Applying Accessibility Metrics to Measure the Threat Landscape for Users with Disabilities

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An Accessible Internet

Step 1

Pick a Web Browser

Step 2

Browse the Internet

Step 1

Pick a Web Browser

Step 2...n

Find and Setup
Accessiblity Tools

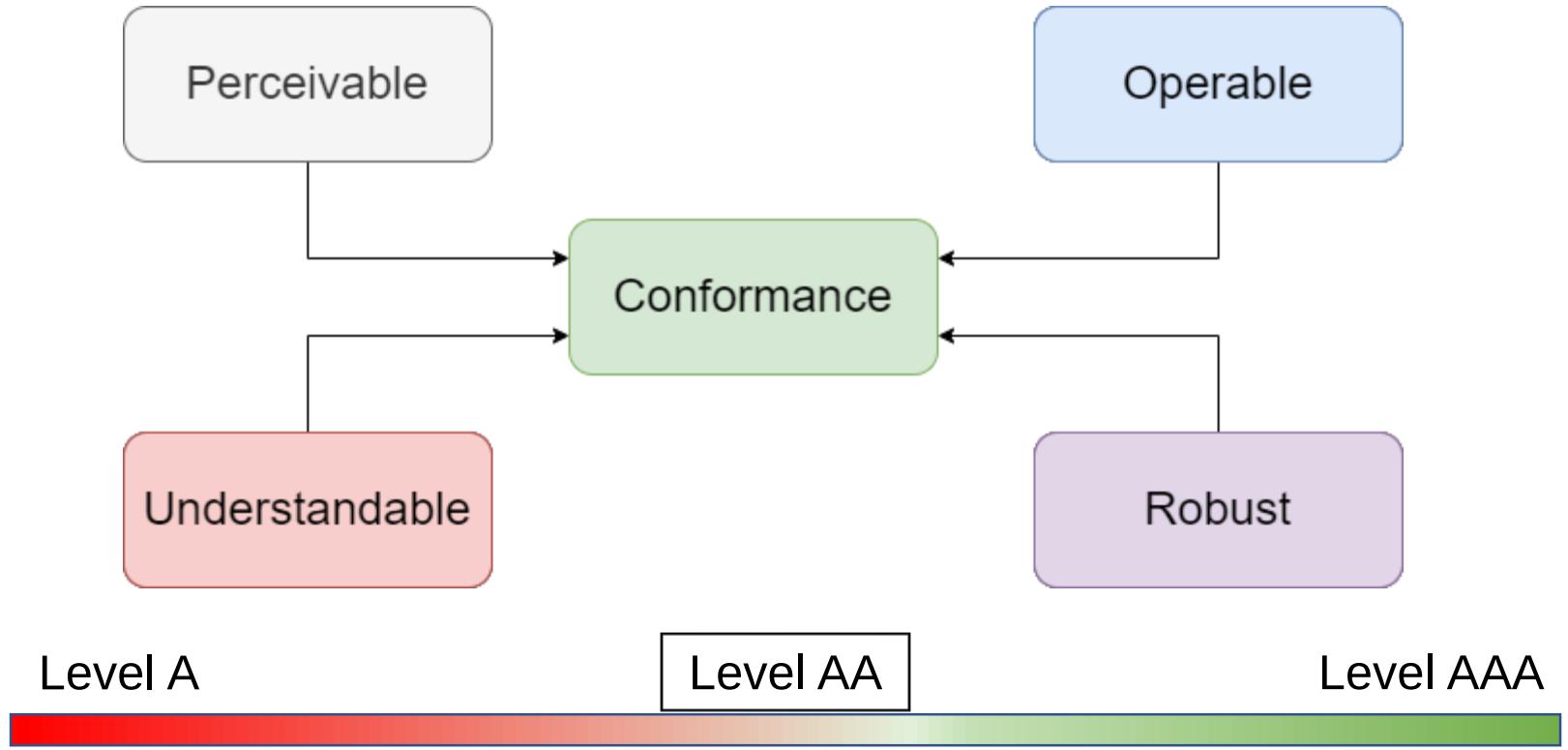
Step n+1

Hope the Website
Adheres to WCAG 2.X

Higher risk of attacks and privacy violations?

WCAG 2.X

Created and maintained by W3C, the latest version is WCAG 2.1*



*WCAG 2.2 is currently under draft

Research Questions

Using basic accessibility metrics, can we suggest a threat landscape for users with disabilities?

Can basic accessibility metrics be used to determine a webpage's accessibility conformance rather than using the full WCAG 2.1 standards?

Contributions

Constructed three basic accessibility metrics related to the ability of a website to minimize threats against users that require accessibility tools to access the web

Developed **WATER**—a framework to assess website conformance to our three basic metrics alongside the accessibility percentage of websites across the Internet

Demonstrated that basic accessibility metrics are not enough to determine the accessibility conformance of a website and the threat landscape for users that require accessibility tools is as large as >80% of the 30,000 domains analyzed

Important Notes

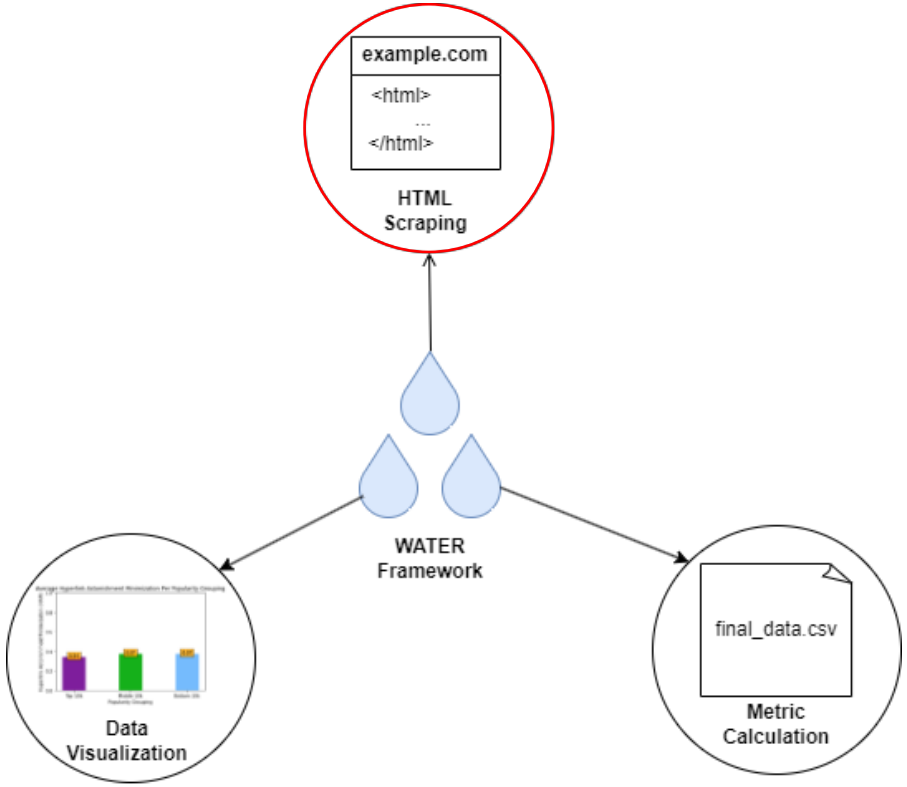
- We focus only on the threat landscape for users that make use of screen readers and alternative means of webpage navigation to limit scope

