

Chapter 8.6

On the Use of Soft Computing Techniques for Web Personalization

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ABSTRACT

Due to the growing variety and quantity of information available on the Web, there is urgent need for developing Web-based applications capable of adapting their services to the needs of the users. This is the main rationale behind the flourishing area of Web personalization that finds in soft computing (SC) techniques a valid tool to handle uncertainty in Web usage data and develop Web-based applications tailored to user preferences. The main reason for this success seems to be the synergy resulting from SC paradigms, such as fuzzy logic, neural networks,

and genetic algorithms. Each of these computing paradigms provides complementary reasoning and searching methods that allow the use of domain knowledge and empirical data to solve complex problems. In this chapter, we emphasize the suitability of hybrid schemes combining different SC techniques for the development of effective Web personalization systems. In particular, we present a neuro-fuzzy approach for Web personalization that combines techniques from the fuzzy and the neural paradigms to derive knowledge from Web usage data and represent the knowledge in the comprehensible form of fuzzy rules. The derived knowledge is ultimately used to dynamically suggest interesting links to the user of a Web site.

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INTRODUCTION

The growing explosion in the amount of information and applications available on the World Wide Web has made more severe the need for effective methods of personalization for the Web information space. The abundance of information combined with the heterogeneous nature of the Web makes Web site exploration difficult for ordinary users, who often obtain erroneous or ambiguous replies to their requests. This has led to a considerable interest in Web personalization which has become an essential tool for most Web-based applications. Broadly speaking, Web personalization is defined as any action that adapts the information or services provided by a Web site to the needs of a particular user or a set of users, taking advantage of the knowledge gained from the users' navigational behavior and individual interests, in combination with the content and the structure of the Web site. In other words, the aim of a Web personalization system is to provide users with the information they want or need, without expecting them to ask for it explicitly (Nasraoui, 2005; Mulvenna, Anand, & Buchner, 2000).

The personalization process covers a fundamental role in an increasing number of application domains such as e-commerce, e-business, adaptive Web systems, information retrieval, and so forth. Depending on the application context, the nature of personalization may change. In e-commerce applications, for example, personalization is realized through recommendation systems which suggest products to clients or provide useful information in order to decide which products to purchase (Adomavicius & Thuzilin, 2005; Baraglia & Silvestri, 2004; Cho & Kim, 2004; Mobasher, 2007b; Schafer, Konstan, & Riedl, 2001). In e-business, Web personalization additionally provides mechanisms to learn more about customer needs, identify future trends, and eventually increase customer loyalty to the provided service (Abraham, 2003). In adaptive Web sites, personalization is intended to improve the organization and presentation of the

Web site by tailoring information and services so as to match the unique and specific needs of users (Callan, Smeaton, Beaulieu, Borlund, Brusilovsky, Chalmers et al., 2001; Frias-Martinez, Magoulas, Chen, & Macredie, 2005). In practice, adaptive sites can make popular pages more accessible, highlight interesting links, connect related pages, and cluster similar documents together (Perkowitz & Etzioni, 1997). Finally, in information retrieval, personalization is regarded as a way to reflect the user preferences in the search process so that users can find out more appropriate results to their queries (Kim & Lee, 2001; Enembreck, Barthès, & Ávila, 2004).

The development of Web personalization systems gives rise to two main challenging problems: how to discover useful knowledge about the user's preferences from the uncertain Web data and how to make intelligent recommendations to Web users. A natural candidate to cope with such problems is **soft computing** (SC), a consortium of computing paradigms that work synergistically to exploit the tolerance for imprecision, uncertainty, approximate reasoning, and partial truth in order to provide flexible information processing capabilities and obtain low-cost solutions and close resemblance to human-like decision making. Recently, the potentiality of SC techniques (i.e., neural networks, fuzzy systems, genetic algorithms, and combinations of these) in the realm of Web personalization has been explored by researchers (e.g., Jespersen, Thorhauge, & Pedersen, 2002; Pal, Talwar, & Mitra, 2002; Sankar, Varun, & Pabitra, 2002; Yao, 2005).

This chapter is intended to provide a brief survey of the state-of-art SC approaches in the wide domain of Web personalization, with special focus on the use of hybrid techniques. As an example, we present a neuro-fuzzy Web personalization framework. In such a framework, a hybrid approach based on the combination of techniques taken from the fuzzy and the neural paradigms is employed in order to identify **user profiles** from Web usage data and to provide dynamical

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