Review of selected Publications presented in International Conference on Computers Helping People with Special Needs (ICCHP) 2010

Morten Goodwin

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Abstract

This paper reviews selected papers for the International Conference on Computers Helping People with Special Needs (ICCHP) 2010. This review is part of Ph.D. study of Morten Goodwin and is a prerequisite for getting participation accredited with 1 ECTS.

1 Introduction

- The conference home page can be found ar: http://www.icchp.org.
- Volume one of the proceedings can be found at: http://www.springer.com/computer/hci/book/978-3-642-14096-9.
- Volume two of the proceedings can be found at: http://www.springer.com/computer/hci/book/978-3-642-14099-0.

The examined papers are chosen because there are re leated to the ongoing Ph.D. studies of Morten Goodwin. How the papers are related to the ongoing Ph.D. studies can be seen in table 1.

2 Analyzing Effects of Web Accessibility–A Framework to Determine Changes in Website Traffic and Success

Hartjes et. al. present an approach for examining how web accessibility affects the usage of a company web site [1].

2.1 Relevance for Ph.D. studies

Providing the cost and profit of making web sites accessible is important both for government and private sector and can be seen as a data complementing measurement results.

Table 1: Reviewed papers from ICCHP 2010.

Section	Paper	Why it is interesting
2	Analyzing Effects of Web Accessibility–A Framework to Determine Changes in Website Traffic and Success	Measuring the cost or profit with making web sites accessible.
3	Improving the Accessibility of Fabasoft Folio by Means of WAI-ARIA	WAI-ARIA is a relatively new accessibility approach which is not measured by the eGovMon framework. Using WAI-ARIA should be measured as something positive.
4	Improving Computer Vision-Based Indoor Wayfinding for Blind Persons with Context Information	Applying classification techniques for accessibility purposes.
5	Audio Classification Techniques in Home Environments for Elderly/Dependant People	Applying classification techniques for accessibility purposes.
6	Evaluating Conformance to WCAG 2.0: Open Challenges	The eGovMon framework follows WCAG 1.0, but is planned to be updated to WCAG 2.0.

2.2 Approach

The underlying hypothesis in this paper is that improvements in web accessibility also means improvements in the over all usability of the web site. Furthermore, better usability cultivates the traffic and success of the web site, which is financially beneficial. The presented approach could be seen as a step towards a method for proving that making a web site accessible is profitable.

In the literature there exist nether evidence that it is profitable to improve the accessibility of a web site, nor any sensible way of measuring profit from the accessibility improvements.

A practical example of profit from accessibility revision is using alternative texts for images. When it comes to web accessibility, it is good practice to provide alternative texts of images. Similarly, providing alternative texts of images makes it possible for search engine crawlers to index images and make these searchable. Thus, providing alternative texts makes it easier for potential customers to find the resource they are looking for, which is profitable.

Previous work in this area has focused mostly on the social benefits of accessibility. An example of a metric for social benefit it is how many currently unemployed people with special needs will be able study courses if the teaching material where made accessible.

This paper presents a framework which provides detailed empirical data as well as analytics on how web sites are used when the web accessibility improvements are carried out. The framework includes business indicators which should be collected during an improvement phase. These indicators center around the behavior of visitors and search engines, such as:

- Average time a user spends on the web site.
- Average number of pages a user visits.
- Rate of returning visits.
- Bounce rate.
- Search engine keywords.
- Search engine keyword values.
- Search engine visits per site.

The framework uses different phases for monitoring how making a web site improves the accessibility as following:

- **Analysis phase 1**: An in-accessible phase of 1-3 months where the use of web site is monitored. This is needed to gather information on the behavior of users when the web site is in-accessible. Note that improvements in accessibility can happen simultaneously, but should not be launched until the next phase.
- **Indexing phase**: The new accessible web site is launched and a period of 10 days are given to make sure search engine crawlers are able to gather the updated data. No information is gather at this stage.
- **Analysis phase 2**: An accessible phase of equal length to the first phase where data is gathered from the accessible version of the web site. This allows direct comparisons between the accessible and in-accessible versions of the web sites.
- **Analysis phase 3**: An accessible phase starting at the same time as phase two but with a much longer duration. This allows for the entire web site to be indexed by search engines. With this phase it is possible to examine the long term effects of making a web site accessible.

