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An information delivery system with automatic summarization for mobile commerce

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Abstract

Wireless access with handheld devices is a promising addition to the WWW and traditional electronic business. Handheld devices provide convenience and portable access to the huge information space on the Internet without requiring users to be stationary with network connection. Many customer-centered m-services applications have been developed. The mobile computing, however, should be extended to decision support in an organization. There is a desire of accessing most update and accurate information on handheld devices for fast decision making in an organization. Unfortunately, loading and visualizing large documents on handheld devices are impossible due to their shortcomings. In this paper, we introduce the fractal summarization model for document summarization on handheld devices. Fractal summarization is developed based on the fractal theory. It generates a brief skeleton of summary at the first stage, and the details of the summary on different levels of the document are generated on demands of users. Such interactive summarization reduces the computation load in comparing with the generation of the entire summary in one batch by the traditional automatic summarization, which is ideal for wireless access. The three-tier architecture with the middle-tier conducting the major computation is also discussed. Visualization of summary on handheld devices is also investigated. The automatic summarization, the three-tier architecture, and the information visualization are potential solutions to the existing problems in information delivery to handheld devices for mobile commerce.
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1. Introduction

The advance of mobile network creates business opportunities and provides value-added services to users. Access to the Internet through mobile phones and other handheld devices is growing significantly in recent years. Many m-services applications have been developed for the handheld devices [5–8,38]. However, most current applications are customer-centered applications, for example, users can now surf the web, check e-mail, read news, and quote stock price, etc., using handheld devices. The mobile computing should not be limited to user-centered applications only. In this age of information, mobile applications

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should be extended to decision support in an organization. With a fast paced economy, organizations need to make decisions as fast as possible, they must gain competitive advantage by having access to the most current and accurate information available. For instance, a huge amount of financial news is generated everyday, and access to update financial information is important during decision making. On the other hand, the executives of an organization need make decision when they are on the road. As a result, there is an urgent need of information access through handheld devices.

There are many shortcomings associated with handheld devices although the development of handheld devices is fast in the recent years. The shortcomings include limited screen size with low resolution, low bandwidth, and low memory capacity. It is impossible to search and visualize the critical information on a small screen with an intolerable slow downloading speed using handheld devices. Automatic summarization summarizes a document for users to preview its major content. Users may determine if the information fits their needs by reading the summary instead of browsing the whole document one by one. The amount of information displayed and downloading time are significantly reduced. Active researches on automatic summarization have been carried out. Summarization techniques have been applied to delivery of information on handheld devices [3,42]. Traditional summarizations do not consider the hierarchical structure of document but consider the document as a sequence of sentences. Most traditional summarization systems extract sentences from the source document and concatenate together as summary. However, it is believed that the document summarization on handheld devices must make use of "tree view" [7] or "hierarchical display" [32]. Similar techniques have been applied to web browsing, an outline processor organizes the web page in a tree structure and the user click the link to expand the subsection and view the detail [4]. Hierarchical display is suitable for navigation of a large document and it is ideal for small area display. Therefore, a new summarization model with hierarchical display is required for summarization on handheld devices. Summarization of web pages on handheld devices has been investigated [5–8]. However, a large document exhibits totally different characteristics from web pages. A web page usually contains a small number of sentences that are organized into paragraphs, but a large document contains much more sentences that are organized into a more complex hierarchical structure [48,49]. Besides, the summarization on webpage is mainly based on thematic features only [6]. However, it has been proved that other document features play a role as important as the thematic feature [10,22]. Therefore, a more advance summarization model combined with other document features is required for browsing of large document and other information sources on handheld devices [49–51]. With powerful summarization tool, the ability of handheld devices will be greatly enhanced. Visualization of various information sources becomes feasible, for example, financial news delivery to handheld devices. It provides an information visualization tool for m-commerce.

The information access through mobile devices has drawn attention from researchers in recent years. Mobile devices support instant information and data access that is capable to support decision making. For example, Mendelsohn [35] has presented how physicians may request information to answer questions that occur at the point-of-care through mobile devices. A number of researchers have worked on advanced text input entry for handheld device [29,30,39]. More specifically, there are researches that focus on navigation of documents on mobile devices. Lamming et al. [26] have presented the Satchel system that used tokens to represent documents on mobile device and developed a context-sensitive user interface. In this work, we focus on the delivery of information to handheld devices with the support of automatic summarization. Example of how the proposed system supports the delivery of Yahoo! financial information is presented.

The paper is organized as follows. Section 2 discusses the shortcomings of handheld devices and information visualization on handheld devices. The three-tier architecture, which reduces the computing load of the handheld devices, is used. Section 3 proposes the fractal summarization model based on the statistical data and the hierarchical structure of documents. Thematic, location, heading and cue features are adopted. Experiments have been conducted and the results show that the fractal summarization outperforms the traditional summarization. Fractal