are. It could shape training sessions that help organizations introduce AI responsibly, without losing sight of trust or human experience.

5.7.4 For Researchers:

Finally, for researchers, the framework points to areas that still need more exploration: things like multimodal accessibility, reducing bias, and making sure human judgment stays part of automated accessibility systems. These are not just small details, they are actually details which will decide how well AI actually serves people in the long run.

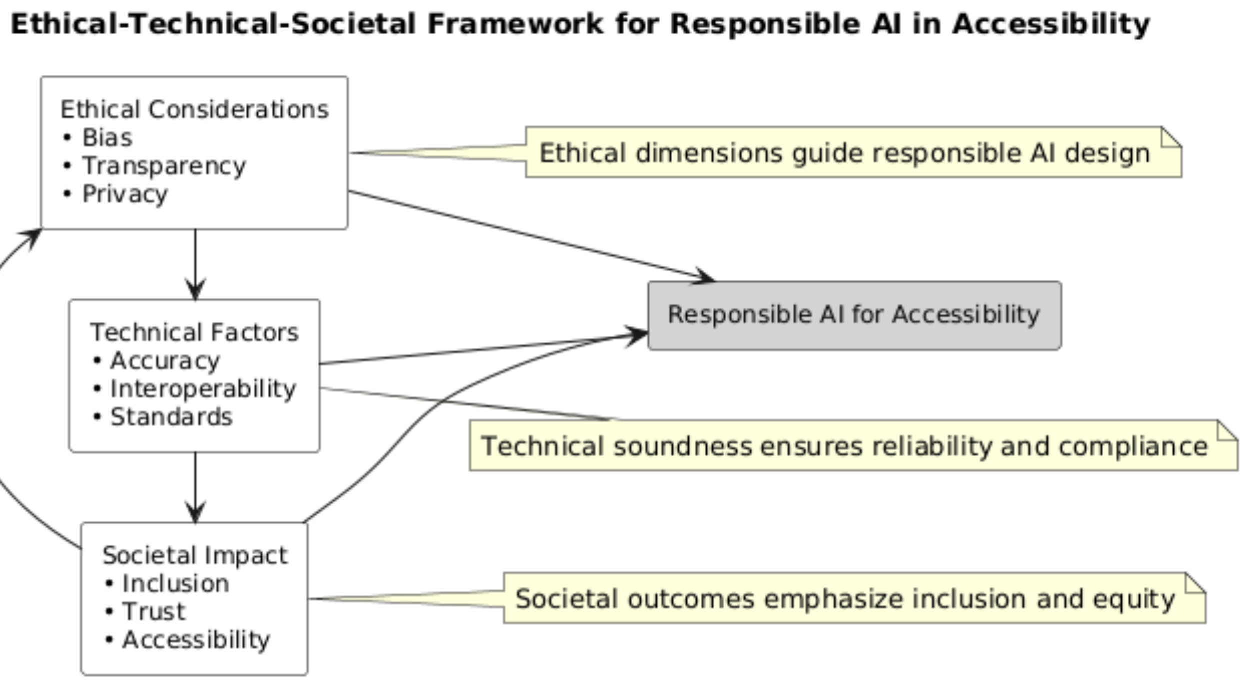
5.8 Summary of Discussion

To sum up, AI is already changing the field of accessibility in noticeable ways. It helps support personalization, automate detection, and allows for richer and multimodal interaction. At same time, these advances also bring new technical, ethical, and social challenges that can not be ignored. Addressing them also requires a thoughtful regulation, strong human centered kind of approach, and also close collaboration across various disciplines. In the end, the actual measure of success for artificial intelligence in accessibility is actually not just how advanced technology is, but how better it reflects the human values specifically inclusivity, fairness, and respect for the individual needs.

The next chapter brings this thesis to an end. It revisits key insights and explains main contributions to both practice and research, and points to the areas where the future work can be built on these findings.

Figure 5.1 shows how the ethical, technical, and societal aspects of this study connect with one another. Overlapping areas in the diagram highlight an essential idea for artificial intelligence to be genuinely more responsible in accessibility; it would need to balance technical reliability, fairness, and social inclusion.

