# E–Government Portals Personalization

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## INTRODUCTION

Several governments across the world enhance their attempt to provide efficient, advanced, and modern services to their users (citizens and businesses) based on information and computer technologies (ICT) and especially the Web. The remarkable acceptance of this powerful tool has changed the way of conducting various transactions and offers citizens, businesses, and public authorities' limitless options and opportunities. Besides citizens' awareness and expectations of Web-based, public services have also increased in recent times.

E-governments' Web portals serve as integrated gateways through which millions of users can access information, services, and other available applications. The complexity and functionality of these Web portals vary significantly from information publishing, linking of existing Web sites, or single agency transactions, to transactions requiring integration of multiple agencies operating as fully one-stop shops for citizens (Gant & Burley Gant, 2002).

The problem arises when e-government portals turn out to large collections of sources and the users suffer from this information overload. To alleviate this problem, personalization becomes a popular remedy to customise the Web environment for users. Web personalization can be described as any action that makes the Web experience of a user personalized to his or her needs and wishes.

This article presents the way an e-government portal can deploy personalization techniques in order to support intelligent interactions with e-citizens. Specifically, it defines Web personalization, describes the tasks that typically comprise the personalization process, and demonstrates the close relation between personalization and Web mining. Finally, it illustrates the future trends and discusses the open issues in the field.

## BACKGROUND

The profusion of resources on the Web has prompted the need for developing automatic mining techniques, thereby giving rise to the term Web mining. Web mining is the application of data mining techniques on the Web in order to discover useful patterns and can be divided into three basic categories: Web content mining, Web structure mining, and Web usage mining (Kosala & Blockeel, 2000). The first category includes techniques for assisting users in locating Web documents (i.e., pages) that meet certain criteria, while the second relates to discovering information based on the Web site structure data. The last category focuses on analyzing Web access logs and other sources of information regarding user interactions within the Web site in order to capture, understand, and model their behavioural patterns and profiles and thereby improve their experience with the Web site.

The close relation between Web mining and Web personalization has motivated much research work in the area. Web mining is a complete process and consists of specific primary data mining tasks, namely data collection, data reprocessing, pattern discovery, and knowledge post-processing. The deployment of Web mining in the e-government domain relates to the analysis of citizen behaviour and the production of adequate adaptations. For example, given a specific citizen, the presentation of required information from an e-government portal can be tailored to meet individual needs and preferences by providing personal recommendations on topics relative to those already visited. This process is typi-

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cally based on a solid user model, which holds up-to-date information on dynamically changing citizen behaviour.

Recently, semantic Web is coming to add a layer of intelligence in Web-based applications (Berners-Lee, Hendler, & Lassila, 2001). The capacity of the semantic Web to add meaning to information, stored in such way that it can be searched and processed, provides greatly expanded opportunities for Web-based applications. The combination of Web mining and semantic Web has created a new and fast-emerging research area that of semantic Web mining. The idea behind the use of the semantic Web to generate personalized Web experiences is to improve Web mining by exploiting the new semantic structures. With the integration of semantic Web mining technologies, the provided Web applications will become smarter and more comprehensive (Markellou, Rigou, Sirmakessis, & Tsakalidis, 2004). In this framework, ontologies that comprise the backbone of the semantic Web appear as a promising technology for integrating with e-government applications, since they offer a way to cope with heterogeneous representations of Web resources. The reason that ontologies are becoming so popular is due to what they promise: *"a share and common understanding of a domain that can be communicated between people and application systems"* (Davies, Fensel, & Van Harmelen, 2003).

## USE CASE: A PERSONALIZED E-CITY PORTAL

An e-city portal can provide a variety of information and services to the citizens as depicted in Table 1. To access the advanced options and to assure portal's reliable and efficient operation, a security policy can be adopted (the citizen uses unique login/password when entering the site). Other functionalities may include multilingual support, statistical data, surveys, access for people with special needs, multiple

communication channels (Web, e-mail, SMS, etc.), portal's administration and content management tools, availability (24/7), layered functionality, open-structure, etc. (Tsoukalas & Anthopoulos, 2004). Moreover, the pilot site is based on an ontological schema, which allows semantic annotation and has the ability to perform semantic querying and ontology-based browsing. This ontology formulates a representation of the site's domain by specifying all of its concepts, the relations between them and other properties, conditions and regulations.

The overall personalization process comprises the following tasks: data collection, data preparation, data analysis, knowledge discovery, and personalization (Figure 1).

## Data Collection

Collecting accurate and sufficient data about the portal's users is a crucial task of the whole personalization process. Reactive and non-reactive approaches can be used for acquiring user data depending on whether the user is actively engaged in the process or not. In the reactive approach, the user is asked explicitly to provide the data using questionnaire forms, filling-in preference dialogs, or inserting keywords in specific fields. In the non-reactive approach, the portal implicitly derives such information without initiating any interaction with the user using acquisition rules, plan recognition, and stereotype reasoning. However, in both approaches, we have to deal with different but equally serious problems. In the case of explicit profiling, users are often negative about filling in questionnaires and revealing personal information online, they comply only when required, and even then the submitted data may be poor or false. On the other hand, in implicit profiling, even though our source of information is not biased by the users' negative attitude, the problems encountered derive once again from the invaded privacy concern and the loss of anonymity. In the specific

*Table 1. E-city portal's information and services*

| Information/services for all users | Information/services for registered users |
| --- | --- |
| – Online city guide. | – Information publication and interconnection of various Internet sites. |
| – Guidelines for the citizens to perform certain governmental transactions. | – Information search, retrieval, and data submission for further processing. |
| – Opportunities for financing e.g. call for proposals, contests, etc. | – Send/receive e-mail to/from public authority, containing personal information. |
| – Laws, presidential enactments. | – Online filling-in of applications' forms, life episodes (having a baby, change of address, emigration, driving license acquisition), financial transactions, emergencies' confrontation, etc. |
| – Announcements, news, press releases. | |
| – Links to other e-governmental portals/sites and sources of interesting information. | |
| – Information searching, help desk, FAQ, portal's map, etc. | – E-voting, e-learning, e-commerce, e-auctions, online libraries, etc. |
| | – Discussion forum with other citizens, complaints' submission. |

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