SPONTANEOUS AND PERSONALIZED ADVERTISING THROUGH MPEG-7 MARKUP AND SEMANTIC REASONING

Exploring New Ways for Publicity and Marketing over Interactive Digital TV

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Abstract: Publicity is one of the sustaining pillars of the television industry. In an increasingly competitive market, the involved agents are striving to exploit all the possibilities to get revenues from advertising, but their techniques lack targeting and are usually at odds with the comfort of the TV viewers. In response to those problems, this paper introduces a new advertising model that aims at harnessing the interactive capabilities of the modern TV receivers (either domestic or mobile ones). The approach is based on automatically identifying products which are semantically related to the things on screen that catch the viewer's attention, and then assembling interactive services that provide him/her with personalized commercial functionalities.

1 INTRODUCTION

Numerous market studies point out a significant drop in the effectiveness of the advertising techniques currently employed on TV, suggesting that publicity needs to be reinvented in the years to come (Kim, 2006). In order to preserve such a fundamental source of income, it is necessary to address the limitations of those techniques, which stem mostly from presenting the same products to all the TV viewers in a way that interferes (temporally or spatially) with their enjoyment of the audiovisual contents.

Our vision in this paper is that the solution to the aforementioned problems will come from the growing development of the *Interactive Digital Television* (IDTV) technologies, due to the possibility of transmitting interactive software applications jointly with the audiovisual contents. Specifically, we present here a system that implements a new advertising model following three basic steps:

- Broadcasting the audiovisual contents along with metadata characterizing the things that will appear on screen in the different scenes.
- Identifying products which are semantically related to the things that draw the viewer's attention on the screen.
- Assembling interactive services (hereafter, *i-spots*) that provide the viewer with commercial functionalities suited to his/her interests and needs.

We refer to this model as *spontaneous and personalized advertising*, because it does not require inserting publicity in the audiovisual contents, and it adapts to the peculiarities and circumstances of each individual viewer. The following section describes the main design features of the implementing system; after that, Section 3 discusses a sample application scenario, and the paper finishes with a summary of conclusions in Section 4.

2 SYSTEM OVERVIEW

Our advertising system assumes a receiver architecture following the GEM standard (DVB consortium, 2006), with a Java-based middleware defining the mechanisms available to access the broadcast networks and the return channels, to construct the interactive applications, etc. This architecture is now common for the fixed IDTV receivers at homes, and is also being considered for the incipient developments over mobile receivers (DVB consortium, 2004).

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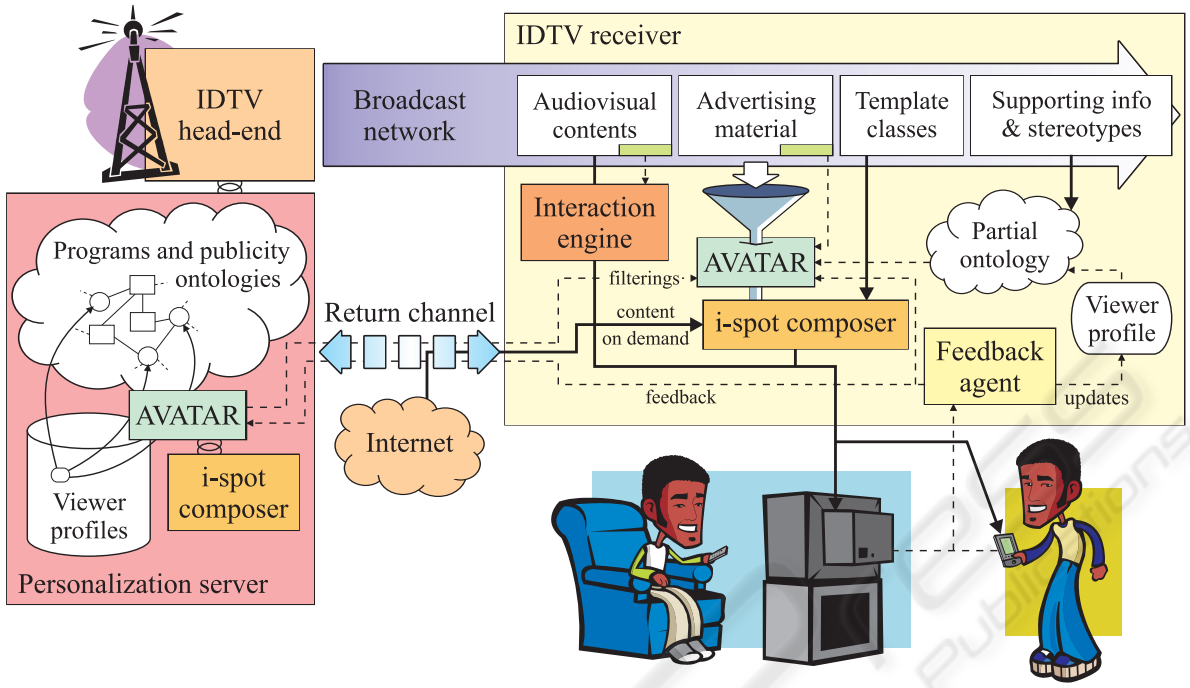

Figure 1: The operational scheme of the spontaneous and personalized advertising model.