- Our study was conducted on November 19th, 2022 using the Alexa top 1M sites list from that day

- We targeted breadth over depth, targeting only 30,000 domains divided between three popularity groups (top, middle, bottom) and we only analyzed landing pages

WATER Framework

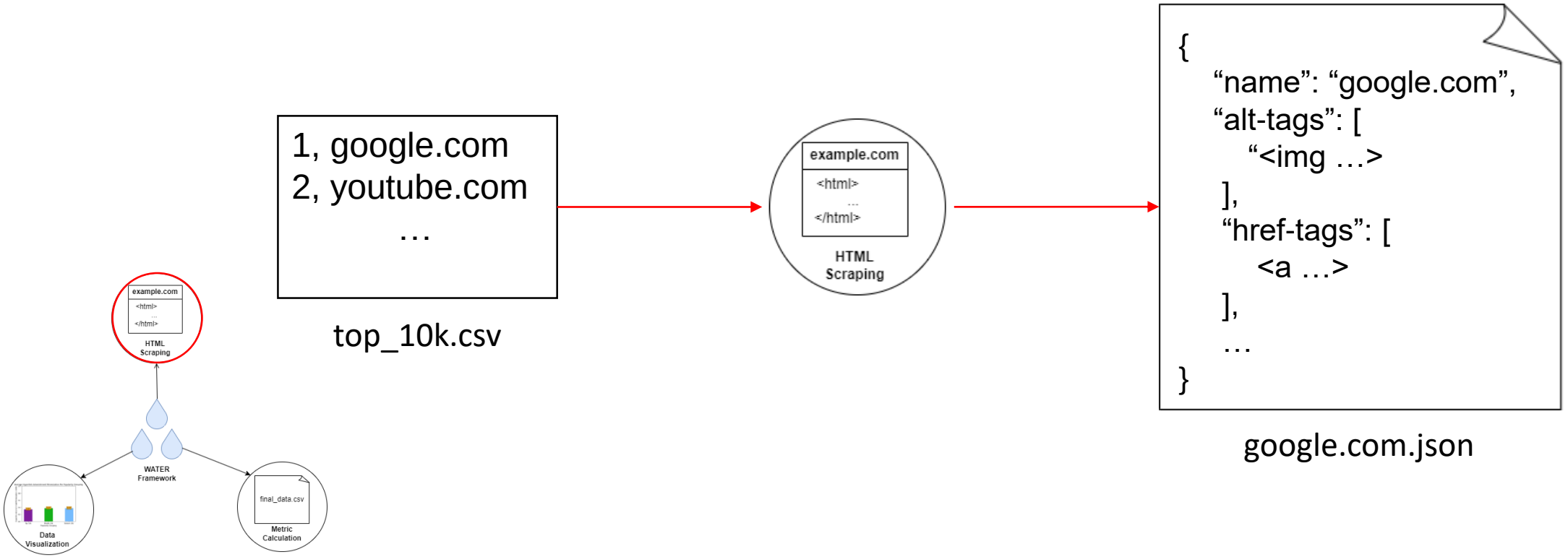
Web **A**ccessibility **T**hreat **E**stimation **R**esearch



HTML Scraping

WATER takes a URL, scrapes HTML, and trims it

Uses headless selenium instances and supports concurrency



Metric Calculation

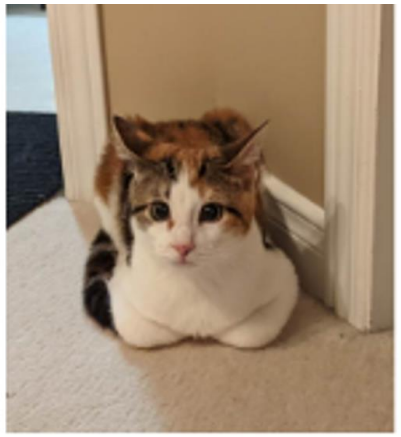
WATER uses the JSON files to calculate **three metrics:**

ITAA – Image Tag Alt Adherence

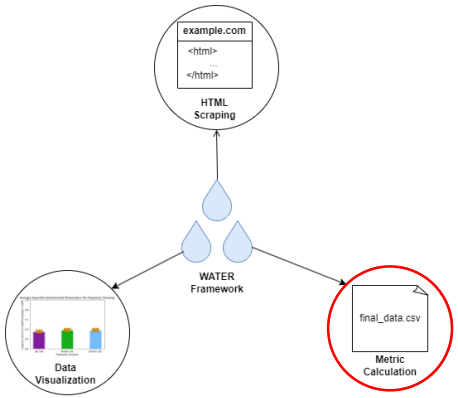
HAM – Hyperlink Astonishment Minimization

LIM – Label-Input Mapping

Image Tag Alt Adherence



With approrpiate alt attribute: "A cat lying down on carpet with its front paws tucked in"