Figure 5.1. Ethical–Technical–Societal Framework



This chapter has discussed what the results mean in relation to existing theories and emphasized their ethical, technical, and social importance. The concluding chapter that follows summarizes the central insights once more, outlines the broader details of current research, and suggests a practical roadmap for research in future.

6 Conclusion and Future Work

6.1 Summary of Insights

Main goal of this research was actually to take a structured look at how AI can help in improving website accessibility for the users with disabilities. Using PRISMA based conceptual analytic approach and Systematic Literature Review (SLR) highlighted by Järvinen (2004), 43 peer reviewed studies which were published between 2018 and 2025 were also analyzed and reviewed. The purpose was to identify the types of AI techniques being used, how they are applied across different disability areas, and what benefits or limitations come with them.

The results show that AI is starting to play a much larger role in how accessibility is handled, especially in automating certain processes, personalizing user experiences, and expanding what's possible through technology. From the review, five main groups of AI methods emerged: Computer Vision (CV), Natural Language Processing (NLP), Speech Technologies, Adaptive and Assistive Interfaces, and AI-Based Accessibility Testing Tools. Each of these contributes in its own way to reducing accessibility barriers, with the most progress seen so far in applications for visual and auditory disabilities. The taxonomy developed through this study organizes these techniques by disability type and shows how AI connects to the core accessibility principles of Perceivability, Operability, Understandability, and Robustness outlined in WCAG (2023).

Even after all this progress, various current issues still remain around inclusivity, accuracy, ethical responsibility, and tendency of relying so heavily on automation. Some commercial solutions, like AccessiBe (2025), illustrate this risk by promoting surface-level compliance rather than genuine accessibility and inclusion (FT, 2024; The Guardian, 2024). Review also indicated that most of the existing studies focus more heavily on auditory and visual impairments, while motor and cognitive disabilities receive relatively less focus. Moreover, bias mitigation and user centered evaluation are usually underexplored.

Overall, this research concludes that while artificial intelligence has much potential to transform web accessibility, its success also depends on keeping the humans at decision making and center of design. Artificial intelligence should be used as a supportive tool, the tool that helps instead of replacing human expertise, judgment, and empathy in creating the accessible digital spaces.

6.2 Practical Contributions

This research shows various practical contributions related to policymakers, developers, educators, and accessibility professionals.

6.2.1 For Developers and Designers

The findings and taxonomy developed in this study offers practical guidance on how the different AI methods can be combined and selected to meet the specific accessibility goals. These classifications can help the developers make more informed design decisions, making sure that each approach aligns with particular disability domains and WCAG principles. When artificial intelligence is used along with manual auditing, it can also enhance the accuracy while keeping human expertise at the center of the process. Automation should actually support, not replace, human judgment.

6.2.2 For Policymakers and Regulators

This study offers some practical guidance for shaping future policy around the use of AI in accessibility compliance. The European Accessibility Act (2025) already sets out the basic legal framework for digital accessibility, but it doesn't really cover everything that comes with AI. Issues like how algorithms make decisions, what happens with the data they use, or how transparent these systems should be still need more attention. The evidence gathered here could help policymakers think through these gaps as regulations continue to evolve.

6.2.3 For Organizations and Accessibility Advocates

Research also shows how important ethics and honesty are when it comes to using artificial intelligence for accessibility. Companies that depend on AI driven tools should not show they're flawless. It's better to be clear about what technology can do and where it may fall short. Getting different people with disabilities engaged early in design and testing the process makes a real difference, it keeps things accountable, builds trust, and makes sure end results are properly helpful, not only technically compliant.

6.2.4 For Educators and Researchers

Lastly, this work can serve as a foundation for teaching and further study. By outlining what's already been tried and where the gaps still are, it opens the door for interdisciplinary courses, research projects, and training programs focused on designing AI that supports accessibility in meaningful, human-centered ways.

