Just-In-Time Browsing for Digital Microfilm

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Extended Abstract

We describe "Just-In-Time Browsing," (JITB) a method we are developing at B.Y.U. for quickly browsing large collections of digital images over the Internet,[1] and demonstrate its usefulness for browsing digital microfilm.

Millions of rolls of microfilm exist that are potentially of great use to individuals and groups doing family history and genealogy research. Access to this microfilm data usually requires, at a minimum, the time and effort of going to a family history center or library to locate the correct microfilm and view it. In many cases, the library or family history center doesn't have the desired film, and a much lengthier process is required - the microfilm must be ordered, copied, shipped, and delivered before it can be viewed to even know for sure that it has the desired information. In many parts of the world, even this process is of no use, since there are no family history libraries nearby. By providing access to digitally scanned microfilm images over the Internet, people all over the world can simultaneously use this vast amount of information without the expense and delay of physically copying and shipping the microfilm, or even having to physically travel to a library or family history center.

While the ability to download microfilm images over the Internet is a great improvement over waiting sometimes as much as weeks to view a physical copy, the methods that are commonly used today for viewing digital images over the Internet are still somewhat slow and cumbersome. Just-In-Time Browsing provides an improved method of browsing microfilm images by transferring just the information that will be useful to the user, just when the user needs to see it, or "Just-In-Time." Thus, valuable time and bandwidth are not wasted sending unnecessary details of the microfilm images that are not of any interest to the user.

JITB requires preprocessing of the original scanned images and providing access to them via a server, as well as providing browser software for people to use in order to actually browse the microfilm images over the Internet.

Preprocessing of an image for use with JITB consists of creating tiled versions of the original image at various resolutions, splitting the various tiles into bitplanes, repaletizing the image for progressive bitplane encoding, and compressing the individual bitplanes to reduce the amount of information that must be transferred. In addition, an index of data offsets is stored with each image to allow random access to the various data segments within the file, such that the image data can be sent in a default priority order, or interactively as the user requests various regions of interest of the image with the mouse.

The digital microfilm browser provides the user with an interface for communicating with the image server over the Internet. Low-resolution preview images are quickly loaded to give the user an overall view of the layout of each microfilmed image, and to provide context to the user as various portions of the image are loaded at higher spatial resolution.(Figure 1) The areas to be loaded at higher spatial resolution

can be determined by default browsing templates, or by explicit user interaction with the mouse. The browser will be able to automatically prefetch previews and other information to reduce the amount of user interaction necessary, and will be able to use recent interaction to help determine what parts of subsequent images to load with higher priority.
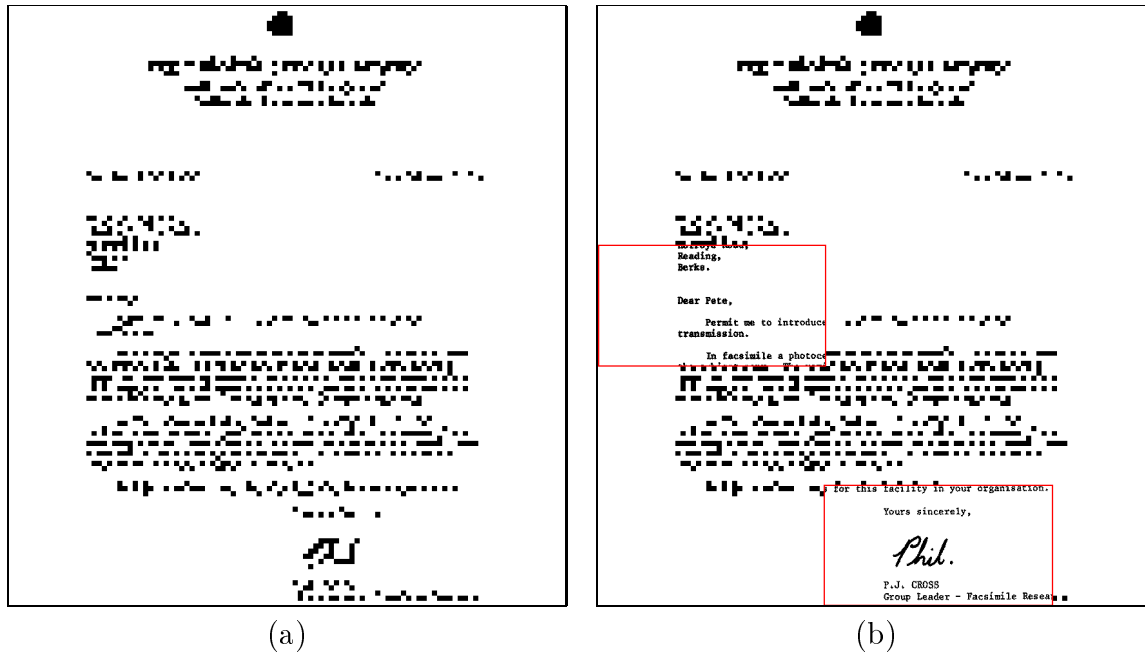