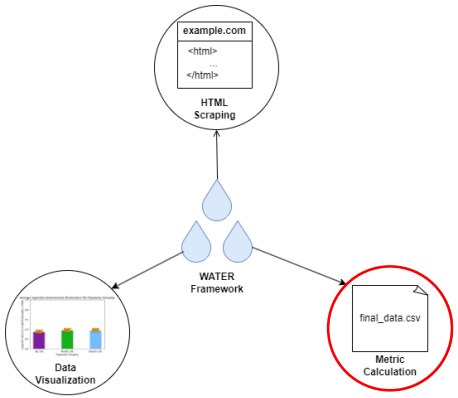


Leads to general privacy risks for users

Hyperlink Astonishment Minimization

Click here to login!

```
<a href="virus.com" rel="nofollow">Click here to login!</a>
```



Violates security design principles and could be used maliciously in phishing attacks

Label-Input Mapping

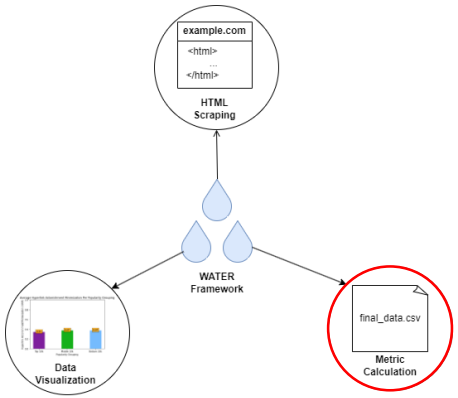
Fill in your name:

```
<label for="name">Fill in your name:</label>
<input id="name" name="name" type="text" />
```

Fill in your name:

Fill in your name: <input type="text" id="name" name="name" />

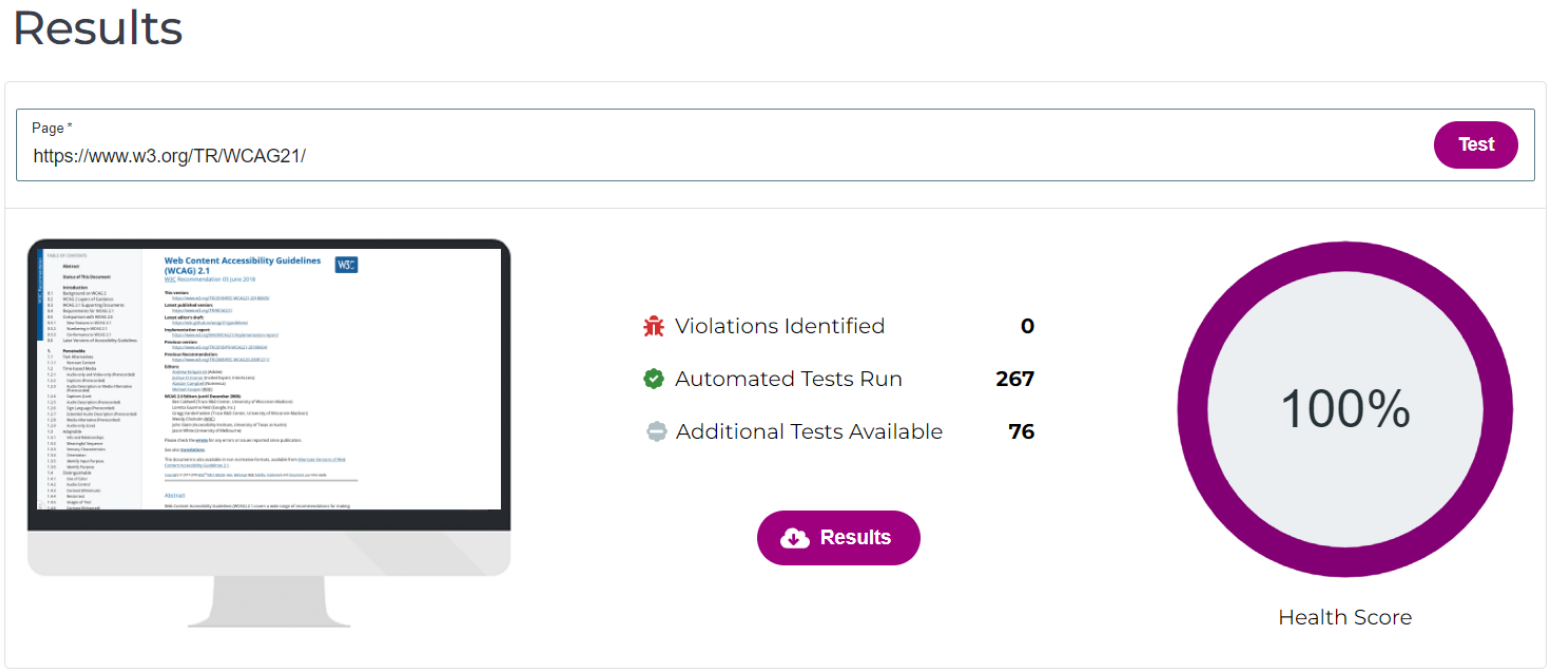
Screenreaders may fail in this instance

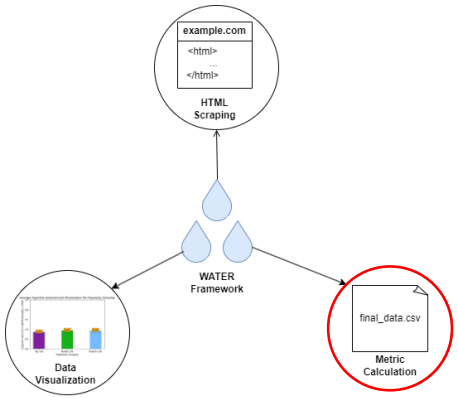


Can lead to information leakage

Accessibility Percentage

We query https://www.webaccessibility.com/, a tool provided by **LevelAccess** to determine the AP of a website