The operational scheme of our system, shown in Figure 1, includes four core elements, to be described in the following subsections. Since the personalization tasks exceed (by far) the memory and computing capabilities of an IDTV receiver, the elements involved are primarily placed in remote *personalization servers*; nonetheless, there are also local instances in the receivers to enable sub-optimal operation in cases of intermittent, sporadic or null access to a return channel.

2.1 The Interaction Engine

The *interaction engine* is the element in charge of detecting the viewer's interest for the things appearing on screen. To this aim, it introduces different interactive elements depending on the input capabilities of the receiver:

- When using a remote control or the keypad of a mobile phone, a certain button opens a menu listing the things that have appeared on the current scene thus far. The viewer can then navigate to select the particular thing he/she is interested in.
- When using a device with a touch screen (for instance, a PDA), the viewer can click directly on the things he/she wants with a finger or using a stylus.

Obviously, the system allows interaction only with the things characterized in the metadata linked to the audiovisual contents, which are expressed following the MPEG-7 standard (Manjunath et al., 2002). Whichever the interaction method, the viewer can choose to launch i-spots immediately, or later (most commonly, when the current program finishes). In the former case, if the IDTV receiver allows operation as a PVR (*Personal Video Recorder*), it is even possible to do *time shift*, i.e. to pause the programs while the viewer explores the i-spot, and then resume the viewing.

2.2 The AVATAR Recommender

The *AVATAR recommender* is responsible for identifying products related to the things that have caught the viewer's attention, and then selecting those which best match his/her preferences, interests and needs. This is done by applying the *semantic reasoning* algorithms presented in (Blanco-Fernández et al., 2006) over the following sources of information:

- The metadata describing the things and the action on screen.
- *Ontologies* that characterize and interrelate audiovisual contents, commercial products and advertising material —using metadata fields from the TV-Anytime specifications (TV-Anytime forum,

2003), MPEG-7 and several *ad hoc* syntaxes.

- A *profile* containing demographical data of the viewer (age, gender, job, ...), together with pointers to contents/products that he/she has evaluated in the past (each one labeled with a *degree of interest*, DOI) and products that he/she owns (labeled with a *degree of satisfaction*, DOS).

The filtering is triggered by context information indicating what the viewer is watching. The personalization servers proceed over complete ontologies and viewer profiles, whereas the local instances of AVATAR handle partial versions due to the limited resources. In the latter case, the quality of the reasoning can be enhanced using ontological information and stereotypical profiles received through the broadcast networks. This supporting material, inserted in the IDTV head-end, can be tailored to the programs and the advertisements which are broadcast at any moment.

2.3 The I-Spot Composer

The product selections made by AVATAR are the entry for the *i-spot composer* to assemble interactive services that let the viewers navigate for detailed information about the products, search for the closest establishment where they can be bought, purchase online, subscribe to the notification of novelties, etc.

It is foreseeable that many i-spots will provide essentially the same functionality. In our system, therefore, they are assembled from *template classes*, and it is up to the i-spot composer to decide which templates to use (considering hardware requirements, return channel availability, ...) and which contents to lay over them (received through broadcast or downloaded from the Internet). The outcome of those decisions is later used in the receivers to start the services, retrieving the corresponding templates from the broadcast stream and setting them up using the Java *reflection* mechanisms. This approach enables good use of bandwidth while not increasing the computational cost for the receivers, as it is not necessary to modify or recompile any source code.

Remarkably, the selection of contents in the i-spot composer can be driven by the same semantic reasoning algorithms of AVATAR, to increase the odds that the viewer will appreciate the information included in the i-spots.

2.4 The Feedback Agent

Just because the interests, preferences and needs of the viewers may vary with time, the model of spontaneous and personalized advertising requires mechanisms to update their profiles by capturing new data and discarding obsolete knowledge. In literature, one can find proposals to do this implicitly, by inferring information from the viewers' interaction with a system, or explicitly, by asking the viewers to enter some information from time to time.

Our prototype system supports both forms of feedback to recompute the DOI values stored in the profiles, for which it applies the same functions of *gradual forgetting* and *relevance feedback* defined in (Montaner et al., 2002). The implicit form gathers information by monitoring how long the viewer takes to learn about the different products, whether he/she decides to buy, hire or subscribe, and how much money he/she spends. On the other hand, the explicit form relies on interactive questionnaires, constructed just the same way as the i-spots. We also provide the viewers with questionnaires to enter DOS values for the products they own, and to update their demographical data.

3 A SAMPLE SCENARIO

For a brief example, consider the case of a TV viewer whose profile indicates, among other facts, that she has two children and a middle-income economy (demographical data), that she is a loyal viewer of programs devoted to travel (viewing history), and that she is subscribed to an oenology magazine (consumption data). The viewer is watching a documentary about Switzerland on her PDA, with the current scene describing a town in the Geneva canton. As shown in Figure 2, the metadata linked to this part of the audiovisual contents identify four things on screen, namely the village, the sky, the lake and the vineyard. These entities are related to some concepts in the system ontologies, represented by the gray and dashed elements of the figure.

