A Comparative Study of Reasoning Techniques for Service Selection

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Abstract. Open multiagent systems do not provide guarantees about the quality of the service of its providers. This makes it difficult for service consumers to find correct service providers. Many existing approaches share the intuition that service consumers can share their knowledge about service providers to help locate useful service providers. However, representing existing past knowledge and reasoning about this knowledge are two important challenges. A traditional approach for dealing with these challenges is to represent past dealings with ratings and to aggregate the ratings. However, rating-based approaches lack the expressiveness to articulate objective information about service dealings. To enable richer representations, we have developed an objective experience-based approach for service provider selection, in which consumers record their experiences with service providers rather than the overall, subjective ratings for a provider. A consumer’s experience with a service provider is represented using an ontology that can capture subtle details including the context in which the service was requested. When a service consumer decides to share her experiences with a second service consumer, the receiving consumer evaluates the experience using its own context and evaluation criteria. In this work, we tackle the problem of reasoning about the collected experiences. We study different reasoning techniques for consumer agents to use in selecting service providers. We formulate these techniques into agent strategies and examine their strengths and weaknesses through simulations.

1 Introduction

Finding service providers for specific needs is difficult when service providers offer services at varying levels. A consumer agent can try various service providers on its own and choose a provider solely based on its previous experiences. But, that means many trial-and-errors on the consumer side. A more acceptable solution is to enable consumers to exchange knowledge about service providers, so that each agent can reason about the knowledge it gathers from other agents.

The simplest form of such exchange is that of ratings, commonly employed in today’s e-commerce sites. The basic idea is that the consumers rate the providers that they interact with and reveal their ratings publicly [1] or privately to certain agents. The

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agents then examine these ratings and decide if any of the service providers are satisfactory for their own purposes [2]. Rating-based approaches reflect the subjective opinion of the raters. Most of the time, the context of the ratings are not made explicit. Hence, it is hard to judge what the rating would correspond to in a different setting. Furthermore, even if the context of the ratings is made explicit, these ratings may still mislead the consumers, because the satisfaction criteria of the consumer using these ratings may be different from the satisfaction criteria of those who give the ratings in the first place.

The reasoning process is inherently dependent on how the knowledge is represented. For example, since the ratings represent previous knowledge compactly, it is difficult to interpret what the numbers mean in different settings and to reason on these ratings. Thus, reasoning elaborately on others’ knowledge will require the knowledge to be expressed in greater detail.

We have recently proposed an approach for distributed service selection that allows consumers to capture their experiences with the service providers using ontologies [3]. The ontology represents the details of the requested service description and the received service. The consumers can then exchange their detailed experiences of service providers rather than plain ratings. A consumer that receives another agent’s particular experience evaluates the received experiences individually considering her own context to decide on which service provider to select. Whereas rating-based approaches reflect the subjective opinion of the raters, the experience-based approach allows the objective facts of the experience to be communicated to the other party.

The proposed approach enables experiences to be expressed in detail. The immediate question is how the agents will use these experiences to select a service provider. We had previously employed a parametric classification technique using Gaussian model. Here, we also develop a strategy in which agents use case-based reasoning to select a service provider. Our results show that when service providers do not change the quality of their service, both reasoning techniques perform equally well in finding service providers. However, case-based reasoning finds the service providers in a shorter time than the parametric classification. On the other hand, if the service providers vary their service offering even a small percentage, then case-based reasoning performs worse than the parametric model.

The rest of this paper is organized as follows: Section 2 gives a brief overview of our representation of experiences and Section 3 explains how agents interact to exchange their experiences. Section 4 and Section 5 explain parametric classification using Gaussian model and case-based reasoning respectively and how they can be used for selecting providers using a set of experiences. Section 6 explains our experimental setup, simulations, and results of comparisons. Section 7 summarizes our contribution and compares it to relevant literature.

2 Representation of Experiences

Rating-based approaches reflect the subjective opinion of the raters. Even though the context of the ratings is explicitly expressed, these ratings may still mislead the consumers, because the satisfaction criteria of the consumer using these ratings may be different from the satisfaction criteria of those who give the ratings. Even if their service