Profiling and targeting opportunities in pervasive advertising

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Abstract. Pervasive computing has created a need to profile users of these systems in a way never required in traditional computing. To pursue many of the commonly expected goals of pervasive advertising, we also need rich sources of profile information to build up a model of a user's identity and so target ads to them more effectively. We present an advertising platform that uses information gleaned from a person's Facebook profile to target personalised ads to them in a pervasive environment. Our system uses the existing Facebook application platform and has tunable privacy settings. Secondly, we propose a new class of advertisements that are made possible with this platform.

1 Introduction

Adaptive systems that operate within the environment have always needed to be responsive to the user, by being aware of the presence of each individual user, as well as ideally some personal information about them. The presence of users within a particular space can be sensed via camera systems, or near field communication technologies such as RFID or Bluetooth.

Uniquely identifying and remembering these users, and storing and accessing personal profile information about them has presented a more difficult problem. Some systems learn about the user through their implicit and explicit interactions with the environment. Other techniques require the user to explicitly provide this information to each system by entering it manually, which puts the onus on the user to populate this new record of their preferences. Systems like GroupCast identify users by wireless badges and display content to them based on pre-stored profiles [3]. Mahato et al. describe a method to encode profile information into the broadcasted "friendly name" of a Bluetooth device [2].

Techniques such as these require an external, newly-generated profile to base their adaptations on. We argue that users will be unlikely to maintain two or more profiles to service the personalisation needs of multiple separate systems. We are investigating ways to harness pre-existing profiles which users already keep up to date, and believe such a platform to be an ideal foundation for pervasive advertising.

2 Pervasive profiles

The envisaged new generation of pervasive, population-aware advertisements will ideally go beyond presence and demographic information and tailor their messages more directly towards individual people in the environment. A well-designed personalised advertisement may be more persuasive to a customer than a traditional billboard. However, we can expect users to be skeptical of an advertising entity's attempts to gather information about them.

On the other hand, users have been found to be quite willing to generate and share personal information freely on social networking websites like Facebook, Bebo, LinkedIn and MySpace. This information goes beyond merely demographic information on age, sex or nationality, and often encompasses significantly personal information such as a user's favourite musicians, films, and groups that they belong to[1]. Beyond all of this information, these social networking websites also catalogue a user's designated "friends" who are also present on the site, giving a rich view into the life of each person.

Facebook incorporates an application platform, which allows activity that occurs elsewhere to be integrated into a Facebook user's profile. As the social network website becomes a digital nexus, bringing together disparate threads of activity from across the web (for example, photos posted to flickr, status updates on twitter, social bookmarks on delicious), they come to represent a complete picture of the user's interests.

We see an opportunity here to take this rich seam of market data available through social networking websites, and make it available within a framework for pervasive advertising. We have developed such a platform, which consists of a method to gather profile information using the Facebook application platform, which links a user's real-world presence to their online presence. We can identify users uniquely by their Bluetooth-enabled devices—most commonly mobile phones—and through nothing more than their movement throughout an environment, we can provide rich profile information to applications running nearby.

3 Deploying Facebook applications in the wild

The Cityware project has previously deployed a set of Bluetooth-enabled nodes around a city environment, that tracks users who have joined the system [1], which works in a similar way to our system. Users can get involved by installing an application into their Facebook profiles and entering their mobile phone's unique MAC address into it. Once the application is granted access to the user's profile, it can then see some or all of the user's personal information (based on Facebook's relatively comprehensive privacy controls).

The application is given access to a wide range of profile information, from sex, age and education history to images of the user, and identities of their friends, including whether they are in a relationship (including, in some cases,

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[1] The Facebook platform API:
http://wiki.developers.facebook.com/index.php/Users.getInfo

the identity of their significant other). These fields can be selectively hidden from an application by the user, leaving their privacy in their hands. Our application can be accessed and installed at http://apps.facebook.com/basadaeir.

We have a collection of networked Mac mini computers deployed around our research lab which can then sense a user's presence via their Bluetooth handset, and go on to access their Facebook profile information by looking up their MAC address in a local database. This builds on previous work we have done on distributed presence-aware collaborative tools for office blocks [5].