6.3 Academic Contributions

This study makes various contributions to the academic knowledge in domains of accessibility studies, human computer interaction (HCI), and responsible AI research:

6.3.1 Comprehensive Synthesis:

This study provides one of the most comprehensive and latest reviews of AI based accessibility research, covering the work which was published between 2018 and 2025. It brings together a wide range of scattered findings and organizes them into a single, coherent framework that helps clarify how AI is being used to support accessibility.

6.3.2 Taxonomy Development:

The taxonomy outlined in Chapter 4 provides a structured way to connect specific AI methods with different categories of disability. In doing so, it deepens the theoretical understanding of how these technologies relate to accessibility goals and lays the groundwork for future comparative studies.

6.3.3 Interdisciplinary Integration:

By linking the technical advances with the legal perspectives. and broader ethical, including standards like European Accessibility Act (2025) and WCAG 2.2, research connects worlds of policy, computer science, and social inclusion. This cross disciplinary focus contributes in helping to translate the innovation into real world accessibility.

6.3.4 Framework for Evaluation:

Findings also focus on the importance of developing the mixed evaluation models which balance the data driven performance based measures with the insights from the actual user experiences. Combining qualitative and quantitative approaches can give a more realistic idea of the accessibility performance and also serve as foundation for the future standardized tools.

6.3.5 Ethical Perspective in AI Accessibility:

Finally, the study adds an ethical dimension to the discussion of AI in accessibility. It frames the technological progress within the idea of responsible innovation, the one that actually values fairness, openness, and continued human involvement as important to the sustainable, trustworthy design.

6.4 Limitations of the Study

Even though this thesis followed a well-structured and careful methodological approach, it's still of value to understand a few limitations.

First, this study actually depends majorly on the secondary data which was drawn from different existing publications, so depth and accuracy of conclusions depend on completeness and quality of those original sources. Second, because the reviewed studies used a wide range of research methods and evaluation criteria, it wasn't feasible to perform a consistent quantitative meta-analysis. Third, AI technology changes so quickly that some findings may soon feel out of date as newer systems, tools, and standards appear. Finally, this research focused mainly on web-based accessibility, leaving out other relevant areas such as mobile platforms, virtual reality, and physical assistive technologies.

Having said that, these types of limitations are very common in conceptual and literature based research. They do not take away from the value of different findings but instead help frame them in the context. Understanding these boundaries actually makes it easier to interpret results honestly and leads towards meaningful directions for research in future.

6.5 Future Research Directions

Building on different gaps determined during this thesis, various promising topics for the future research can be proposed:

6.5.1 Empirical Validation of AI Accessibility Tools

Future research should include hands-on usability studies and user testing that involve people with a wide range of disabilities. This would make it possible to see how AI-based accessibility systems actually perform in real-world settings, rather than just in theory. Alongside qualitative feedback, quantitative measures, such as effectiveness, efficiency, and user satisfaction, could help strengthen and refine the conceptual framework developed in this study.

6.5.2 Multimodal and Inclusive Design Approaches

There seems to be an increasing need for looking at multimodal artificial intelligence systems which combine linguistic, visual, and auditory processing. These systems have good potential to serve users in a better way with overlapping or multiple disabilities (Vera-Amaro, 2025). By enabling cross modal adaptation, the digital interfaces can also become more inclusive and flexible for a wide range of users.

6.5.3 Development of Standardized Evaluation Metrics

Another area for future work is the creation of consistent and standardized evaluation measures. These should also bring together the functional accessibility testing, technical compliance checks, and the user experience data. A similar shared framework would make it much easier to benchmark the progress across different studies and to also tell difference between surface-level automation and real accessibility improvements