The paper does not conclude with a result of how profitable it is to make a web site accessible, but rather presents some guidelines. The potential financial profit depends on what the company uses their web site for:

- **High profit**: A company using the web site as its only place for revenue.
- **Medium profit**: A company using the web site to distribute products through other channels.
- **Small profit**: A company not using the web site for revenue, but only for presenting the company.

2.3 Concluding remarks

The paper presents an interesting and useful approach for collecting financial data from web sites which are updated. However, further work is needed for a complete methodology to prove that it is cost-affective to make web sites accessible.

It should be noted that the approach is limited to private business. The same metrics cannot be applied directly to for example governmental web sites. As an example, it is preferable for a private company that its users spend as much time as possible on their web site rather then going to the web site of competitors. A user which quickly leaves the web site is likely to have switched to a competitor. However, in government, it is most often not the case that competitors exits. For example, if a citizen wants to apply for a building permit online, it is only one location where this is possible. Thus, for the government it is beneficial for the citizen to visit the web site as quickly as possible but still get the task done.

3 Improving the Accessibility of Fabasoft Folio by Means of WAI-ARIA

Batusic et. al. present a practical case study for improving the accessibility of a web site using WAI-ARIA [2].

3.1 Relevance for Ph.D. studies

WAI-ARIA (Accessible Rich Internet Applications) is a relatively new accessibility technology which is not measured by the eGovMon framework. eGovMon should measure and reward the use of WAI-ARIA.

3.2 Approach

Many web pages use JavaScript and AJAX to enable interactive environments for their users. Often this causes problems for people with special needs because the assistive technologies are not able to execute JavaScript. Thus, web sites which rely on JavaScript are often in-accessible for people with special needs.

Folio is a collaborative web site which resembles a desktop application. Users can upload, download and share files by dragging from the local machine to the server in a web application which resembles windows explorer. This is designed so that most users are already familiar to how the web site works, since most users are familiar with windows explorer. However, the drag-and-drop functionality causes challenges to some users which are not able to use mouse. Furthermore, the drag-and-drop functionality is implemented with Ajax, a JavaScript technology not supported by many assistive technologies.

WAI-ARIA is a technology recently launched by W3C-WAI as a way to support advanced and complex user interfaces on the web. It is a markup language which integrates with (x)HTML and introduces roles, states and properties. In contrast to static web pages, web developers can with WAI-ARIA define roles and applications for parts of web pages. This makes it possible for rich internet applications to be accessible for all users, also users with with special

needs. Currently, it is not in much use in public web sites, but, despite that no final release of WAI-ARIA is available yet, it is supported by many assistive technologies.

An example of proper use of WAI-ARIA is defining menu items. Menus are often created with HTML, sometimes supported by JavaScript. In most cases, it is easy for visual users to quickly detect that a menu item is available. By only using HTML and/or JavaScript there are no method for assistive technology to automatically identify that a link as a menu item.

However, if a web site is implemented with WAI-ARIA it is possible for an assistive technology to present a menu item as an actual menu items. This makes it possible for a user to for example skip forward to the menu items in the page without having to navigate throughout the content.

In the Folio web sites, menu item are implemented with WAI-ARIA as following:

```
<li role="menuitem">Project Inbox</li>
```

3.3 Menus

For menus, the roles used are as following:

- **application**: Identifying a region of the web page.
- **menubar**: Container for menu items.
- **menuitem**: Container for a single menu item.
- **menu**: Container for a pop-up menu or sub-menu.
- **menuitemcheckbox**: A menu item which can be enabled, disabled.
- **menuitemradio**: A menu item which can be chooses from a group of menu items.

The states and propertoes used for menus in the Folio web site are as following:

- **aria-haspopup**: If an element offers a submenu.
- **aria-disabled**: Interactive menus which has to be focusable to reveal its existence to screen readers.
- **aria-hidden**: Menu items which are hidden with CSS.
- **aria-labelledby**: To identify the connection between menu item and menu header.

3.4 Toolbar

Following is the WAI-aria roles, states and properties used in the toolbar, not already covered by the section 3.3 about menus.

For toolbars, some commonly used roles include

- **toolbar**: The toolbar itself.

- **button**: Single symbol in the toolbar.

Some commonly used states and properties include:

- **aria-controls**: To tell the assistive technology that it can cause dynamic changes.
- **aria-labelledby**: Connection between the toolbar symbol and header.

