

# Context-based Local Hot Topic Detection for Mobile User

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**Abstract.** Mobile context-awareness becomes an important research topic since mobile information browsing is still difficult due to the limitations of mobile devices. On the other hand, it is easier to gather more user contexts because mobile devices are equipped with more sensors. In this paper, we introduce a real-time local hot topic browser which displays hot topics related to a mobile user. In order to retrieve user-related hot topics from microblogs, it exploits mobile user contexts such as location, activity, blogging history, and social relationship. Through taking advantage of these contexts, it reduces the search range of microblogs and infers user interests. It can filter out unrelated topics based on inferred preference. Through our proposed approach, a mobile user can be aware of topics related to interests surrounding the user. This paper describes details of the proposed framework and its components.

**Keywords:** Context-awareness, Twitter Topic Detection, Mobile Browser

## 1 Introduction

The number of smart phone users is continuously increasing with improvements in smart phone performance. Various kinds of mobile applications and mobile interaction approaches have been developed recently. They provide similar features as those existing desktop-based applications have provided. However, limitations of mobile phones, for example, small display and low computation power, bring difficulties to the retrieval and visualization of plenty of information. So, it becomes important to effectively retrieve contents related to information needs of mobile users. Even though mobile applications also have limitations in comparison with desktop-based applications due to limitations of mobile phones, it is easier to take advantage of user contexts because mobile phones are very personal and have built-in sensors [3]. Contextual information allows web sites and applications to provide user centric contents. Therefore, through exploiting contexts, it is possible to improve mobile applications and overcome the limitations.

This paper proposes a system which provides users with real-time local hot topics. Based on [4], we define a local hot topic as a topic mentioned frequently over a period of time by local users. For example, ‘*snow*’ was a local hot topic in New York on Dec 19th, 2009 since it was the most frequently used term by New

York users (There was snowstorm in New York on the day). In order to detect real-time topics, microblog messages are used as documents [5]. We use user context such as location, activity, blogging history, and social relationship, for providing context-aware contents. The location of a user is used to search local microblogs. We infer user interests from the other contexts. Through measuring similarity between interests and hot topics, we give high-priority to hot topics related to user interests. Then the system filters out less relevant hot topics. Finally, it shows user-related hot topics together with geo-tagged microblogs on a mobile device. The system consists of a server for detecting hot topics using massive data and a mobile client application mashed up with web services for visualizing the results. In this paper, we present details of the proposed approach.

## 2 Context-based Local Hot Topic Detection

Our proposed system consists of a server and a mobile client application. The server utilizes Twitter [2] as microblog contents for detecting real-time local hot topics. The mobile application gathers contexts and utilizes Microsoft Bing Map [1] for visualizing the local hot topics. It is developed on a smart phone equipped with a GPS and a digital compass for obtaining location context.

Figure 1 shows the framework of the system. First, user contexts are gathered by a mobile application and used to retrieve microblogs by server. The system detects local hot topics by temporal and spatial data comparison. Exploiting contexts including activity, blogging history and social relationship, it infers user interests. It measures similarity between topics and interests according to categories of them and filters out less relevant topics. Finally, the system provides the user with real-time local hot topics related to user interests.

### 2.1 User Context

We use user context for retrieving local microblogs and inferring user interests. First, sensory data obtained by mobile phone sensors, for instance, latitude and

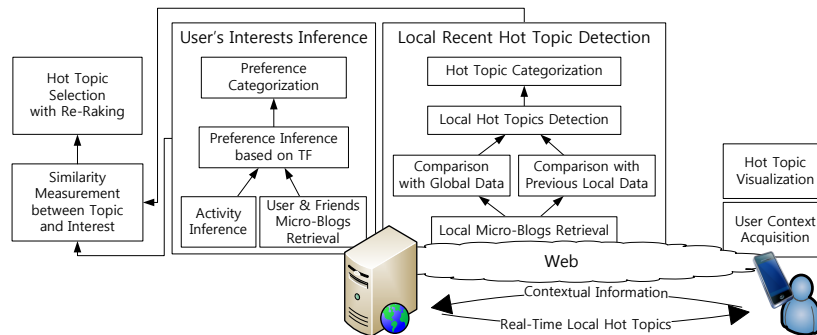


Fig. 1. Framework of the proposed system

longitude, is used to narrow down search range of microblogs to boundary area where a user is located. Through exploiting a G-sensor, a compass, GPS trajectories, and time, we can infer user activity, for example, ‘before go to work from home’ or ‘walking on street in the afternoon’. Both user activity and profile including blogging history are used to get user interests. Social relationship is also used to infer user interests because we assume that it reflects interests. Examples of contexts used in this paper are shown in table 1.

## 2.2 Detection of Local and Recent Hot Topics

The system provides local hot topics around a user. Since it is difficult to display all microblogs on a mobile display, we alternate with topics representing them. As explained in the above, for local topics, it exploits location contexts given by smart phone sensors. First, it retrieves recent local microblogs messages using location contexts. It calculates TFs (Term Frequency) with stop-word elimination and stemming to find the most frequently used terms. Then they are compared with both previous local and recent global TFs. The system can find rising hot topics and give more weight to local topics than global one. For example, ‘snowstorm’ and ‘NY Yankees’ are local hot topics if local users recently mention them more frequently than global users and previous one. Therefore, these two comparisons make the system detect local and recent hot topics.

## 2.3 Inference of User Interests

In order to select user-related contents, we exploit user context such as blogging history, activity, and social context including friendships. Because previous user’s data and social relations reflect user interests, the system analyzes them to infer user interests. It retrieves microblogs of a user and his/her friends and then it finds the most frequent terms from them. In addition to the terms, it considers user activity because preference can be shifted by activity. It gives more weight to topics related to user interests and activity. For instance, when a user prepares to go to work, a topic related to weather such as ‘snowstorm’ is provided rather than ‘NY Yankees’. In order to easily measure similarity between topics and interests, the system categorizes them into directories based on TF-IDF (TF-Inverse Document Frequency). Then, it measures similarities between categories of topics and interests and re-ranks the detected hot topics in order of similarity.

**Table 1.** Examples of contexts used in different domains

Domain	Examples
<b>Time</b>	morning/afternoon/night, lunch/dinner, working time, ...
<b>Location</b>	latitude, longitude, orientation home, work, school, shopping, street, restaurant, ...
<b>Transportation</b>	none, walk, car, subway, ...
<b>Social Relation</b>	friendship, near-by friends, ...



Fig. 2. Demonstration of the mobile application

## 2.4 Mobile Application

We develop a mobile application which gathers contexts from the built-in sensors and browses detected topics. When a user agrees to disclosing contexts to a server, the server exploits them and detects local hot topics related to the user. Because mobile phones don't have high-performance computing resources, heavy computations with a large amount of data such as topic detection, explained previously, are done by server. A user can browse where he/she is with a map and geo-tagged hot topic microblogs. A user can be aware of what happened in this area recently. Figure 2 shows a demonstration of the mobile application.

## 3 Conclusions

This paper introduces a real-time local hot topic browser which runs on mobile phones with mash up enabled web services. This system exploits user contexts to retrieve user-related hot topics. We expect that our proposed approach can reduce difficulties to retrieve information when users are mobile. We think it is necessary to enable context-awareness for effective information retrieval on a mobile device. In the near future, to verify the effects of contexts on contents, we need to do experiment on microblogs with various kinds of contexts.

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