The Seventeenth International Symposium on Artificial Life and Robotics 2012 (AROB 17th '12),
B-Con Plaza, Beppu, Oita, Japan, January 19-21, 2012

Web Search Support System for the Smartphone Using Call and Web Logs

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Abstract: In recent years, Web searching on mobile devices with a touchscreen has increased. However, a search query using a mobile phone is not easy as that using a PC. In this study, we propose a search support system that provides user search queries and Web pages to suit the user's situation. This system continually records the user's location, time, Web search log and call log. Since the system does not have a server, the user's mobile phone records everything and provides search assistance to the users based on the recorded information.

Keywords: Mobile Phone, Web Serch, Query, Search Intention

1 INTRODUCTION

The increase of smartphones with a Web Browser has resulted in an icreasing need to view Web pages created for a PC using a mobile terminal rather than for mobile phones. Nevertheless, the labor required for searching is a major issue for mobile devices using touchscreens, unlike PCs where data can be entered from the keyboard. In order to solve such problems, a method recommending useful search queries and web pages from the search history, Web page information recorded when the user searches the Web, has been proposed. Whereas, they are focused on activities in the user's web search. However, little research on Web page recommendations has focused on the user's behavior in the real world.

Our goal is to recommend appropriate Web pages to users and to determine their search intentions with mobile phones depending on their situation. Their search intentions are related to the content that they utilize on their mobile phones , not rather than being limited to their user's Web search history. Call and mail contents are rich with keywords of interest to the user. Recently, smartphones have becomes popular. Therefore, with the user's permission, it is easy to collect Web search history and call history beyond the user's location. However, the risk of leaking user's private information to others has increased. Also related to the issue of personal privacy is the fact that the proposed system uses call logs.

The purpose of this study is to recommend Web pages that users can easily visit and search queries that users are expected to use, in order to eliminate the need for user input and to allow quick access to the desired page. For this reason, this system recommends Web pages and search queries based on the user's situation e.g., latitude and longitude, time, call log, and Web search log from the mobile phone.

In this paper, Section 2 discusses the motivation for this study. Section 3 describes the design of the proposed syste. Section 4 describes the implementation of the proposed design. Section 5 concludes this paper.

2 MOTIVATION

Mobile phones are used in many different situations. Therefore, research has focused on gathering information that can be observed with mobile phones and added sensors, and the use of the collected information to suit the user 's situation. For example, Uesaka et al. observed actual daily mobile phone user operations with minimal interference for six months [1]. As a result, they demonstrated that Machine learning could be used predict operation from the collected information. Additionally, Uesaka et al. proposed a system to recommend applications, according to the situation, based on collected information and application usage [2]. In studies using sensors in mobile phones, Minamikawa et al. proposed a system that indicates calories burned by the user by estimating the user movement with an accelerometer in the phone [3]. Yamamoto et al. proposed to a system to recommend contents using a GPS sensor in a mobile phone[4]. The system in the present study searches for the overlap between context of the content to be recommended and context in the user's Web page by recording Web page browsing history, location information, and time. Moreover, the system recommend a wide range of information. The difference between the system and this system is to decide to delivery information and to recommend contents which Web pages are viewed by the user.

Mobile phones involve many physical constraints such as the difficulty of entering information as compared to a PC. It is studies on the support that has been searching for many studies. Letizia by Lieberman automatically recommends

links based on the user's browsing behavior[5]. FIXIT by Hart et al. searches repair information from copier manuals, associating keywords related to the symptoms of the failure[6]. Uchiyama et al. proposed an information search system in the user's clearance time, by using mobile phones that recommend queries extracted from the browsing history on the user 's PC[7]. Y!Q by Kraft et al. searches related pages, analyzing the Web pages content[8, 9]. For example, when a user searches news articles related to browsing news articles, the system extracts only the keywords that the user selects the area of care from the area of interest. Hattori et al. proposed a system that presents queries that meets the user's search request by gestural manipulation after the user specifies a range of the word that would be[10]. Nishio et al. proposed a recommendation system that automatically extracts words that are likely to be used as a search query from Web pages that the users views[11]. Their studies recommend queries that are expected to be available to users within a Web page. In contrast, the present system recommends search queries based on the user's current location.

3 SYSTEM DESIGN

This section describes the processing flow and a system overview of search support that reduces input effort by reaching its goal of a user's page.

3.1 System overview

The purpose of the proposed system is to reduce the user's input in a search. Therefore, the user's input must not be inhibited when this system is collecting necessary information. This information must be collected automatically when the user acts (e.g., searches). Furthermore, the information collected and removed should be ready for utilization, and the user's privacy must be protected. Screens to help users find prepare recommended Web Page screen and recommended search query screen. A screen recommends Web pages in a list format, in descending order based on points assigned by this system. The information on each page includes the title, some excerpts from the text in the body, and frequently appearing keywords. In addition, each page has a related- view button. Thus, even if the desired page is not presented, the user can find some input by pressing the related-view button to close the related page. A screen also recommends search queries in a list format, in descending order based on points assigned by this system, and each query has a related-view button. Two screens were prepared for the following reasons. To reduce the user 's input, it is better to recommend Web pages than to recommend search queries. However, a Web page provides more information than a search query does. Therefore, the method of recommending a search query can be more widely applied than the method of recommending Web pages. Thus, the search query screen supplements the Web Page screen.