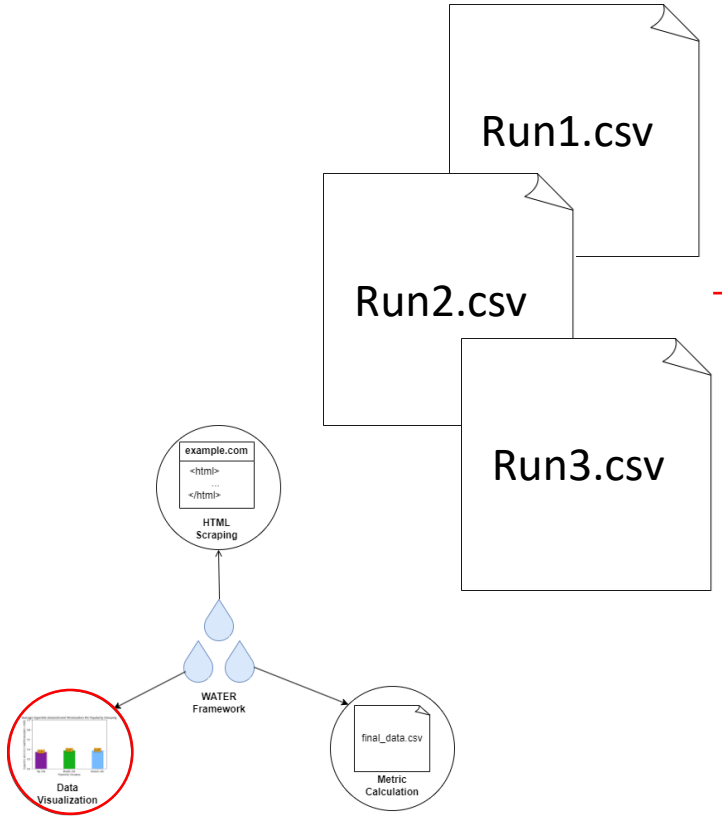


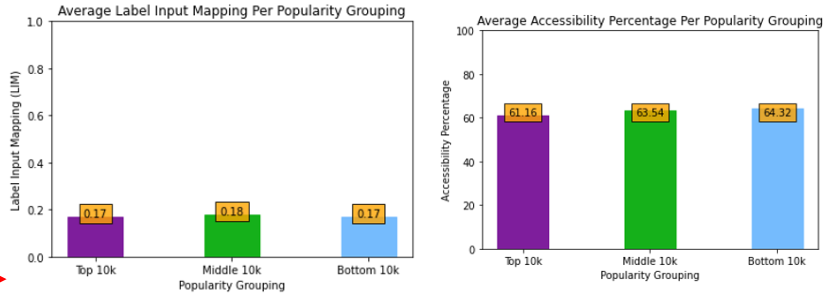


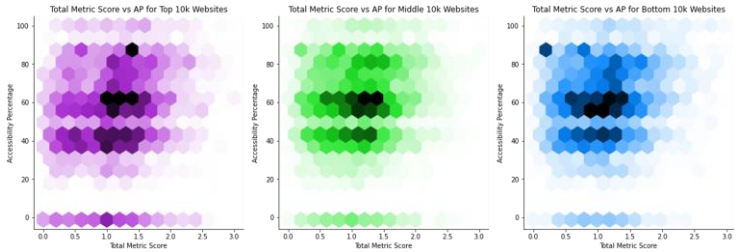
100% AP implies Level AA WCAG 2.1 conformance

Data Visualization

WATER can use the computed data from multiple runs to make graphs for comparative analysis:





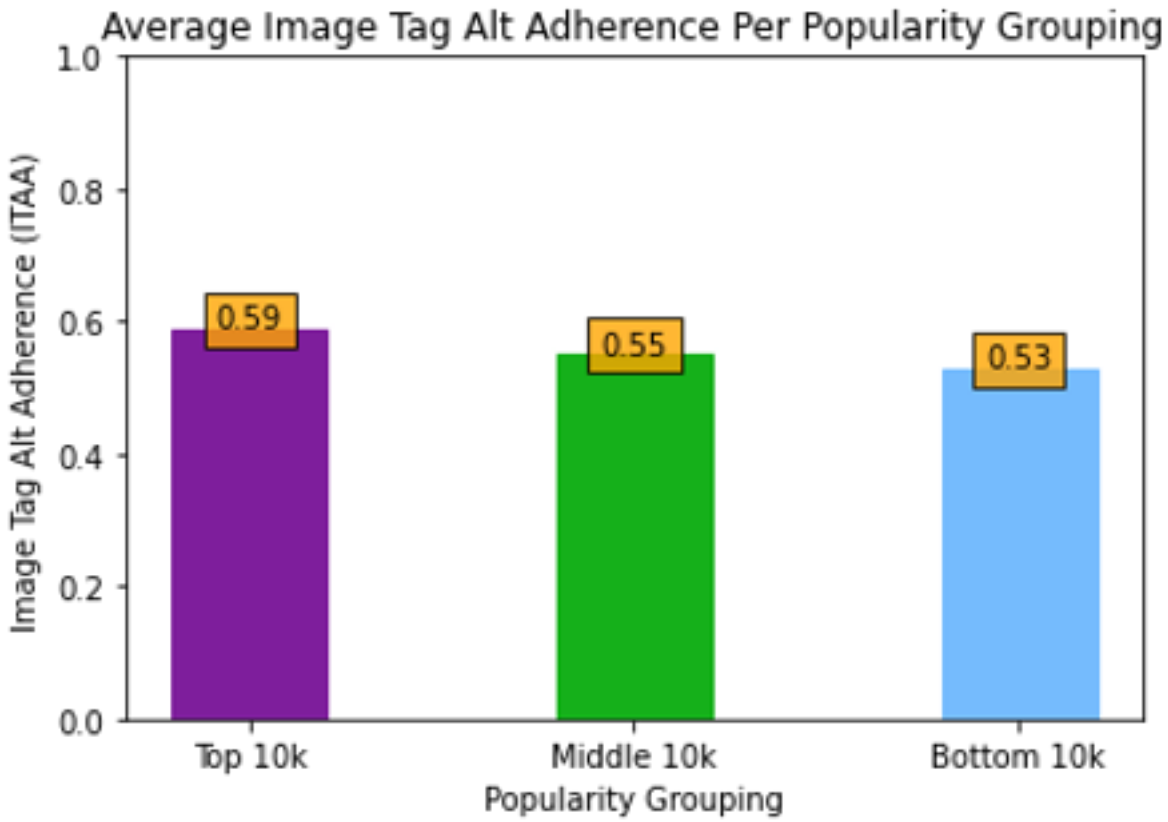


Results

- **WATER**'s HTML Scraping module successfully scraped:
  - 8,915/10,000 of the top 10k websites
  - 9,283/10,000 of the middle 10k websites
  - 7,325/10,000 of the bottom 10k websites
  - For a total of **25,523** websites

