MyAds: A system for adaptive pervasive advertisements

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ABSTRACT

In this paper we show how pervasive technologies can be employed on a public-display advertisement scenario to enable behavioral self-adaptation of content. We show this through *MyAds*, a system capable of exploiting pervasive technologies to autonomously adapt the advertisement process to the trends of interests detected among the audience in a venue. After describing the rationale, the architecture and the prototype of MyAds, we describe the advantages brought by the use of such a system, in terms of impact on the audience and economic efficiency. The comparison of MyAds performances with different advertisement selection techniques confirms the validity of our advertisement model, and our prototype in particular, as a means for maximising product awareness in an audience and for enhancing economic efficiency.

1. Introduction

Advertising has an extreme importance in today's society, and business companies invest constantly growing parts of their budgets in engineering ways to attract higher numbers of customers towards the products and services they offer. Historically, advertisement has always followed the main technological trends exploiting, from time to time, the new channels that technological development has been capable of providing [1]: newspapers, billboards, radio, television and, more recently, the web and email.

The traditional advertisement strategy consists of taking a generic audience to achieve product awareness through a massive bombardment of advertisements. However recent marketing studies are drawing attention to the fact that this strategy, besides being economically onerous for companies, is becoming less effective as the bombardment strategy sometimes challenges the audience in reaching a peak of irritability [2], for instance through email spam.

Given the above situation, new advertisement techniques and strategies need to be studied. Advertisement through the web [3,4], for instance in the form of so called *web ads*, represents a first attempt in the direction of refining the advertisement policy, where user potential needs and preferences are detected, on the basis of past activities, to the end of suggesting links to products of potential interest. Several enterprises in the Internet market arena, such as *Google* and *Amazon*, have adopted the strategy of suggesting links to products or services on the basis of user information (i.e. past navigation history, purchases or preferences). Behind this process lies the business strategy of refining advertisement in a way to suggest products and services only to potentially interested users, leaving uninterested ones aside (thus avoiding negative impact).

Web ads represent only a first step towards the design of adaptive pervasive advertisement systems. Given web ads' success, it is natural to imagine the impact of a fully pervasive environment [5,6], in which several distinct pervasive

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devices concur in building a snapshot of the audience at a specific venue: whereas traditional advertisement systems rely on companies pushing contents to users with the hope to meet a latent need, pervasive advertisement explores the way of providing contents in a revolutionary sort of effective publish/subscribe-like [7] way: users have the ability to express (implicitly or explicitly) their interest in a product, in an event, or a pattern of events, and are subsequently notified of any event, generated by a publisher, which matches their registered interest. Given these considerations, pervasive advertisement appears to have all the characteristics for a fast and effective commercial diffusion.

Large advertisement displays already pervade our cities and everyday environment. These are strategically placed in locations where the audience turnover is high, thus in shopping malls, university cafeterias, metro or railway stations just to mention a few. As of today, these displays are typically governed by policies whereby advertisements are displayed sequentially in a static cyclical way regardless of the audience the display is exposed to. In this paper we focus on the idea of achieving adaptive, i.e. *audience-sensitive*, advertisement conjugating the rationale of adapting ads to users' characteristics with the display-based advertisement technique. In more detail, we present the architecture and a prototype for an innovative advertisement system called *MyAds*, whereby the exposure of advertisements to a potentially interested audience can be maximized. MyAds features a modular and adaptive architecture for capturing and processing user profiles and an advertisement allocation policy based on a real-time auction. The latter enhances the competition among advertising companies in such a way to allow allocation of an advertisement slot to the advertiser who values it the most. Potential advertising companies are thus given real-time information they can employ in the process of evaluating (whereas not predicting) the impact of the exposure of an own advertisement on the basis of dominant interests in the current audience. This, in turn, enables them to refine the investment, from time to time, as this information is disclosed to them.

Summarizing, our paper makes at least 3 contributions: (i) it presents an innovative paradigm of pervasive advertisement for the detection of users through short-range wireless technologies enabling the display logic to "sense and understand" the characteristics of its potential audience; (ii) it proposes a distributed prototype platform that shows how adaptive pervasive advertising systems are potentially easy to realise and deploy while yet effective from a commercial point of view; (iii) it proposes and evaluates a content selection paradigm based on auctions and experimentally studies its impact by comparison with other possible strategies.

The remainder of this paper is organised as follows: in Section 2 we introduce scenario and approaches to adaptive pervasive advertisement. In Section 3 we describe the general architecture of the MyAds system. In Section 4 we describe the way components have been developed in the prototype while, in Section 5, we discuss, study and evaluate strategies for advertisement selection. Finally, Section 6 draws some conclusion and identify areas for future research.

2. Adaptive pervasive advertisement: Scenarios and approaches

Adaptive pervasive advertisement is a relatively new advertisement paradigm, whose nature is strongly influenced by the peculiar characteristics of the application scenario. In the remainder of this section, we detail the scenario we consider in our work and introduce related research and industrial approaches.

2.1. Scenarios

The scenario considers an environment equipped with sensorial and computational capabilities as a modern exhibition centre, a museum or a stadium, in which it is realistic to assume the presence of a pervasive infrastructure of embedded devices such as sensors of various types, Wi-Fi connections, RFID tags and other location systems. Without loss of generality, we assume that visitors will carry portable devices, such as PDAs or smartphones, and/or be provided with RFID-based tickets storing a sort of personal profile embedding implicit heterogeneous information about the user (e.g. the nature of the visit, visitor category, or eventual fees paid). This profile could be furthermore enriched with explicit personal information (e.g. sport practiced, favourite music, hobbies, etc...) provided, on a voluntary basis, during a registration/subscription (to events or services) phase from the user itself.

We consider the presence, in the venue, of a number of advertising displays that shows information about the centre itself, events thereafter hosted and organised, as well as third-party commercial advertisements. Public point of interest may afford the costs of deploying such infrastructure if this enables the provision of good services to visitors (and accordingly attract a higher number of persons) and an increase in the revenue.

Moreover, potential advertising companies can be interested in delivering their commercials on the basis of real sampling of dominant interests in the current audience, and refining their investments, from time to time, as this information is disclosed to them.

Therefore, we mainly recognise three typologies (groups) of people that have a direct or indirect stake in such a scenario because they can affect, or be affected by, a pervasive advertisement system:

- the *Audience*, or i.e. people attending at broadcasted ads;
- the *Display Owners*, i.e., those who sustain the cost for displays' purchase and maintenance;
- the *Advertisers*, i.e., industrial companies that want to maximise the exposure of products to interested customers taking advantage of information about audience's interests that a system for an adaptive pervasive advertisement could make available;