3.5 Concluding remarks

This paper presented a practical example of how to use WAI-ARIA. The implementation would be useful to anyone implementing similar web sites, special web sites using menu items, toolbars and drag-and-drop functionality.

The implementation example is also useful for benchmarking accessibility. For example, if a benchmarking tool is able to detect a menu item with some heuristic test, a potential approach would be to reward the web site with a better score if the detected menu has been correctly marked as a menu with WAI-ARIA.

4 Improving Computer Vision-Based Indoor Wayfinding for Blind Persons with Context Information

Tian et al present a help blind people for navigating indoors using a computer based vision system [3]. The paper applies classification techniques for accessibility purposes.

4.1 Relevance for Ph.D. studies

Classification techniques can also be applied for accessibility measurements. The presented techniques in this paper can be used to for example parse images in web pages to make sure the alternative text is correctly describing the content.

4.2 Approach

The paper focuses on detecting physical signs which are available in public buildings. These public signs include representations such as exit, bathroom and elevator. Such signs are needed to navigate throughout building both for blind and sighted people.

The proposed application includes a wearable camera which can automatically provide information to the blind users for example through sound.

Often camera based classification fail for the following reasons:

- The camera has insufficient resolution.
- The lightning is uneven.
- Distortions in thecamera lens .
- Text is on non-planar surfaces.

- The backgrounds are too complex be classified.
- The area is out of focus.
- The camera or area to classify has too much movement.
- Too much colour quantization or shift of intensity is used.
- The sensor has too much noise.

The presented process avoids the above common failures by using the following process:

1. The process starts with colour reduction to reduce the complex colours of both the forground and background.
2. Subsequently, text extraction algorithms are applied. This allows for text to be presented as simple black text on white background.
3. Algorithms to detect geometric shapes which are not part of the text are applied.
4. All non-text are removed.
5. Existing OCR software is applied to translate the remaining image to text.

The results reach a high classification accuracy. The authors plan to apply priority levels to the presented outcomes such that the most relevant signs are presented first.

4.3 Concluding remarks

The method can only detect signs which are text, not iconic signages. For example, a common sign for bathrooms are ether a stick-figure of a man or a woman. The presented approach cannot detect such iconic figures, only signs which explicitly present letters. This is scheduled for further work. This means that the approach is currently to premature for web page benchmarking, as it is not possible with this technique to extract information of what is in the picture and use it to compare it with alternative text.

5 Audio Classification Techniques in Home Environments for Elderly/Dependant People

Lozano et. al. present a short paper on a method for classifying audio sounds [4].

5.1 Relevance for Ph.D. studies

The presented techniques in this paper can be used as input to parse audio to make sure the alternative text is correctly describing the audio content.

5.2 Approach

The presented algorithm focus on detecting household sounds which are important for everyday life. The audio to be classified consists of "non-speech" sounds such as alarm clock, door bell, telephone, etc.

People who loose their hearing as adults often have a difficult time functioning in everyday life as they can no longer recognize sounds which they have been dependant on their entire life. This includes both sounds which are recognised consciously such as the sound from an alarm clock, and sounds which are often unconsciously recognised such as in which direction the traffic comes from. This is a frequent problem as loss of hearing is very common in old age.

The paper presents an algorithm that can help people in everyday life translating audio sound to for example visual representation on a screen.

5.3 Implementation

Both for training data and to be able to compare incoming sounds with existing sounds, a sound database with 100 household sounds was created.

The paper presents the following process:

5.3.1 Feature extraction

The following acoustic parameters where selected to be extracted from the data: Mel Frequency Cepstrum Coefficients, Zero Crossing Rate, Centroid and Roll-Off Pint.

The feature extraction includes a multi-resolution analysis technique with multiple windows of different sizes, instead of the traditional fixed length window. This gives a higher number of parameters which would worsen the performance of the classifier. However, this is compensated by a heuristic selection of parameters to reduce the size of the feature array.

5.3.2 Classification

The classification algorithm applied is the Gaussian Mixture Model, which has been shown to be a good classifier for detecting sounds.

The experimental carried out with 60% of the data for training and 40% for testing. The windows sizes ranged frmo 20 to 80 milliseconds.

With the most preferable configuration, the classified reached an accuracy of 92.44%. The results also showed that using multi-resultion analysis outperformed the use of single-windows.

