Adding Semantic Annotations into (Geospatial) RESTful Services

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ABSTRACT

In this paper the authors present an approach for the semantic annotation of RESTful services in the geospatial domain. Their approach automates some stages of the annotation process, by using a combination of resources and services: a cross-domain knowledge base like DBpedia, two domain ontologies like GeoNames and the WGS84 vocabulary, and suggestion and synonym services. The authors’ approach has been successfully evaluated with a set of geospatial RESTful services obtained from ProgrammableWeb.com, where geospatial services account for a third of the total amount of services available in this registry.

Keywords: DBpedia, GeoNames, Geospatial RESTful Service, Semantic Annotation, World Geodetic System (WGS84)

INTRODUCTION

In recent years, since the advent of Web 2.0 applications and given some of the limitations of “classical” Web services based on SOAP and WSDL, Representational State Transfer (REST) services have increased their presence on the Web (Pautasso, Zimmermann, & Leymann, 2008). Machine-oriented Web applications and APIs that are conformant to the REST architectural style (Fielding, 2000), normally referred to as RESTful Web services, have started appearing, mainly due to their relative simplicity and their natural suitability for the Web.

However, using RESTful services still requires much human intervention since the majority of their descriptions are given in the form of unstructured text in Web pages (HTML), which contain lists of available operations, their URIs and parameters (also called attributes), expected output, error messages, and some examples of their execution. This hampers the automatic discovery, interpretation and invocation of these services, what may be helpful to improve the efficiency in the development of applications that are based on their use.

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Traditionally, semantic annotation approaches for services (WSMO, OWL-S, SAWSDL, etc.) have focused on defining service description formalisms, and have been normally applied to WS-* services and their corresponding middleware. More recently, these (usually heavyweight) formalisms have started to be adapted into more lightweight approaches for the semantic description of RESTful services (Maleshkova, Kopecký, & Pedrinaci, 2009; Kopecký, Gomadam, & Vitvar, 2008; Lathem, Gomadam, & Sheth, 2007), as described later in this paper. One of the reasons for making these annotations more lightweight is to increase their uptake, promoting the creation of such annotations by service developers and publishers, while still providing some added value to the syntactic descriptions currently available for both WS-* and REST approaches.

Nevertheless, most of the processes related to the annotation of such services still require a large amount of human intervention. In this paper we will mainly focus on RESTful service annotation, for which some approaches already exist (e.g., (Maleshkova, Pedrinaci, & Domingue, 2009; Alowisheq, Millard, & Tiropanis, 2009). In these approaches, humans firstly need to understand the informal descriptions provided in the RESTful service description pages, and then the semantic annotation of these services is done mostly manually, with or without tool assistance.

In this paper, we describe our approach to address the challenge of automating the semantic annotation of RESTful services by: (1) obtaining and formalising their syntactic descriptions, what allows their registration and invocation, and (2) interpreting and semantically enriching their parameters, what allows generating semantically-enriched service descriptions in any of the available formalisms for RESTful semantic service description.

The main contribution of our work is the partial automation of the process of RESTful semantic annotation services, what improves the current state of the art in this area. We have defined a process to perform this type of annotation, and we propose the usage of diverse types of external resources and services to help in this process: a cross-domain knowledge-base like DBpedia, two domain ontologies like GeoNames and the WGS84 vocabulary (since we are focused on RESTful services on the geospatial domain), and suggestion and synonym services.

The remainder of this paper is structured as follows: First, we present the background and related work in the context of semantic annotation of WS-* and RESTful services. Then, we describe our RESTful service annotation approach, explaining how we structure the process into syntactic and semantic annotation, and how we derive such syntactic and semantic descriptions making use of external resources and services. Next, we present the evaluation of our system in the context of geospatial services. Finally, we present some conclusions and identify future lines of work.

BACKGROUND AND RELATED WORK

In this section, we provide a brief introduction to WS-* and RESTful services, and describe existing approaches related to the semantic annotation of such types of services.

WS-* and REST Services

According to Haas and Brown (2004), “a Web service is a software system designed to support interoperable machine-to-machine interaction over a network. It has an interface described in a machine-processable format (specifically WSDL). Other systems interact with the Web service in a manner prescribed by its description using SOAP-messages, typically conveyed using HTTP with an XML serialization in conjunction with other Web-related standards”.

The World Wide Web Consortium (W3C) identifies two classes of Web services. On the one hand, the “Big” Web services technology stack (SOAP, WSDL, WS-Addressing, etc.), where the service may expose an arbitrary set of operations and specialised middleware is needed in order to handle service publication and message handling. On the other hand, RESTful Web
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www.igi-global.com/chapter/semi-automatic-ground-truth-annotation/28927?camid=4v1a

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