

CPSC 533C Project Proposal

Sam Davis
sddavis@cs.ubc.ca

Introduction

Scrolling through large documents composed mostly of text is among the most common actions in modern computer use, and is perhaps especially important when browsing the web. There are four major tasks for which it is often used, which I will refer to as *reading*, *overview*, *understanding*, and *search*. *Reading* simply means reading a document from the beginning until some stopping criteria is met (e.g. the end of the document is reached, the user has determined that the text is not useful to her, or she has acquired the information she needed). *Overview* involves quickly getting a sense of the overall structure or content of the document, usually in more detail than is provided by a table of contents, by selectively reading small parts of the document. This task usually involves scrolling back and forth between different sections of the document. *Understanding* is similar to overview in terms of the user's actions, but the motivation is different. Understanding involves (re)reading certain parts of the document, often out of order, so as to better understand the connections between them. *Search* involves looking for a particular item in the document, which could be anything from a word or sentence to a whole section (and which may or may not be present in the document). To some extent, search is a subtask of overview and understanding. Note that there are not sharp boundaries between these four tasks: the user will often move fluidly amongst them, and may not make a conscious distinction between them.

The standard scrollbar is suitable for the reading task, however, it makes the search task so difficult that users often give up without finding what they are looking for. Furthermore, the difficulty in moving back and forth between related parts of the document via the scrollbar impedes the overview and understanding tasks. If scrolling takes too much time or cognitive effort, the user may forget what they were looking for, or why they were looking for it. The ability to search the text for keywords can be helpful, but it fails when the user does not know the precise words used in the interesting part of the document, and when the search yields too many results. Personal experience suggests that many users tend not to use text search features, perhaps because they are often rather cumbersome.

Dataset

The web provides documents with a range of lengths and with varying amounts of non-text content (e.g. images, tables), from news stories to academic papers to entire books.

Proposed Infovis Solution

The proposed solution lies at the intersection of navigation, zooming, and focus+context. The user will control scrolling and zooming independently with the two degrees of freedom of the mouse, similarly to OrthoZoom. However, instead of shrinking the text so that it is illegible, as done in Speed-Dependent Automatic Zooming, or relying on the existence of a multi-scale table of contents, text will be selectively elided, for example by hiding the last or middle N lines of each paragraph, where N will depend on the level of zoom and the paragraph size. This will allow more rapid scrolling through a long text, on the theory that people rely primarily on the beginning of a paragraph (and in some cases also the end) to make quick determinations about whether it is the one they are looking for. The precise

method for determining what text to hide will be refined in the course of the project. In addition, the question of whether to hide whole sentences or to preserve the physical layout of the text by hiding lines, will be investigated.

In addition to controlling the overall level of zoom, users will be able to select paragraphs to zoom in on, so that some paragraphs will be fully visible while others are mostly hidden. This will allow the user to specify their focus while retaining context by showing a greater portion of the document on the screen at one time than would usually be possible. This selection will also allow the system to keep track of which pieces of text the user is interested in, so that they can be visually marked and so that hiding them can be avoided. A potential extension to the project could use the selection information to suggest related sections of the document.

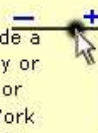
The images show a text at three different levels of zoom, starting with no zoom (i.e. no text is elided). Red ellipses indicate where text has been elided. Note that the zooming and scrolling widget follows the mouse cursor, but is only visible while the mouse button is held.

4. Restrictions. The license granted in Section 3 above is expressly made subject to and limited by the following restrictions:

- a. You may distribute, publicly display, publicly perform, or publicly digitally perform the Work only under the terms of this License, and You must include a copy of, or the Uniform Resource Identifier for, this License with every copy or phonorecord of the Work You distribute, publicly display, publicly perform, or publicly digitally perform. You may not offer or impose any terms on the Work that alter or restrict the terms of this License or the recipients' exercise of the rights granted hereunder. You may not sublicense the Work. You must keep intact all notices that refer to this License and to the disclaimer of warranties. You may not distribute, publicly display, publicly perform, or publicly digitally perform the Work with any technological measures that control access or use of the Work in a manner inconsistent with the terms of this License Agreement. The above applies to the Work as incorporated in a Collective Work, but this does not require the Collective Work apart from the Work itself to be made subject to the terms of this License. If You create a Collective Work, upon notice from any Licensor You must, to the extent practicable, remove from the Collective Work any reference to such Licensor or the Original Author, as requested. If You create a Derivative Work, upon notice from any Licensor You must, to the extent practicable, remove from the Derivative Work any reference to such Licensor or the Original Author, as requested.
- b. You may not exercise any of the rights granted to You in Section 3 above in any manner that is primarily intended for or directed toward commercial advantage or private monetary compensation. The exchange of the Work for other copyrighted works by means of digital file-sharing or otherwise shall not be considered to be intended for or directed toward commercial advantage or private monetary compensation, provided there is no payment of any monetary compensation in connection with the exchange of copyrighted works.

