Interactive systems, such as personal navigation devices, cell phones, home entertainment and automotive dashboards systems, are part of our everyday lives. Offering more and more features to their users, these systems however increase in their complexity. In addition, the diversity of the users is constantly growing, for instance with older people using interactive systems. One solution for solving the problem of an increasing user diversity and a growing number of features are systems that adapt themselves to individual users. Such an adaptation comprises different steps and relies on an observation of the user’s behavior and conclusions drawn from these observations. This process is called user modeling. Adaptations are thereafter selected based on the user modeling information. This book introduces a general framework for adapting multimodal interactive system, comprising a detailed discussion of each of the steps required for such an adaptation.

The observation of user behavior is a prerequisite for performing adaptations. Based on an observation of basic events, such as button presses, speech input, or internal state changes, user preferences are derived. Different algorithms extract information from these basic events, such as preferences of the user or a prediction of the most likely following user action. Additional models support the user modeling process. An interaction model describes user actions. We introduce the use of a task model for describing higher-level user-system interactions and for deriving adaptation triggers, such as predicting user actions and detecting user problems.

In this book, adaptations are presented as a set of adaptation patterns, which are similar to patterns known from software or usability engineering. Patterns describe recurring problems and present proven solutions for these problems. Each of these patterns includes a discussion of the context of use. The patterns provide guidance to the system designer for integrating adaptive features into interactive systems. We introduce a novel set of adaptation patterns. These address both graphical interfaces as well as speech-based and multimodal interactive systems. In addition, we describe an adaptation framework that provides tool-support for creating adaptive interactive systems. For
this purpose, the framework introduces an abstraction layer that uses semantic web technology. The adaptations are implemented on top of this abstraction layer by creating an abstract representation of the adaptation patterns, including a system-independent and reusable part and a system-specific part.

In summary, a generic approach for adapting multimodal interactive systems is presented. This approach comprises algorithms for user modeling and a set of adaptation patterns. A reference implementation proves the feasibility of the approach as well as the viability of the user modeling algorithms and adaptation patterns. The evaluation demonstrates that adaptations present a means for improving the usability of interactive systems for an individual user. The conceptual adaptation framework provides a sound foundation for the implementation of adaptations in interactive systems.
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