(a)   (b)

Figure 1: (a) Low resolution (pixel-replicated) preview of letter (1479 bytes) (b)Selected regions (highlighted in red) displayed at full spatial resolution - in context (additional 2321 bytes).

The server responds to requests from the browser by transferring the image data as it is requested, ordered by the priority of each current request. For example, if the browser has automatically requested higher spatial resolution image data for a particular region of interest, but the user explicitly requests higher spatial resolution for a different region of interest while the first region is still being transferred, the explicit user request will be honored immediately, and then the detail from the first region will continue to be sent.

Since microfilm images are basically bitonal (black/white) in nature, it is often sufficient to browse the images as bitonal images, greatly reducing the amount of data to be transferred. In many cases, however, 2-3 bits of grayscale data are necessary to provide a readable representation of an image.(Figure 2) Progressive bitplane encoding, [2] used in JITB, allows microfilm images to be browsed with varying amounts of grayscale resolution. We have also extended bitplane encoding to color images, which will allow JITB to be used with images acquired from digital camera instead of microfilm.

JITB will make browsing digital microfilm a faster and easier process than it currently is with the methods that are commonly used for viewing microfilm images on the Internet. We anticipate that browsing microfilm with JITB will be practical,
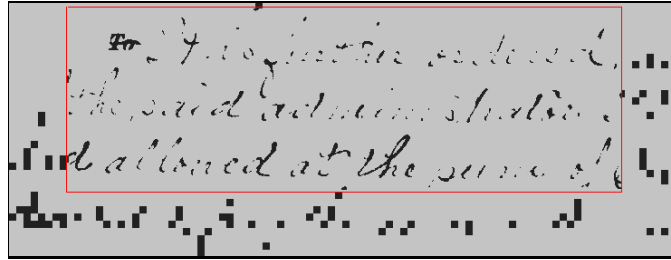
(a) 1 Bitplane (2 Levels of Gray)
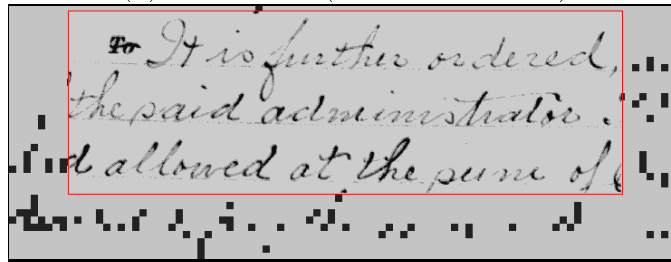
(b) 2 Bitplanes (4 Levels of Gray)

Figure 2: User-selected regions (at full resolution in red box) displayed in the context of the surrounding (coarse) pixel-replicated representation. While 1 bitplane is sufficient for some documents, many require more than one bitplane to be readable.

even at modem speeds. This will be of great benefit to those who wish to access microfilmed information while doing family history and genealogy research.

References

[1] Douglas J. Kennard and William A. Barrett. Just-in-time browsing for digital images. *IEEE Data Compression Conference (DCC '2001)*. To be presented at Snowbird, Utah, March, 2001. (Poster).

[2] Majid Rabbani and Paul W. Jones. *Digital Image Compression Techniques*. SPIE Optical Engineering Press, Bellingham, WA, 1991.