LEAD-ME

cost
EUROPEAN COOPERATION
IN SCIENCE & TECHNOLOGY

Funded by the Horizon 2020 Framework Programme
of the European Union

# How AI and ML have advanced Digital Accessibility

LEAD-ME Accessibility Workshop @ NEM Summit

Author: **Carlos Duarte**
LASIGE, University of Lisbon, Faculty of Sciences



June 6, 2023

LEAD-ME

cost
EUROPEAN COOPERATION
IN SCIENCE & TECHNOLOGY

Funded by the Horizon 2020 Framework Programme
of the European Union

# Introduction

# Introduction

Digital accessibility is crucial for ensuring equal access to information and services for people with disabilities.

AI has the potential to improve digital accessibility and make it more efficient.

# Systematic review

**Purpose**

To investigate the use of artificial intelligence in digital accessibility studies

**Scope**

A systematic review of the literature published in the last 5 years

**Outcome**

A total of 71 papers were considered for the review

LEAD-ME

cost
EUROPEAN COOPERATION
IN SCIENCE & TECHNOLOGY

Funded by the Horizon 2020 Framework Programme
of the European Union

# Methods and Analysis

# Paper selection

## Eligibility criteria

Papers related to digital accessibility and AI published in the last 5 years

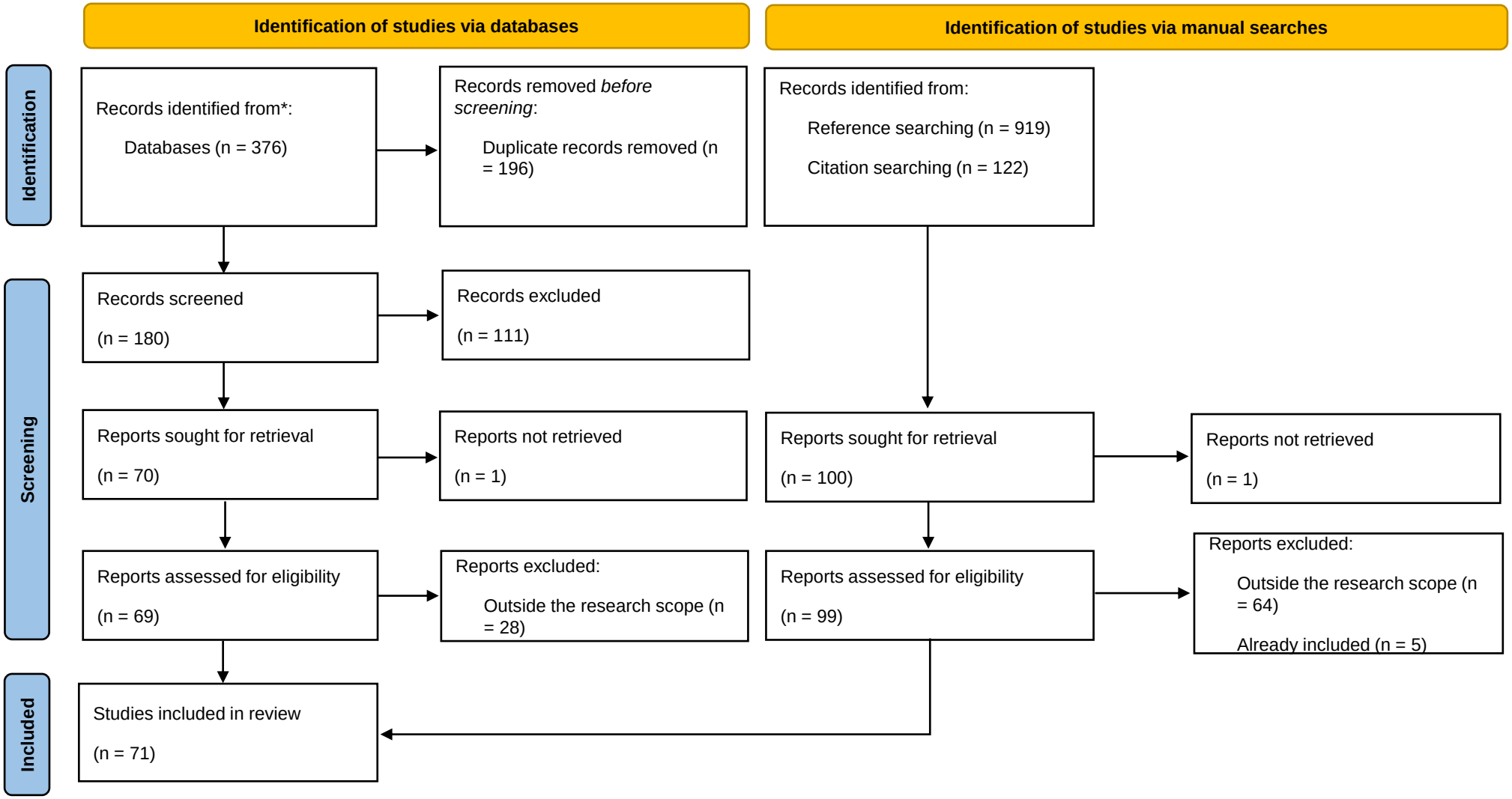
## Information sources

5 scientific research databases and papers cited multiple times by the retrieved papers

