

# Chapter 1

## A User Context–Aware Advertising Framework for the Mobile Web

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### ABSTRACT

*Context-aware advertising is one of the most critical components in the Internet ecosystem today because most WWW publisher's revenue highly depends on the relevance of the displayed advertisement to the context of the user interaction. Existing research works in context-aware advertising mainly focus on analyzing either the content of the web page (in which it is also called contextual advertising), or the keywords of the user search. However, we have identified the limitations of these works when being extended into mobile web, which has become a major platform for users to access Internet with thanks to the new lightweight web technologies and the development of mobile devices. These mobile devices are equipped with networking capabilities and sensors that provide versatile contexts including physical environment, user internal and social community. These contexts, which are far beyond just page content and search keywords, should be well organized and utilized for online advertising to gain better user experience and reaction. In this chapter, we point out the aforementioned limitations of the existing works in context-aware advertising when being applied for mobile platforms. We also discuss the characteristics of the contexts that are available on mobile devices and clearly describe the challenges of utilizing these contexts to optimize the advertisement on mobile platforms. We then present a context-aware advertising framework that collects and integrates the user contexts to select, generate, and present advertising content. The purpose of this framework is to provide the mobile users with targeted and purposeful advertisement. Finally, we discuss the implementation aspects and one specific application of this framework and outline our future plans.*

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## **INTRODUCTION AND MOTIVATION**

Online advertising constitutes a large portion in the financial ecosystem of web sites nowadays, including search engines, commercials, blogs, news, reviews etc. Driven by recent Internet revolution and the tremendous increases in on-line traffic, a huge growth in spending on online advertising is seen in last few years. eMarketer (2007) reports a total Internet advertising spending of nearly 20 billion US dollars just in 2007. This number supports the World Wide Web (WWW) to be amongst the top 3 advertisement medium, along with TV and print media. In these online advertisements, contextual advertising is a main category that we have identified in providing the advertising content matching the keywords of the user searches or the content of the web pages where the advertising content will be placed. The main players in this domain are major search engines and yellow pages on WWW. How to optimize the advertising content in this method is always an important research topic with the dual goals of increasing revenue of both publisher and advertising business.

An optimized context-aware advertising web should only provide ads that very match with the content of the Web pages, which therefore provides the users with information to their interests and allow advertisers to reach their potential customers in a non-intrusive way (Chartterjee & Hoffman & Novak, 2003, Wang & Zhang & Eredita 2002). In order to find the matching ads, two issues have to be carefully addressed: first is to identify and organize the applicable contexts in a user activity. Second, matching and ranking ads must be based on the identified and organized contexts.

Meanwhile, mobile computing technologies have profoundly transformed the way how people communicate and receive information from various media including WWW. With mobile devices becoming more powerful and affordable, the user base has expanded from the early business elites to ordinary people. By the end of 2007, there are

about 3 billion cellular phone subscribers, which is more than twice the number of PC users worldwide. Furthermore, the cellular phone coverage is estimated to reach the 90% of the world's 6 billion population by the year of 2010. The statistics clearly indicates that mobile phones are already the most pervasive information technology platform. In this regard, mobile information access is gaining widespread prominence with improving connection speed and access technologies leading to richer content explosion and user experience. The addition of mobility has opened up new prospects as devices are expected to be with users at all time providing reliable information on user intentions and contexts. The next generation of mobile applications would be adaptive in that they leverage mobility with context awareness in order to provide more customized information and, at meantime, more targeted advertisement. Thus, it is becoming imperative that context awareness be seen as one critical norm in developing advertising framework on mobile platforms.

Recent mobile computing research is investigating how to collect and analyze contexts of user activities in mobile environment (Bardram, 2004, Couder & Kermarrec, 1999, Pascoe, 1998, Wennlund, 2003). Because of the lack of heterogeneous context structures amongst different applications in this domain, the existing research works, however, have not identified and organized sufficient context resources from mobile user activities. In addition, even provided a large amount of contextual information, the existing works we have identified still cannot utilize this information to match and select advertising content. Considering addressing these challenges in mobile platforms that has limited processing capacities, a new framework is needed to provide well designed and illustrated solutions to these challenges.

Therefore, this chapter has described a user context-aware and processing framework applicable on mobile platforms. This framework defines context structure suitable for users' activities in mobile environment. This framework also

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