Service Selection and Recommendation through Collective Intelligence

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Services computing as a science and engineering discipline has enjoyed steady growth in the past 10 years. With continued innovation in cloud computing, everything is being packaged and delivered as a service, from hardware infrastructure as a service (IaaS), to platform and middleware as a service (PaaS), to software and applications as a service (SaaS). The recent explosion in new communication and collaboration models such as social media and crowdsourcing has further fueled the growth of services computing in multiple dimensions. Collective intelligence becomes an attractive channel for improving service-provisioning quality.

Using collective intelligence as a service recommendation tool helped motivate the work of Michael Lyu and his colleagues at the Chinese University of Hong Kong ("QoS-Aware Web Service Recommendation by Collaborative Filtering," *IEEE Trans. Services Computing*, vol. 4, no. 2, 2011, pp. 140–152). The authors described a framework that enables consumers to select and discover offerings with the best quality of service (QoS), measured by user-independent dimensions such as price, popularity, and availability as well as user-dependent dimensions such as response time and invocation failure rate.

The authors started by analyzing system requirements and the feasibility of measuring user-dependent QoS properties for each Web service client. Their proposed recommendation framework uses historical QoS data collected from similar users and similar services. Without resorting to Web service invocations, the framework can predict user-dependent QoS properties of desired Web services by performing statistical analysis of both historical Web service QoS data from similar users and historical QoS data captured for similar Web services by combining user- and item-based collaborative filtering (CF) methods.

To evaluate their approach's prediction accuracy, the authors collected 1.5 million Web service invocations from 150 service users in 24 countries on 100 operational Web services in 22 countries. The authors tested the effectiveness of their approach by dividing the 150 users into training users and active users. They first randomly removed different numbers of QoS entries for active users and then used the CF methods to predict the removed QoS entries, with original values as the ground truth. They showed both the effectiveness and efficiency of their methods by comparing them with existing CF methods.

In the broader context of services computing research, this work indicates yet another subject area where harnessing the collective intelligence of multiple users can improve service selection and discovery affordably. As the number of services and their users grows, our ability to learn by capturing collective experiences increases. Socially driven data analysis technologies will continue to enhance the ways that computing and IT services are delivered, used, and managed in the years to come.

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