## Selection process

Preliminary screening and final screening

# Paper selection



# Data processing

## Data extraction

Relevant data from each paper was extracted, including study characteristics, demographic information, and themes

## Data analysis

Quantitative and qualitative data analysis was conducted on the extracted data to identify key themes and trends

LEAD-ME

cost
EUROPEAN COOPERATION
IN SCIENCE & TECHNOLOGY

Funded by the Horizon 2020 Framework Programme
of the European Union

# Findings

# Studies characteristics

- Total number of papers reviewed: 71
- User groups studied: **People with visual impairments**, hearing impairments, cognitive impairments, and physical impairments
- AI techniques used in the studies: Machine learning, natural language processing (NLP), computer vision, and deep learning
- Most often digital accessibility subdomains studied: Web accessibility evaluation and media accessibility (including audio and video)

# Machine learning for web accessibility evaluation

- AI-based automated evaluation methods have been developed to **quickly** identify web accessibility issues and **reduce reliance on manual** assessments.
- **Improved metrics** have been introduced to better align accessibility evaluation with the user experience of individuals with disabilities.
- Advances in AI and machine learning have enabled the analysis of **dynamic web content** and improved compliance with accessibility standards.
- Existing approaches in web accessibility evaluation have limitations in covering all accessibility requirements, leaving **certain issues overlooked**.
- The reliance on representative samples of web pages may introduce **biases** and overlook important pages in the evaluation process.
- Evaluating websites with **complex structures and dynamic content** remains a challenge, requiring innovative approaches to accurately assess accessibility in such scenarios.

# NLP for media accessibility

- The works have led to **improved machine-generated descriptions** for various types of media by utilizing contextual information and NLP techniques.
- Challenges such as ambiguous descriptions and validation of accuracy have been identified, and **further investigation is needed** in areas like personalized preferences and evaluation procedures.
- The integration of AI-based systems for digital accessibility, while not specifically built for it, shows potential for enhancing accessibility through **automatic translations and captions**.
- Machine-generated descriptions face **limitations in quality and accuracy**, particularly in image captioning.
- **Evaluating the accuracy** of these descriptions is challenging, with scalability issues for human studies and limitations in automatic metrics.
- Addressing **social biases** and improving algorithm performance are crucial limitations to be tackled in the field.

# Computer vision for media accessibility

- Researchers have proposed techniques to address the **lack of alternative text** for web images, improving accessibility.
- Efforts have been made to **enhance machine-generated descriptions**, particularly in the context of social media and memes.
- **Contextual information** is recognized as vital for improving image descriptions, especially in e-commerce platforms.
- Machine-generated descriptions face **limitations in quality** and handling ambiguous content.
- **Personal photos** present challenges in generating accurate alternative text due to their uniqueness.
- Providing **timely image captions** and balancing speed and quality in crowdsourcing alt text are technical limitations in media accessibility.

LEAD-ME

cost
EUROPEAN COOPERATION
IN SCIENCE & TECHNOLOGY

Funded by the Horizon 2020 Framework Programme
of the European Union

# Discussion

# Leveraging Digital Accessibility

- AI has the potential to enhance digital accessibility by refining methods, using real data, and optimizing training models.
- Contextual considerations are crucial for improving AI-powered accessibility, especially in areas such as image descriptions.
- AI-based systems can provide multi-modal representations, explore content relations, and offer customizable preferences to enhance accessibility.
- AI techniques can also contribute to improved identification and categorization of web components and facilitate multilingual accessibility through machine translation.

# Hindering Digital Accessibility

- Lack of accuracy and reliability in AI-based services designed for accessibility, particularly in interpreting nuanced details such as emotions and personal traits.
- Ethical concerns related to potential social biases, privacy implications, and legal responsibility when accessing and generating data using AI systems.
- The challenge of defining the boundaries of algorithms and training them with personal data, balancing the need for improved accuracy with privacy considerations and ethical development practices.

LEAD-ME

cost
EUROPEAN COOPERATION
IN SCIENCE & TECHNOLOGY

Funded by the Horizon 2020 Framework Programme
of the European Union

# Conclusion

# Conclusion

- AI has the potential to significantly improve digital accessibility for people with disabilities
- But there are challenges related to ensuring that these technologies are accurate, reliable, inclusive, and ethical
- There is still the need for ongoing research and development in this area, as well as collaborative efforts between researchers, developers, policymakers, and disability advocates

https://lead-me-cost.eu/action/deliverables/

LEAD-ME

cost
EUROPEAN COOPERATION
IN SCIENCE & TECHNOLOGY

Funded by the Horizon 2020 Framework Programme
of the European Union

# Thanks for your attention!

Carlos Duarte - caduarte@campus.ulisboa.pt