6.5.4 Ethical and Regulatory Research

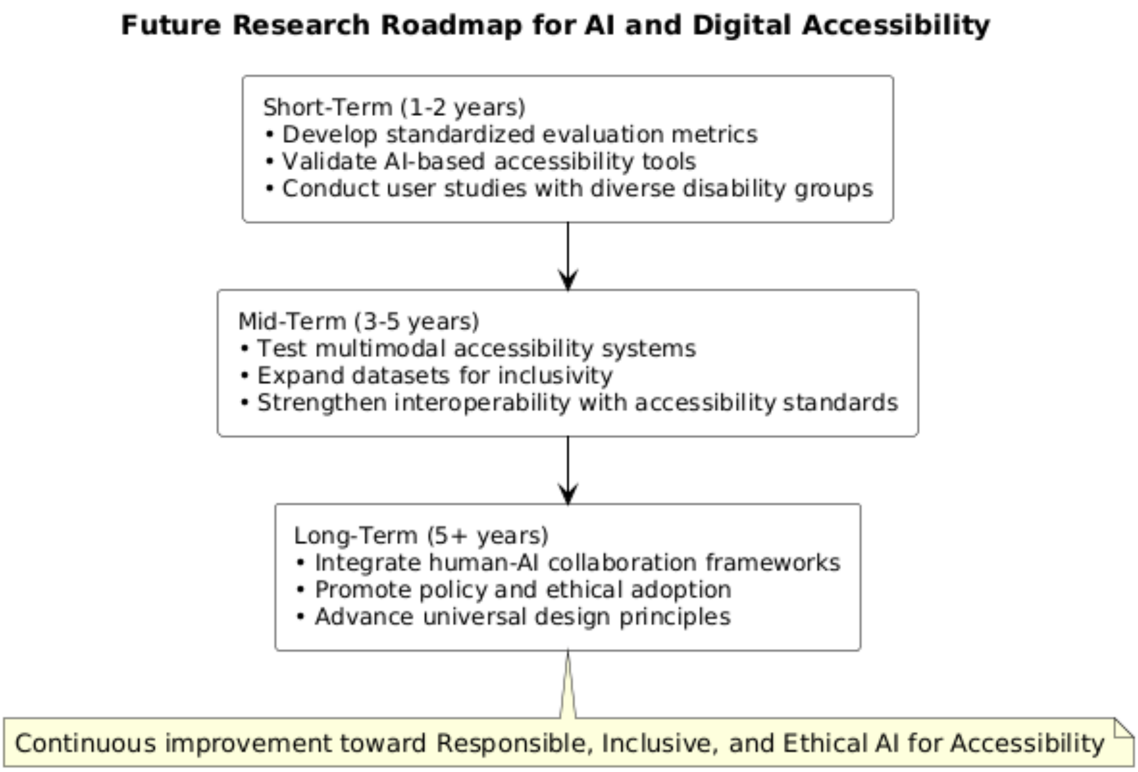
Further interdisciplinary research is required to make sure that innovation related to accessibility aligns with the broader legal and ethical principles, especially around accountability, fairness, and data protection. The comparative studies around different countries could also shed light on how the different frameworks like European Accessibility Act (2025) influence the ethical practices in accessibility design and artificial intelligence adoption.

6.5.5 Integration of Human Oversight

Finally, it is also essential to keep exploring how human expertise can also work alongside artificial intelligence. Future studies could focus on "human-in-the-loop" systems, where accessibility professionals collaborate with intelligent tools to review, validate, and improve automated outputs. This hybrid model can make sure automation strengthens, rather than replaces, expert judgment and empathy.

Proposed directions for the future research are explained in Figure 6.1, which outlines short-, medium-, and long-term priorities. Together, they offer a clear roadmap for advancing AI accessibility through approaches that are measurable, ethical, and genuinely inclusive.

Figure 6.1. Future Research Roadmap



6.6 Final Reflections

This research explains that AI has very good potential for improving web accessibility, but its actual impact relies on how it is utilised. Automation and technology should always serve the people first, promoting openness, fairness, and inclusion, not just convenience or speed. As the online world keeps growing, accessibility should move beyond being a simple compliance task and become an ongoing, thoughtful, and ethical design process that AI helps to support.

This thesis brings together existing research, points out the gaps that still need attention, and sets the stage for using AI in accessibility in a thoughtful and responsible way. It highlights that innovation and inclusion are not the opposing ideas, they are both important for building a digital world that properly works for everyone.

Finally, this study actually helps expand our understanding of how artificial intelligence can improve digital accessibility while staying grounded in ethical and social responsibility. Proposed recommendations and roadmap are to guide the policymakers, researchers, and designers to a more people-focused, inclusive future for accessibility and artificial intelligence.

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