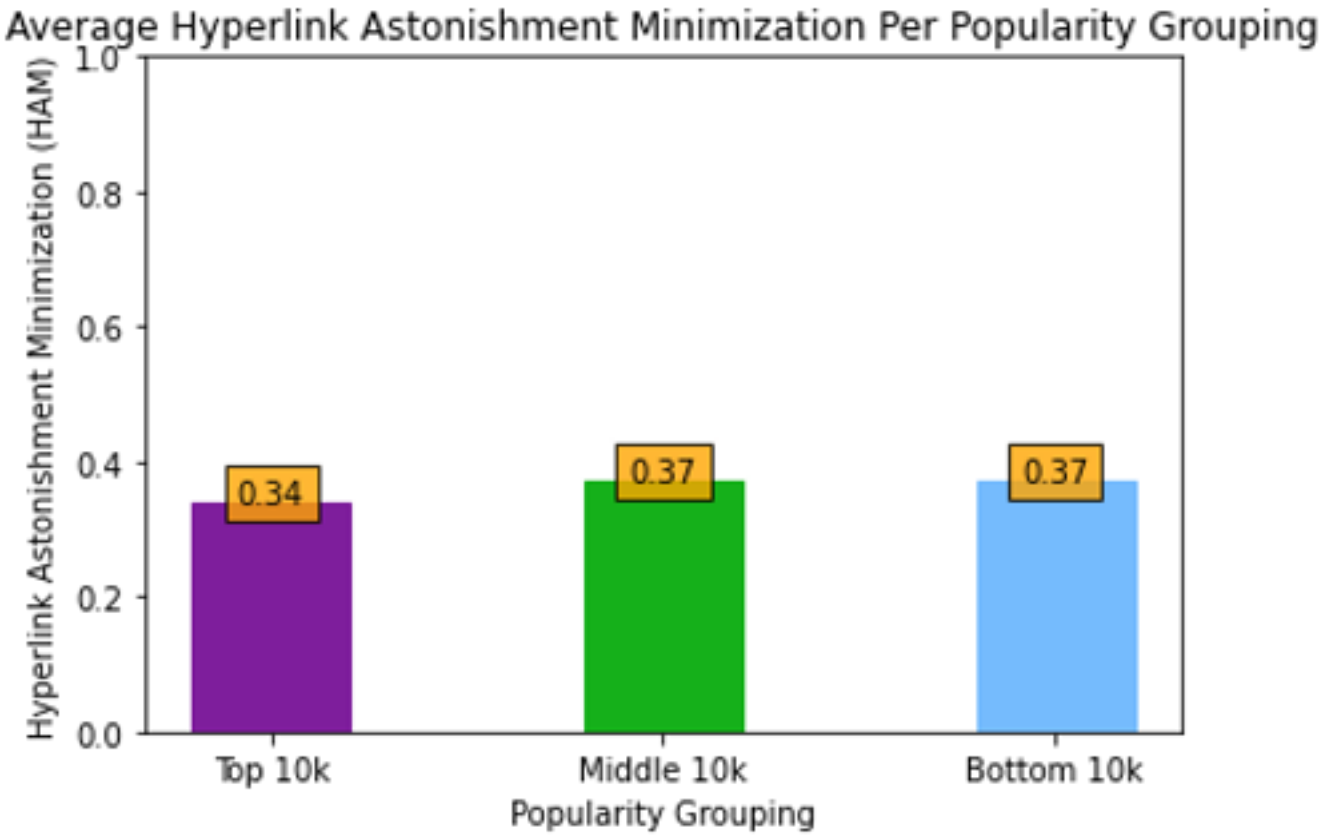
- **WATER**'s Metric Calculation module:
  - Retrieved the AP for 24,019/25,523 websites
  - 22,492/25,523 had enough data to calculate an ITAA score
  - 23,099/25,523 had enough data to calculate a HAM score
  - 18,222/25,523 had enough data to calculate a LIM score

Results – ITAA



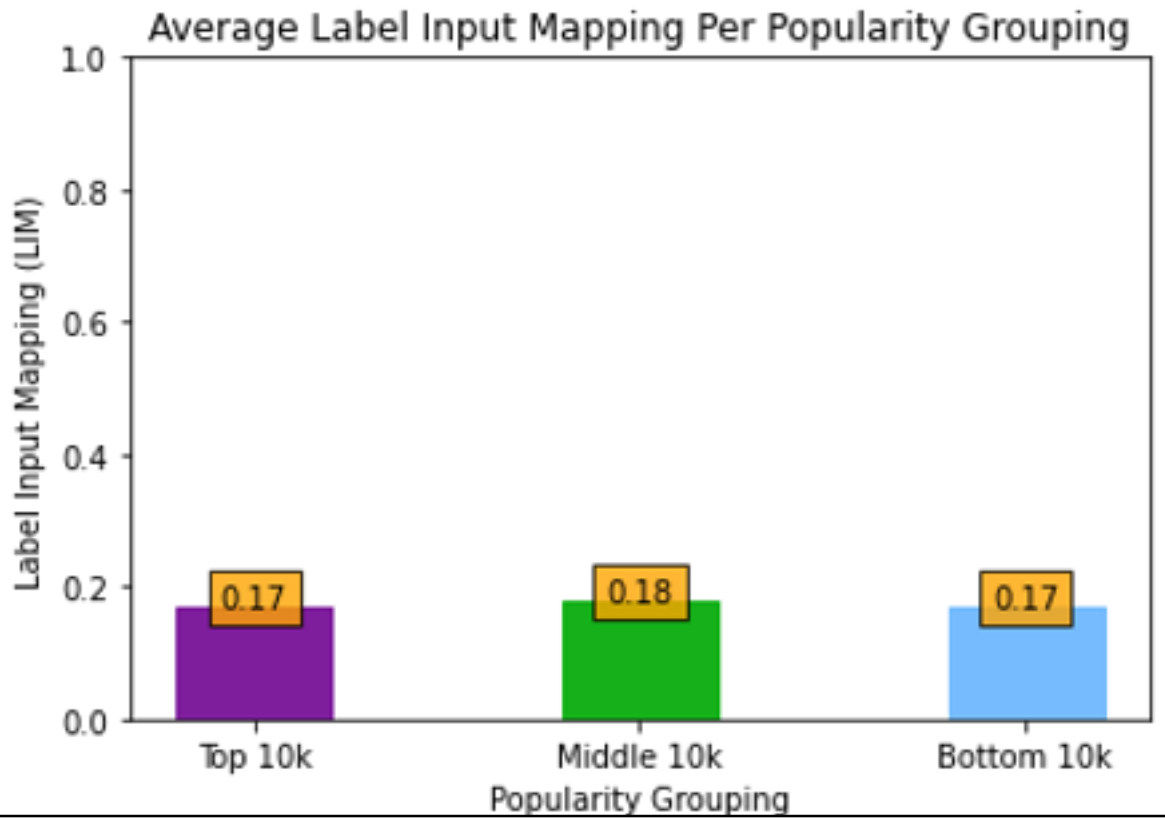
On average, the most popular sites have more images with appropriate alt attributes compared to the least popular sites, and 55.67% of all images observed had appropriate alt attributes

