An Integrated Service Selection Engine for Context-aware Computing

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Context-aware computing is expected to be a key enabler for customized provision of fast-growing mobile services. The growth on the number and diversity of mobile services makes current approach and practice of service selection inadequate.

In this study, we present a context-aware service selection engine which integrates Rule-based Reasoning (RBR) and Case-based Reasoning (CBR) to support proactive recommendation of mobile services based on users’ current situation. This service selector is especially useful for people in places they have never been to before. Apart from tourists and truck drivers, a large group of such people consists of business travelers. Often, business travelers do not know their ways, nor which restaurants and public services are available to them. Facilitating the mutual discovery of users and services is the main motivation of our project.

The integrated reasoning approach we proposed here can make use of advantages of both existing domain knowledge and past user experience. Our system is mainly based on Case-based Reasoning, because the knowledge elicitation and rule composing becomes extremely difficult in an open and dynamic application domain. The suitability of a mobile service to the present context of a user is estimated by matching a large number of old cases against the current situation. The solution of the matched old case will be recommended to the current user. However, pure case-based systems suffer from several deficiencies in terms of mobile computing. First, real time response is an imperative requirement of mobile applications, but the efficiency of CBR is unsatisfactory on that point. Second, it is hard for a pure case-based system to adjust the granularity of reasoning.

The limitations of CBR discussed above therefore call an integrated reasoning approach to combine both domain and general knowledge. Our system exploits rules to reduce the number of candidate cases as well as improving the adaptability of case matching process. This is achieved by the Case Filter and the Case Adepter, two embedded components in the system architecture as complements to the CBR process. The Case Filter tests new cases against the rules attached to candidate solutions before case matching. Because irrelevant solutions can be excluded by pre-defined rules extracted from mature domain knowledge, the work load of CBR engine will be significantly reduced.

As for the Case Adepter, one type of rules called Policy is defined to support case generalization. Policy is used to explain old cases with domain theory; hence more generalized cases can be formed. Moreover, the same cases can be interpreted in different ways when policy changes. As a result, the integrated system should be able to reason on a broader range of problems and render more careful and thorough suggestions to the user. Nevertheless, Policies cannot independently accomplish the task of generalization. It must work with Facts, the true statements or the rules of thumb representing the domain-specific knowledge that may not change over long time. The most common form of Fact is concept hierarchy which has been used in our system for adjusting the granularity of context elements.

The whole process of the service selection is summarized in the figure above. In conclusion, we believe the integrated reasoning mechanism described here could serve as methodological guidance for the future practice on the context-based recommendation of mobile services.