Case-Based Planning with User Preferences for Web Service Composition

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ABSTRACT

Web services composition has emerged as a solution to answer the requester's requirements. However, the selection of an appropriate Web service has become a difficult task due to the number of Web services present on the Web and mostly they offer similar functionalities. User preferences are a key factor that can be used to rank candidate services and retain only the best ones. To improve the process of web service composition the authors propose a Case-Based Planning (CBP) approach based on preferences which uses successful experiences in past to solve similar problems at present or/and in the future. How to make a choice base on non-functional factors becomes a problem that need to be solved. This paper, argues that the selection should be considered in a global manner based on the user's preferences. The authors present a framework that deals with web service composition based on user preferences and CBP method. Results obtained offer more than a solution to the user and taking both functional and non-functional requirements.

Keywords: Case-Based Planning, Ontologies, User Preferences, Web Service Composition

1. INTRODUCTION

A Web service is a standardized way to integrate applications based on the Web using open standards and Internet transport protocols. However, a single service cannot respond to a pre-determined request by user. Thus, it is necessary to compose services. The composition object is to combine the functionality of several Web services within a business process in order to respond to complex applications that single service could not meet. However, the creation of service from other services is far from being trivial task (Rao & Su, 2005; Dustdar & Schreiner, 2005; Bartalos & Bielikov, 2011).

Web service composition is a hard and complex task, and out of the human capability to deal with the whole process manually. One of the factors of the complexity is to find appropriate

services to be composed. However web services composition is usually based on the functional properties only neglecting a very important point which is the user preferences. As the number of web services increases significantly during the recent years and therefore a huge repository of Web services to be searched (Sreenath & Singh, 2004), user preferences are used to select appropriate services. For example planning a travel, there will be several compositions of web services that allow the user to travel from a source location to a destination but such travel planning have to take into account the user preferences such as the total cost of the trip, preferences on particular transportation companies or hotels, and times/dates for the travel.

Case-based planning (CBP) is a problem-solving method that uses a library of cases, where a case associates a past problem and goal description with a plan that solves the problem by achieving the goal (Hammond, 1989). In similar situations, CBP can take advantage of previous planning experiences by reusing stored plans.

In this paper, we present a novel approach to compute the best service compositions based on user preferences. The proposed approach differs from the previous works in that user's preferences are taken into count as an additional input, so we model preferences and incorporate them into the user request. We use an algorithm to determine the relevant services that may be used to answer the composition request.

Our approach integrates the user preferences in the process of CBP. We generate the plan for the user's new request by finding a composition plan from the library of cases. The newly generated plan together with the new request can now be stored as a case in the case base for future reuse. Many CBP retrieve and adapt a single plan (Lee et al., 2010; Liu et al., 2009). We propose to retrieve multiple plans using an algorithm for retrieving based on two steps find and select according to the preferences. The sub-plans retrieved are merged and adapted to solve the problem.

This paper is organized as follows: Section 2 present an overview of recent methods that use CBR in Web service composition. Section 3 introduces the case based planning approach, user's preferences and a motivating scenario. Section 4 introduces our approach to service composition and present an experimental result of our methodology. Section 5 presents conclusions and future works.

2. RELATED WORK

Artificial Intelligence techniques can provide a solution to the problem of service composition. In particular, there have been several proposals using AI planning.

Case-based reasoning (CBR) (Aamodt & Plaza, 1994) is a problem solving methodology based on reutilizing specific knowledge of previously experienced and concrete problem situations (cases). Case-based planning is the application of the CBR methodology to planning, and as such, it is planning as remembering (Hammond, 1990).

Different approaches based on CBR and CBP have been proposed for the composition of Web services. In this section, we review selected works based on their relevance for our approach.

Limthanmaphon and Zhang (2003) are the first who proposed a framework for WS composition using the CBR technique for the discovery process. However, his similarity assessment method is based on keyword matching, so the accuracy is very low. The algorithm for retrieving a case is only based on the service name and this approach does not use the semantic descriptions to make efficient reasoning. So the automation aspects for Web services search and composition is affected. Lajmi et al. (2006) presented an approach semi-automated Web Service composition based on CBR technique and the semantic description of Web Services called WeSCo_CBR. But

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