

# Visualization of Context-Aware Web Service Clusters

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Web services have shown potential in a distributed computing paradigm that is suited to publishing and describing business processes and models as services. Therefore, most business organizations are moving towards the adoption of Web services, resulting in an increased number of services being published on the Internet in recent years. With this proliferation of Web services, service discovery is becoming a challenging and time-consuming task. Clustering Web services into similar groups, which can greatly reduce the search space for service discovery, is an efficient approach to improve discovery performance. A principal issue for clustering is computing the semantic similarity between services. Current approaches use similarity-distance measurement methods such as keyword, information-retrieval or ontology based methods. These approaches have problems that include discovering semantic characteristics, loss of semantic information and a shortage of high-quality ontologies. Further, the approaches do not consider the domain-specific context in measuring similarity and this has affected their clustering performance. In this research, we propose a context-aware similarity method that learns domain context by machine learning to produce models of context which is created using snippets that are extracted from real Web using search engines. Support vector machines are trained to produce a model for computing the similarity of Web services for different domains. We are able to compute reasonable similarity values by capturing the semantic relationships between services within a particular domain through the extracted context and trained support vector machines. In addition, our approach overcomes limitations of current similarity calculation methods, including the lack of up-to-date information, the lack of high-quality ontology, and the loss of machine-interpretable semantics. To analyze visually the effect of domain context on the clustering results, our clustering approach applies a spherical associated-keyword-space algorithm as the clustering algorithm that projects clustering results from a three-dimensional sphere to a two-dimensional spherical surface. Visualization helps with human manipulation of the results and gives inspiration for a specific domain from visual feedback. Experimental results show that our clustering approach works efficiently for the domain-context-aware clustering of services.

**Keywords:** Web services, web service clustering, context-awareness, cluster visualization