Results – HAM



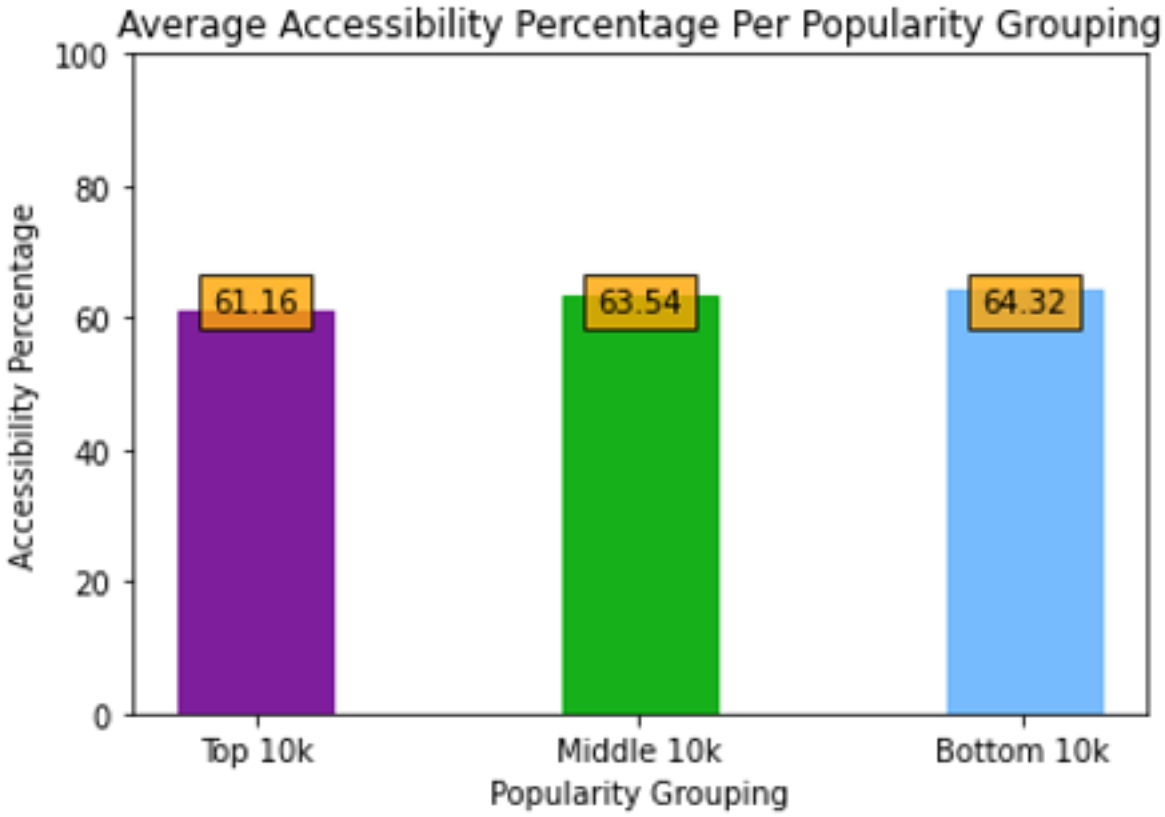
On average, the most popular sites had fewer conforming hyperlinks compared to the least popular websites

Results – LIM



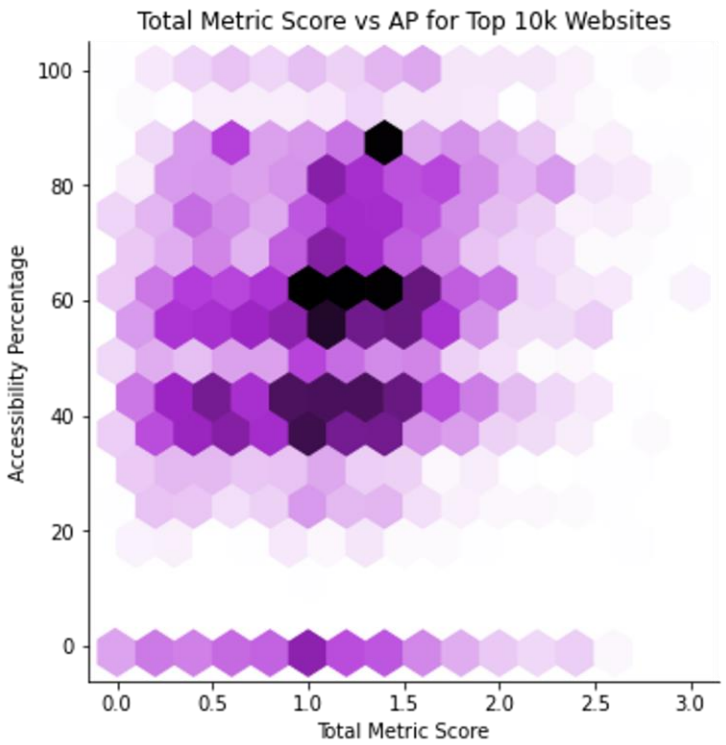
Bad across the board, suggesting a high risk to users that require accessibility tools to access the Internet with regards to information leakage

