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Adaptable and Adaptive Hypermedia Systems

(Book Review)

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Introduction

This book contains more than an overview of different adaptable and adaptive hypermedia systems (AAHS). It provides a broad range of information about them and considers the incorporation of adaptation issues in hypermedia systems at different stages of the life cycle. Starting with requirements analysis of AAHS as the first section, architectural aspects, modelling techniques, application development, and evaluation methodologies are addressed in further sections. The book is organized in 16 chapters divided into the above mentioned sections. In a preface the editors provide an overview of the book and relate each chapter to the context of its section. Because all chapters are written by different authors, this preface gives a good introduction and helps to get the overall picture of each section as well as of the whole book.

Requirements Analysis

The first chapter presents two case studies dealing with incorporating adaptivity into digital libraries. In a first study, the requirement of providing adaptivity was identified by analysing the behaviour of novice users in digital libraries. The study shows that novice users have difficulties in framing queries and their behaviour during the searching process differs from the behaviour of experienced users. In a second study, an adaptive digital library is used. This library provides detailed non-adaptive information for beginners and gives adaptive tips regarding the result of a query. A tip includes an explanation about what happens during the search, showing the number of corresponding words found for each word in the query. Additionally, suggestions and examples for improving the query result are given. As a result of the second study it can be seen that novice users using the new features improve their seeking behaviour.

The second chapter aims at adaptive navigation support as answer to the problem of disorientation and "lost in hyperspace" in large websites. Attention is turned to the site structure, how it can be modelled and analysed as well as to aspects of modelling and analysing the navigation path of the users based on the site structure. Based on literature as well as on a performed study, navigation patterns predicting disorientation are discussed. Finally, different kinds of orientation glues are presented.

While the first chapter is practical oriented, showing that novice users of digital libraries can be supported by providing adaptivity, the second chapter discusses models, measures, and methods concerning site structure and user navigation in a more theoretical way, and therefore provides the basics for applying adaptive navigation support. When reading the title of the section, one would expect to read about studies which show that adaptivity and adaptability are useful and required concepts for different application areas of hypermedia systems. But the chapters show this only for two areas, digital libraries and the problem of getting lost in large websites. These two areas are good examples but do not cover all kinds of hypermedia systems. Incorporating adaptivity and/or adaptability can be used to enhance many different application areas of hypermedia systems. An additional

chapter proving a summary of studies that shows the usefulness of adaptivity and adaptability in many different kinds of hypermedia systems would be very valuable for this book.

Architectural Aspects

Chapter three deals with adaptation engineering in adaptive concept-based systems. The authors provide an overview of engineering approaches and discuss the principles of adaptation engineering, including modelling the domain, user, and adaptation. Three main classes of adaptive concept-based systems are identified: adaptive web information systems, adaptive hypermedia systems, and adaptive task-based systems. Each of these classes is described and representative engineering methodologies and typical system architectures are illustrated by examples. Regarding adaptation, discussion is provided on how adaptation issues are incorporated in these three classes.

The Extended Abstract Categorization Map (E-ACM), presented in chapter four, is a conceptual tool for assessing and comparing methods and tools in adaptable and adaptive hypermedia systems concerning modelling mechanisms. Related to adaptation issues, four modelling perspectives are considered: services, traditional concerns, abstraction levels, and goal conditions. After a detailed description of E-ACM, a comparison of two adaptive authoring systems is illustrated using E-ACM.

In the next chapter a framework for facilitating the implementation of adaptive hypermedia systems is described. The framework follows a XML-based document-centric approach and supports adaptive presentation and adaptive navigation by providing document-oriented adaptation actions and model-update actions. As an application of the framework, the PALIO system is described. This system supports several kinds of adaptivity and has a special focus on accessibility issues.

This section provides a good overview of architectural aspects of AAHS. Different views are considered. While chapter three provides general information also beyond the scope of adaptive hypermedia systems (including web-information systems and task-based systems), the last chapter in this section is very specific, dealing with a XML-based document-centric framework for incorporating adaptivity. Because of the diversity of the chapters, the section includes valuable information for all who are planning to develop an adaptable or/and adaptive hypermedia system.