5.4 Concluding remark

The short paper presents an interesting approach for classifying audio sound. However, since the approach is limited to household sounds, the approach is too premature to directly apply web page classification.

6 Evaluating Conformance to WCAG 2.0: Open Challenges

Alonso et. al. present remaining challenges for developing measurement techniques for evaluating web sites according to WCAG 2.0 [5].

6.1 Relevance for Ph.D. studies

The eGovMon tool and corresponding methodologies are all according to WCAG 1.0, but should be updated to WCAG 2.0.

6.2 Approach

WCAG 1.0 was launched in 1999 and was followed up by WCAG 2.0 in 2008. During this 9 year period, many measurement methodologies for WCAG 1.0 was created. Since WCAG 2.0 differ from WCAG 1.0 in significant ways, the measurement existing methodologies cannot easily be translated to WCAG 2.0. Thus, very few applications for evaluation according to WCAG2.0 has been produced. Only two tools claiming to be WCAG 2.0 compliant are known to the authors: AChecker and TAW. The details of these tools are not known.

In this paper, the authors identify the main challenges with measuring measuring accessibility in web sites in accordance to WCAG 2.0. The lessons have been learned by applying WCAG 2.0 tests in practice by university students.

The paper identifies the following challenges. The described challenges are in the authors experience unclear parts WCAG 2.0, which often means that the testers need interpret the texts and take decisions of how it should be understood. This could easily lead to inconsistency among testers as the testers may understand the texts differently.

6.3 Accessibility supported Technologies

WCAG 2.0 describes that only accessibility supported technologies can be relied upon for accessibility. It further states that the technology is accessibility supported only when user's assistive technology will work with it. Since there no list of supported technologies are provided, nor any formal way to measure if a technology is supported or not, this causes a challenge. There are no established method of saying that using one technology is accessibility, while using another is not.

6.4 Testability of Success Criteria

WCAG 2.0 consists of testable techniques. A technique is testable if it can be tested ether with machine or by human judgment. It is believed that around 80% of the criteria are testable by humans. However, the authors show that some of the description of the techniques for testing causes confusion, for example: in the sentences, "the test the sequence of elements should be meaningful", it is not evident what is meant by the wording meaningful. What is understood as "meaningful sequence of elements" for one person may not be meaningful for others. This is likely to cause confusion, which leads to inconsistency in any testing results.

6.5 Openness of Techniques and Failures

WCAG 2.0 is divided to separate documents: the guidelines and techniques. The guidelines are stationary and technology independent. In contrast the techniques is a living document which is updated as technology evolves. This makes it possible to update WCAG 2.0 with hands on techniques as the technologies used on the web evolve. One challenge is that W3C updates the techniques document for non-proprietary software only. This means that there will be no techniques collected by W3C for proprietary software, such as for example Adobe Flash. Thus, there will be no techniques from W3C on how to make Adobe Flash accessible.

6.6 Aggregation of Partial Results

How to present data from successfull techniques and common failures have not been presented by W3C.

WCAG 2.0 identifies two types of criteria an element can match:

- **Positive**: Elements which meet the criteria of successfull techniques. Any elements which uses the successfull techniques are known to be accessible.
- **Negative**: Elements which is a common failure. Any elements which uses a common failure, is known to be in-accessible.

It is not so that the successfull techniques and common failures are opposite measures. Thus, not following a success technique does not mean that a barrier exist. Similarly, it is not so that avoid a common failure necessarily means that the element is accessible. Therefor, elements which nether match the successfull techniques nor common failures fall into some unknown state and cannot be claimed to be accessible nor in-accessible.

How to present data from a web page with common failures and successfull techniques are not clear.

6.7 Recommendations

The author further has some recommendations. The recommendations are as following:

- Define what are accessibility-supported techniques and a methodology to identify if a techniques is accessible-suppported, or not.
- More experiments are needed for the testability of the techniques, failures and success criteria. This should be a step towards creating a common understanding of how the tests should be interpreted.
- W3C should define what how test results from successfull use of techniques, common failures, and not applicable should be aggregated and presented as a single result.

6.8 Concluding remarks

The paper identifies challenges with measuring in accordance to WCAG 2.0. The identified challenges is useful knowledge for for an update of the eGovMon tool. Any methodology focusing on detecting barriers, such as the eGovMon framework, would therefor only the common failures. Some method for using and aggregating both common failures and successfull techniques are needed.

References

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