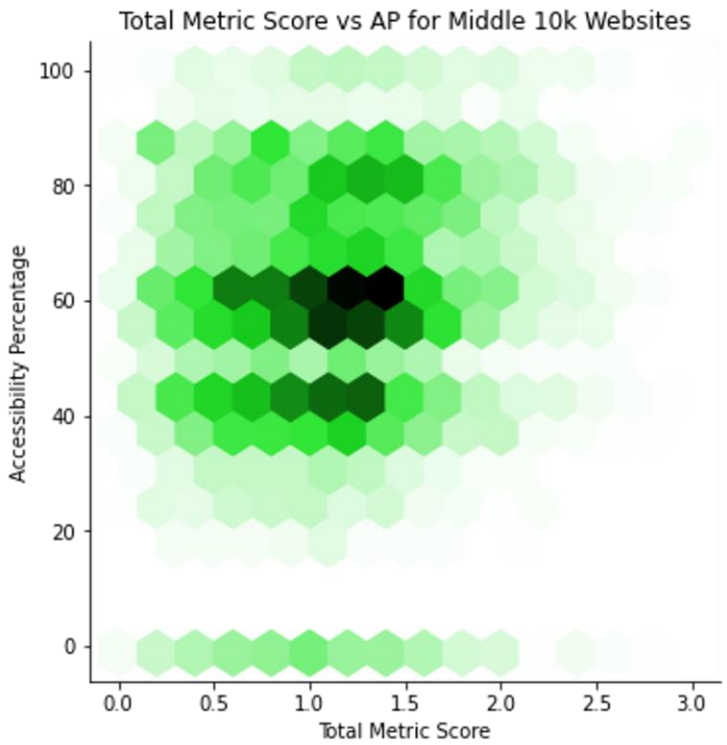
Results – AP

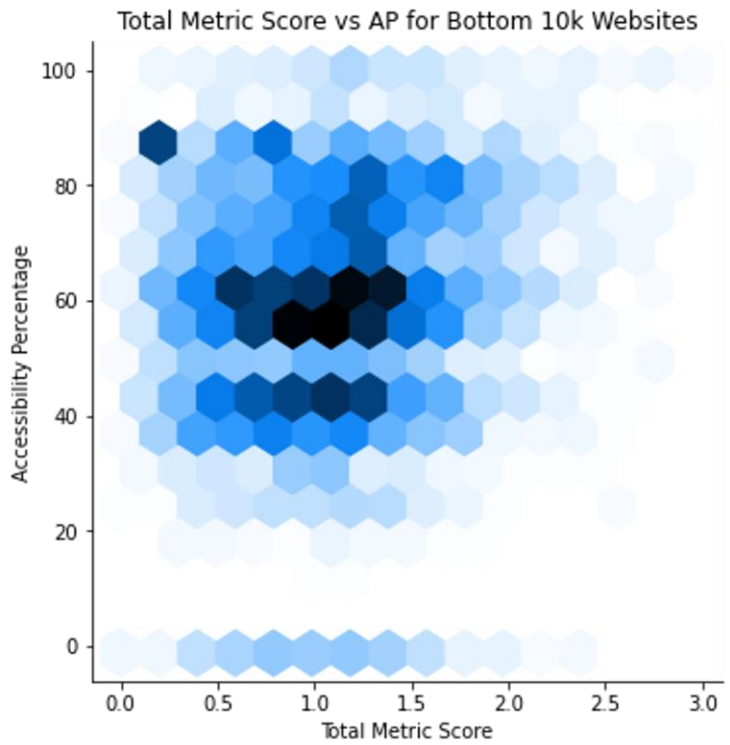


The least popular websites are not less accessible than the most popular websites