If the viewer clicked over the village, our system would be able to locally assemble one i-spot describing affordable trips and tourist attractions around Geneva, getting the contents from broadcast. Alternatively, if bi-directional communication were available, another i-spot could be designed that described rural tourism houses in the viewer's area, emphasizing those which offer facilities for children, and giving the viewer the possibility to book a room for her holidays (see Figure 3).

On the other hand, clicking on the vineyard, the viewer's expertise in wine would take our system to display a list of remarkable vintages (with i-spots allowing her to purchase some bottles), trips to famous wineries, etc. Other viewers would be offered wines

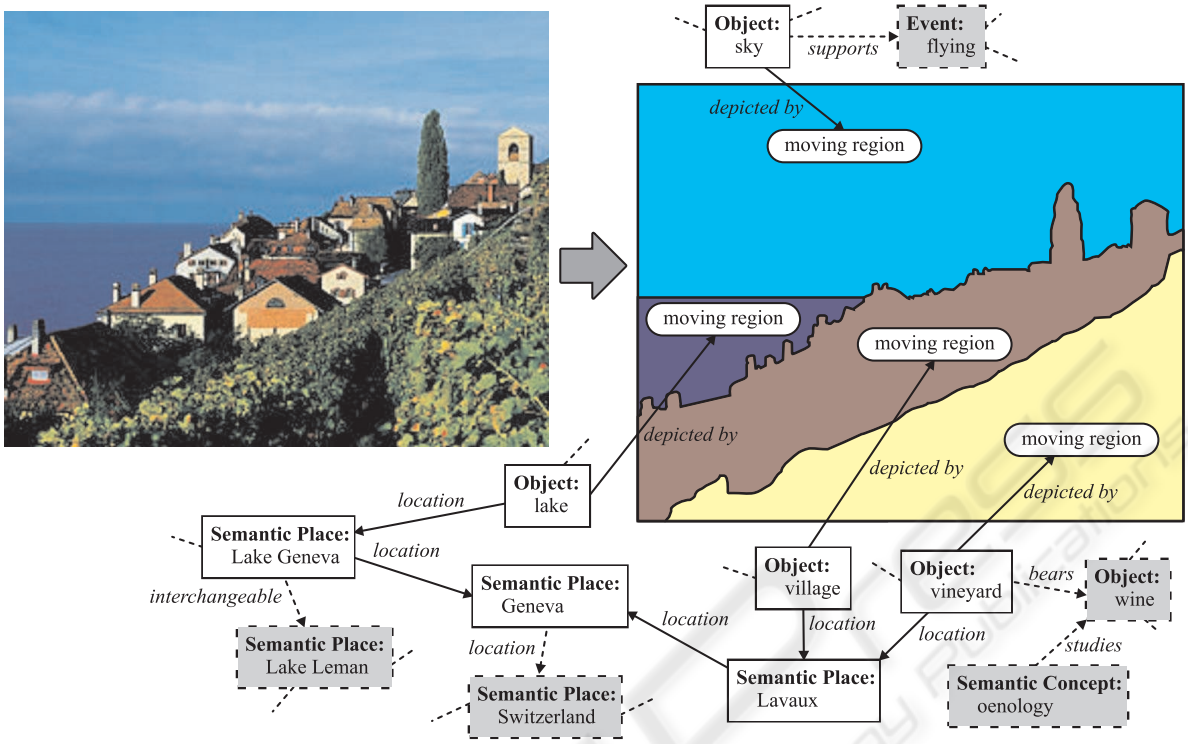

Figure 2: The image on screen, with sample MPEG-7 markup and links to the system ontologies.

Figure 3: A personalized i-spot.

for everyday consumption, guides for cultivating, or simply indications to get to the nearest bar.

4 CONCLUSIONS

In this paper, we have outlined the implementation of a new advertising model for Interactive Digital TV, that exploits the markup of audiovisual contents to face the viewers with products semantically related to the things that catch their attention on the TV screen. This approach is intuitive and pleasant for the viewers, because it does not interfere with their perception of the TV programs and, besides, it removes the need to populate the screen with advertising material.

In what concerns commercial exploitation, our proposal can achieve much better targeting than the current advertising techniques, inasmuch as the publicity is selected by taking into account the preferences, interests and needs of each individual viewer. In this regard, to the best of our knowledge, there is only one precedent of personalized advertising for TV in (Lekakos and Giaglis, 2004), but that work was limited to selecting commercial breaks.

Finally, we want to emphasize that the automatic aggregation of interactive commercials is certainly one step forward to harness the potential of the IDTV technologies to support *t-commerce* and *m-commerce* platforms —as argued in the survey of (Myers Group, 2006), that potential is enormous, but remains heavily underexploited. Our current work is precisely devoted to this part of our system, in an attempt to port our solutions to the standard technologies used for automatic service composition in the field of Web Services (Milanovic and Malek, 2004).

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