3.2 Processing flow

This section describes information processing (e.g., Web browsing history, call log and location).

Location information

The mobile device records position (latitude and longitude) information on a regular basis, and it guesses the user 's movement. Latitude and longitude information is based on GPS information when a GPS is available. When a GPS is not available, latitude and longitude information is received as a unit area of 300m by acquiring radio signals from the base station. We want to collect latitude and longitude information in short intervals in order to estimate the user 's movement. Here, latitude and longitude information is acquired every 600sec, due to battery power[12]. The user is classified as either stationary or moving, based on the speed calculated using latitude and longitude information obtained from the mobile phone. If the mobile terminal indicates lack of movement, Web search history and call history in the error range of latitude and longitude information from the current position are recognized in the same stationary period. If the mobile phone indicates movement, it refers to the Web search history on the move rather than the current position. In addition, the location information is also recorded in the Web browsing history and call history.

Web Browsing Logs

Each time the user searches, Web browsing logs are collected as follows. In general, the users who wants to search for information enters a query into a search engine and then presses the search button. The search results page appears, and the user selects the desired page.

This system detects that the page has changed and collects information about the user's location and the query that the user entered when the search button is pressed. No information about the page that appears in the search engine results list is extracted; this system collects information on the page that the user selects from the search results (e.g., the user 's start time of viewing that page, the URL of the page, keywords appearing on a page, and location information at that time). When the user closes the browser or moves to a different page, this system records the time just be-

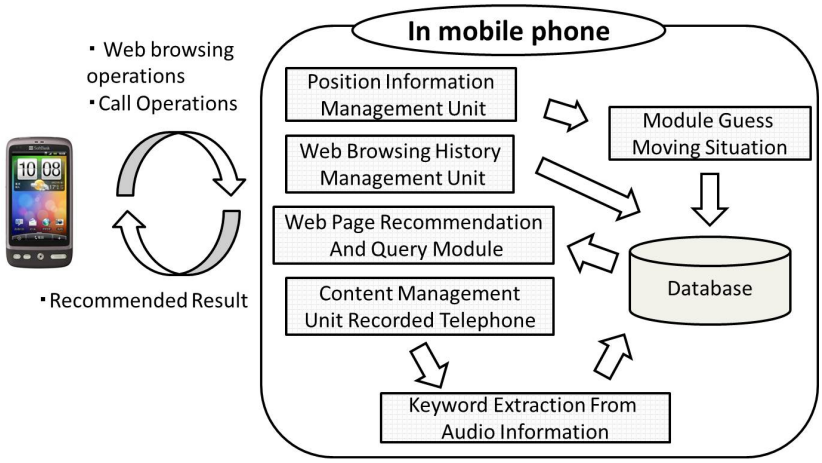

Fig. 1. System configuration

fore the page you were viewing. Thus, the time during which the user was looking at the page is recorded. This is one indicator of whether or not the user was interested in that page.

Call Logs

Each time the user calls, the call log is collected as follows. The system detects that the user's mobile phone is in initiating a call. At that time, this system collects current time and location information, as well as the content of the calls (e.g., what the user said during the call) and keywords from it. When the system detects that the call has ended, it stops grecording the content and extracting keywords. In this case, only the user's voice information is recorded since the called or calling party has not consented to the recording of his or her voice.

This system always records the user 's location information, Web browsing history, and call history. It weights Web pages and search queries using the information collected and recommends Web pages and search queries depending on the user's location and the time when the user starts the system.

4 IMPLEMENTATION

This system is implemented on an HTC Desire SoftBank X06HT equipped with Android 2.2. Getting location information uses locaton package(android.location) in AndroidSDK[13]. GPS that can be used outdoors is better than to obtain the signal strength from base station, so that this system primarily uses GPS. In case that this system does not use only GPS, it uses to obtain the signal strength from base station. Jump detection during Web browsing uses webkit package(android.webkit) in AndroidSDK. In feature extraction from Web Pages, JavaScript extracts HTML sources. The full text is extracted with tagsoup. Feature extraction from the full text of Web Pages uses WebAPI(e.g., Yahoo! keyphrase extraction). The process documenting of call of content uses speech package(android.speech) in AndroidSDK. Feature extraction from call contents is also performed. This system processing almost completely on a mobile phone to protect privacy. Fig. 1 depicts the configuration. From the same viewpoint, algorithm(e.g., Collaborative filtering) does not use, because others do not use the information recorded in the user's mobile phone.

5 CONCLUSION

This study proposes a search support system for a mobile phone with a touchscreen. This system records the user 's Web browsing history, call history, and location and automatically collects information based on the user's daily operations. By utilizing these information, A system to close to help users conduct searches implements. To protect the user's privacy, data is recorded in only the user's mobile device, and the user can view and remove the data. A system to help users conduct searches implements by varying the contents of Web pages and search queries recommendation to the user depending on the user's moving situation and location information.

Since evaluation indicates a time is delay for reading a Web page that users access on a daily basis, it is necessary to review the procession of keyword extraction. Specifically, it is necessary to reduce keyword extraction, or to perform keyword extraction when the user is' not operating his or her mobile phone.

Future tasks include reflecting the user's search, increas-

ing the information collected in the PC Web Browsing History, reducing keyword extraction time, improving the relevancy of recommendations and processing when recording data is little.

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