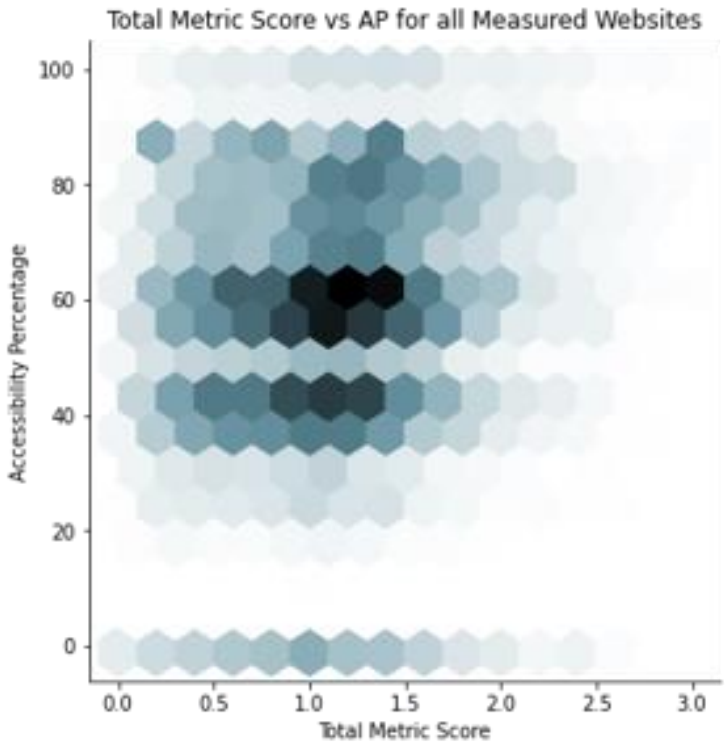
Results – Metrics Against AP





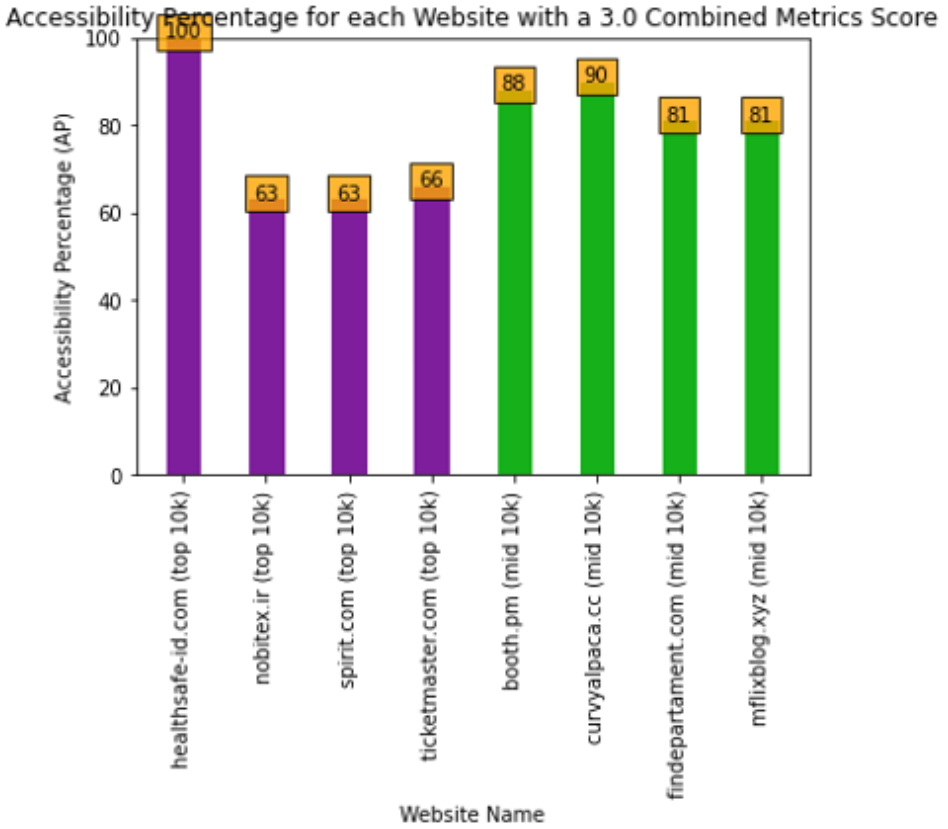


Results – Metrics Against AP



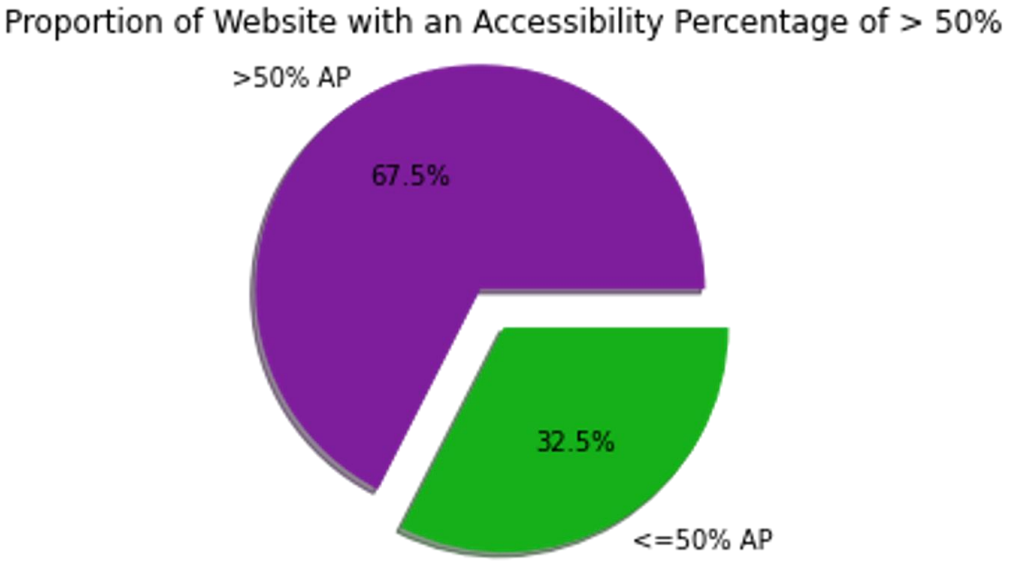
The calculation of base metrics does not appear to be enough to predict the accessibility percentage of a website

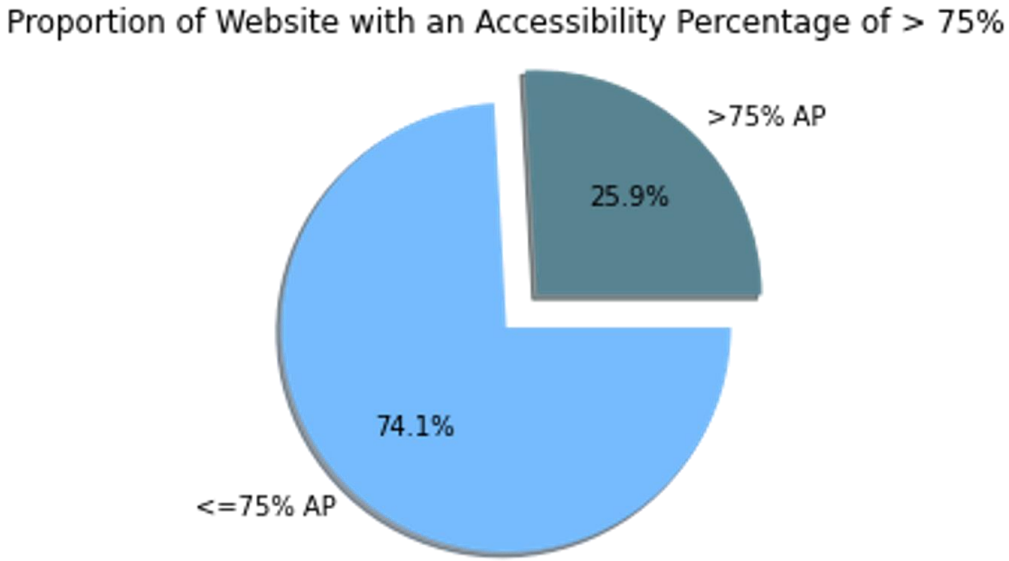
Results – Websites With a 3.0 Score



These three basic metrics alone are not enough to indicate Level AA WCAG 2.1 compliance

Results – AP Ranges





The measured websites do not demonstrate a high adherence to the WCAG 2.1 accessibility standards

Conclusion

- Our data suggests that no trend exists between our basic metrics and the calculated AP based on WCAG 2.1 guidelines
- The threat landscape for users that require accessibility tools to access the Internet does not look promising, with a very high risk for these users to be subjected to phishing attacks and information leakage
- There appears to be no correlation between a website's popularity and its accessibility percentage

Questions?

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All data and the **WATER** framework are available at:
https://github.com/john-breton/WATER

Thank you!

 john-breton

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