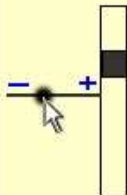
4. Restrictions. The license granted in Section 3 above is expressly made subject to and limited by the following restrictions:

- a. You may distribute, publicly display, publicly perform, or publicly digitally perform the Work only under the terms of this License, and You must include a copy of, or the Uniform Resource Identifier for, this License with every copy or phonorecord of the Work You distribute, publicly display, publicly perform, or publicly digitally perform. You may not offer or impose any terms on the Work that alter or restrict the terms of this License or the recipients' exercise of the rights granted hereunder. You may not sublicense the Work. You must keep any reference to such Licensor or the Original Author, as requested. If You create a Derivative Work, upon notice from any Licensor You must, to the extent practicable, remove from the Derivative Work any reference to such Licensor or the Original Author, as requested.
- b. You may not exercise any of the rights granted to You in Section 3 above in any manner that is primarily intended for or directed toward commercial advantage or private monetary compensation. The exchange of the Work for other
- c. If you distribute, publicly display, publicly perform, or publicly digitally perform the Work or any Derivative Works or Collective Works, You must keep intact all copyright notices for the Work and give the Original Author credit reasonable to the medium or means You are utilizing by conveying the name (or pseudonym if applicable) of the Original Author if supplied; the title of the Work if supplied; on original Work by Original Author"). Such credit may be implemented in any reasonable manner; provided, however, that in the case of a Derivative Work or Collective Work, at a minimum such credit will appear where any other comparable authorship credit appears and in a manner at least as prominent as such other comparable authorship credit.
- d. For the avoidance of doubt, where the Work is a musical composition:



4. Restrictions. The license granted in Section 3 above is expressly made subject to and limited by the following restrictions:

- a. You may distribute, publicly display, publicly perform, or publicly digitally perform the Work only under the terms of this License, and You must include a copy of, or the Uniform Resource Identifier for, this License with every copy or phonorecord of the Work You distribute, publicly display, publicly perform, or publicly digitally perform. You may not offer or impose any terms on the Work that alter or restrict the terms of this License or the recipients' exercise of the rights granted hereunder. You may not sublicense the Work. You must keep any reference to such Licensor or the Original Author, as requested. If You create a Derivative Work, upon notice from any Licensor You must, to the extent practicable, remove from the Derivative Work any reference to such Licensor or the Original Author, as requested.
- b. You may not exercise any of the rights granted to You in Section 3 above in any manner that is primarily intended for or directed toward commercial advantage or private monetary compensation. The exchange of the Work for other
- c. If you distribute, publicly display, publicly perform, or publicly digitally perform the Work or any Derivative Works or Collective Works, You must keep intact all copyright notices for the Work and give the Original Author credit reasonable to the medium or means You are utilizing by conveying the name (or pseudonym if applicable) of the Original Author if supplied; the title of the Work if supplied; on original Work by Original Author"). Such credit may be implemented in any reasonable manner; provided, however, that in the case of a Derivative Work or Collective Work, at a minimum such credit will appear where any other comparable authorship credit appears and in a manner at least as prominent as such other comparable authorship credit.
- d. For the avoidance of doubt, where the Work is a musical composition:



- i. **Performance Royalties Under Blanket Licenses.** Licensor reserves the exclusive right to collect, whether individually or via a performance rights society (e.g. ASCAP, BMI, SESAC), royalties for the public performance or public digital performance (e.g. webcast) of the Work if that performance is primarily intended for or directed toward commercial advantage or private monetary compensation.
- ii. **Mechanical Rights and Statutory Royalties.** Licensor reserves the exclusive right to collect, whether individually or via a music rights agency or designated agent (e.g. Harry Fox Agency),

Scenario of Use

The user is reading a document and remembers that the author has coined a term to describe something, which he believes is related to the part he is reading now, but he cannot remember the exact phrase. Holding down the mouse button to bring up the zooming and scrolling widget, he zooms out of the document until only the first two lines of each paragraph are visible. This results in a much shorter document and he is able to quickly find a paragraph that looks relevant. He moves the mouse to reduce the zoom so that more of the paragraph becomes visible, and realizes that it does not contain the definition he is looking for. However, he sees that the following paragraph looks very promising and clicks on it to show it in full. He finds the definition he is looking for within, and then uses the mouse to quickly zoom out and scroll back to the place he left off reading. Subsequently, he wishes to return to the definition and is able quickly find it because it has been visually marked (as a result of having been clicked on).

Proposed Implementation Approach

I am currently investigating the feasibility of implementing this as an extension to the Firefox web browser, using JavaScript and possibly XUL. Firefox provides a good mechanism for transforming html documents on the fly, so it looks promising.

Milestones

1. Determine whether the proposed implementation approach will work.
2. Implement the html transformations allowing text to be incrementally elided and shown again.
3. Implement the user interface side.
4. Determine the most effective way of choosing text to hide.
5. Evaluate the effectiveness on a range of documents

Personal Expertise

I have no specific expertise in this area, but I've always thought that there must be a way to make scrolling easier. I have programming experience that may be relevant to this project, having worked on a project which extracted the important elements from an XML DOM and presented the user with a more easily navigable document tree. I also have some knowledge of JavaScript.

Previous Work

Previous work includes methods which compress text and methods which rely on a previously existing explicit document structure, such as a table of contents or headings and sub-headings. The first often result in reduced readability, or no readability, and the second have limited applicability for documents with few or no headings and without a detailed table of contents. The Adobe Reader attempts to solve the problem of going back to previously seen parts of a text by providing back and forward buttons, but the number of views remembered is so large that the buttons are almost useless. It also suffers from the "forking" problem common to web browsers, that going back and then navigating to another location erases the forward history. Most closely related to my approach are probably source code editors that support code folding, where blocks of code are collapsed, but these usually rely on the user to explicitly indicate which blocks should be collapsed, and they do not gracefully handle user selection of folded blocks. Recent work attempts to automate the process by identifying the user's focus and showing the other parts of the code which are deemed to be most closely related.