Modelling Techniques

The chapter “Learning Adaptive Behaviour” discusses briefly different kinds of adaptive behaviour. The core of the chapter gives an overview of machine learning approaches (Naive Bayesian Classifiers, Bayesian Learning, Artificial Neural Networks, and Relational Learning) used often in adaptive hypermedia systems. For each approach, a description including the basic underlying formulas is given, some applications in different domains of hypermedia systems are presented, and the advantages as well as the drawbacks are discussed. Finally, the approaches are compared and important questions for choosing a machine learning approach are mentioned. The chapter is very helpful for people who want to gather some ideas on which machine learning approach is suitable for a specific problem but should not be taken as only reference to decide about the applied approach. The author provides references to detailed descriptions of the approaches and its applications which should be read before deciding on one approach.

The next chapter offers a survey about web usage mining and points out the application of these techniques to adaptive systems. Cluster mining techniques are described in great detail, distinguishing between clustering web documents, references of web documents, and user visits. Furthermore, association rule mining techniques and sequential pattern mining techniques are presented. Each of these classes of mining techniques is described in a general manner and different approaches are presented pointing out their main characteristics. Regarding adaptation, discussion is provided about how each class of mining techniques can be used to support certain adaptation aspects.

The enumeration of approaches and their different characteristics are described in detail, presenting a lot of facts where the effects are not clear. Beside that, the chapter gives a good overview, explaining what web usage mining is and how it can be involved in adaptive systems.

Chapter eight is more concrete than the previous ones and deals with the problem of imperfect information in adaptive hypermedia systems. Especially for the user model and in consequence for the adaptation model it is important to consider information imperfection. The MAZE model, introduced in this chapter, is an abstract hypermedia model extended by built-in support for fuzzy set-theoretic notations to cope with imprecision. The extensions for incorporating fuzziness in the model are described in detail. To illustrate the MAZE model, a case study is presented, dealing with social relationships in group collaboration. Different aspects of imprecision handling and consequently adaptive behaviour are demonstrated. The chapter contains a lot of technical details but shows an interesting application of modelling in hypermedia systems.

The next chapter deals also with a concrete application of modelling techniques, namely word weighting algorithms in document-based adaptive hypermedia systems. The authors discuss word weighting algorithms and introduce an algorithm which incorporates the users' individual interests into the weighting process, distinguishing between consistent interest and spot interest. As an example, the algorithm is applied in a browsing support system, which highlights the most relevant and familiar words in a web page for each user. The system as well as the evaluation of the algorithm, comparing it to two other algorithms implemented in the system, is described. Although the chapter is partially formally written, describing algorithms, it provides a lot of concrete examples, figures, and tables, making it easy to understand.

This section shows modelling techniques for complex adaptive or intelligent systems. While the first two chapters provide an overview, the other two chapters deal with concrete applications. This combination makes the section very useful and helps to understand the different possibilities to make systems "intelligent". All chapters are written in a technical way, describing algorithms or techniques, which makes reading not as easy as in the other sections.

Applications Development

Chapter ten deals with adaptive virtual reality museums on the web and presents an architecture for supporting the development of such kinds of museums. After a discussion about the advantages and challenges of adaptive virtual reality museums, the proposed architecture is described in detail. The architecture focuses on adaptability and adaptivity, e.g. the interest of visitors in particular resources is determined, and the internet connection bandwidth can be declared by the visitor or be determined by the system. According to the user's profile including the determined and declared values, an individual virtual museum is generated.

The next chapter shows an application that combines the concept of virtual documents based on a semantic web approach with adaptivity. SCARCE – introduced in this chapter – is an adaptive hypermedia environment aimed at providing virtual documents adapted to the users' needs. The authors discuss the design principles and describe the components of the environment. It is illustrated very well how adaptivity is provided showing some examples.

The following chapter focuses on user modelling and personalisation aspects in knowledge management systems (KMS). After a discussion of trends and challenges in KMS and how to support user modelling with user ontologies, the advantages of user modelling in KMS are pointed out. One of these advantages is personalisation, which is discussed in more detail. The benefits of personalisation in KMS as well as the role of agents for providing personalisation are described. Finally, it is shown how structure, content, as well as presentation and modality can be adapted in KMS.