Due to the limited range of the Bluetooth wireless system, this design allows us to target proximate users with ads specific to their interests on the screens attached to the Mac minis. Secondly, if we place one of these machines in an area of high-traffic, such as a doorway or portal into a larger area, we can track users as they enter an area, and perform more demographic analysis over a population of users that we know to be in the vicinity. There is value both in this aggregated information about a captive audience, as well as the more fine-grained information about individual people.

3.1 New Privacy Issues

Bringing digital information into the physical world like this requires careful consideration. The visibility of the displays in an environment poses an acute privacy problem. Advertisements that are highly-targeted to one single user will undoubtedly be observed by other customers, which raises the likelihood of an unfortunate ad being shown to a wider audience than desired. The user's identity must be protected at all times if these type of systems are to be accepted.

A practice of "privacy in numbers" could apply here: from the well known adage of "safety in numbers," advertisements based on the aggregate interests and characteristics of the people in its environment would be safer to display on public screens. For example, metrics like the ratio of male to female, the age distribution, or some categorisation of shopping preference.

4 New advertising opportunities

Though the rich profile information that is exposed in this manner is obviously very attractive to advertisers, we are eager to explore alternate visions of future advertising which do not require such deep disclosure of personal information by the users in the system. We also foresee a chicken-and-egg type problem wherein the inventory—the actual ad content—that is highly targeted to a single person simply does not exist, because the means to deliver it doesn't exist yet either.

For the film *Minority Report*, director Steven Spielberg hired prominent futurist thinkers to present him a viable view of the future, which included the future of advertising. In this view of the year 2054, the privacy battle between consumers and corporations which we have yet to live through has been decided in favour of corporations, and so shops know each consumer by name. The person's eyes are literally the gateway to their personal profile, taking the common advertising term "eyeballs" to its grotesque extreme.

The above example is not the future of advertising that we want to see. If indeed pervasive advertising becomes commonplace, we will have a wide range of new digital, networked displays distributed around shopping areas and recreational environments. This proliferation of displays offers a chance at a new generation of information access in public spaces. Rather than designing a better billboard specifically to target ads more effectively at individual users, we are researching ways to improve the shopping experience using this information.

Advertisements that are aware of the users within a space or immediately nearby offer a range of new opportunities for targeted information displays:

1. Ads can be reactive to repeat customers.
2. People who are "hubs" in the larger social network (those with many connections) are more valuable to shops, as they will have more influence among their peer group, acting as mavens for products, shops or services. Thus a shop could preferentially offer them benefits and special offers.
3. As the advertisement can deduce how many people in an area know each other by analysing their friend lists, businesses in the area (restaurants in a shopping mall for example) could proactively offer promotions for groups of four or more people who arrive together once they have been observed in the mall together.

These new customer interactions allow the shopping outlets to see the customer as a resource to be optimised. Based on the user's preferences, they can be directed towards shops which want to provide them with better deals and special offers, in a similar manner to the MobiDiC system [4]. Shops with similar customer bases can coordinate to share customers by cross-promoting products. We think that these type of opportunities add a complementary approach to more traditionally targeted advertising.

References

1. V. Kostakos and E. ONeill. Capturing and visualising bluetooth encounters. In *adjunct proceedings of the conference on Human factors in computing systems (CHI 2008)*, Florence, Italy, April 2008.
2. H. Mahato, D. Kern, P. Holleis, and A. Schmidt. Implicit personalization of public environments using bluetooth. In *CHI '08: CHI '08 extended abstracts on Human factors in computing systems*, pages 3093–3098, New York, NY, USA, 2008. ACM.
3. J. McCarthy, T. Costa, and E. Liongosari. UniCast, OutCast & GroupCast: Three Steps Toward Ubiquitous, Peripheral Displays. *Lecture Notes in Computer Science*, pages 332–345, 2001.
4. J. Müller, M. Jentsch, C. Kray, and A. Krüger. Exploring factors that influence the combined use of mobile devices and public displays for pedestrian navigation. In *NordiCHI '08*, pages 308–317, New York, NY, USA, 2008. ACM.
5. M. Stabeler, G. Stevenson, S. Dobson, and P. Nixon. Basadaeir: Harvesting user profiles to bootstrap pervasive applications. In *Pervasive 2009 Late-breaking results*, 2009. In submission.