Chapter thirteen deals with adaptation issues in interactive television. The characteristics of interactive television are described and differences to web-based systems affecting adaptation are pointed out. Afterwards the authors discuss how adaptive hypermedia techniques used for web-based systems can be applied for intra-programme interactivity on TV, where the viewer can interact with broadcast content. For each adaptation technique, the arising problems are mentioned and possible solutions are provided.

The last chapter of this section is also about television but focuses on personalisation issues for advertisements. The main question discussed in this chapter is how to predict the rating of an advertisement spot for an individual viewer. The proposed approach combines the Pearson-based approach with data from the user's lifestyle. In an experiment, described in the chapter, the performance of several approaches is compared, varying the amount of already available user ratings for spots. As a result, a similarity-based approach on the basis of demographics and TV program preferences data lead to better performance than the typical Pearson-based approach for few available ratings and to statistically equivalent results for high availability of ratings.

In this section several examples of meaningful applications for incorporating adaptivity and adaptability in different kinds of environments are presented. The focuses of the chapters are quite different, reaching from describing hypermedia systems which consider personalisation aspects to more general issues showing how adaptivity and adaptability can be used in certain application domains, to more technical issues presenting approaches how personalisation can be implemented efficiently. This section involves adaptivity issues as well as adaptability aspects and delivers a broad overview of different areas where personalisation enhances environments.

Evaluation Methodologies

The first chapter in this section deals with common problems and pitfalls in the evaluation process of adaptive systems. The chapter makes the reader aware of possible problems and provides guidelines, recommendations or/and workarounds. Towards the end an overview of evaluation frameworks is given. The chapter is very helpful for planning and designing an evaluation. It gives a lot of ideas, makes the reader aware of possible problems and provides references for detailed information about the problems and their possible solutions.

The next chapter introduces the DMASC system, a tool for logging and visualising user paths through database-driven websites. The authors discuss logging methods and visualisation aspects, showing how DMASC realises the visualisation of individual user paths. To illustrate the benefits of DMASC, an application is shown, visualising 19.300 user sessions. Expected and unexpected user paths are demonstrated. The detection of unexpected user behaviour facilitated by DMASC system as well as the investigation of its reasons by the site designer allows to formulate adaptation rules which enhance the adaptivity of the website. An interesting aspect in this chapter is that the designers of websites are involved in the adaptation process. This idea can be applied also in other areas of adaptive systems in a more general way, e.g. in educational systems by involving the authors of courses in the adaptation process.

This section provides two interesting chapters, one dealing with evaluation methodology in general and the other showing a concrete example for evaluating the website structure. In the first chapter of this section, evaluation frameworks and some references are mentioned. However, an additional chapter about a concrete evaluation framework would be of merit. Chapter four, describing the Extended Abstract Categorization Map, covers this issue and therefore would also fit very well to this section.

Summary

In general, the book provides a very good overview of the state of the art in adaptive and adaptable hypermedia systems. As Brusilovsky mentioned in the foreword, "… until now there was no book that can capture a snapshot of modern adaptive hypermedia research in a way that the earlier book (Brusilovsky et al., 1998) captured the state of the art of classic adaptive hypermedia.". The authors did a really good job in providing this snapshot.

The book stands out by the diversity of its chapters. At the same time the sections are organised well so that there is no problem of losing the context. All together, the chapters show a great amount of current research work in different research areas and different application domains, all dealing with adaptation issues in hypermedia systems. This makes the book to a combination of theoretical and practical contributions, providing overviews and surveys as well as case studies and implementations. Because of this diversity, the book helps the reader to see new aspects and generate new ideas.

Regarding the title "Adaptable and Adaptive Hypermedia Systems", it should be said that the focus of this book is on adaptivity, adaptability is considered only in some chapters. However, this corresponds with the state of research, where more research work is done in adaptivity than in adaptability.

In conclusion, this book can be strongly recommended to everyone who is interested in adaptation issues in hypermedia systems, especially to people with a background in computing.