ABSTRACT

In the current era, computing ability has been enabled with ubiquity and provided as services over the network. Cloud computing offers computing resources as services which can be accessed by the consumers, from anywhere and at any time. Due to the proliferation of services on the cloud, discovery of services that satisfy the requirements of the consumers has been insisted. The proposed research work aims at satisfying this objective.

Services are available in almost all application domains. Being a critical domain, healthcare requires services that meet the dynamic business approaches of the stakeholders. Cloud computing is considered as one of the key enablers that satisfy the on demand nature of such service requirements. Matchmaking of consumer's request and the provider's service profile is supported by better service representation mechanisms that in turn aid in efficient discovery of services. Service descriptions are provided semantically using ontologies, which describe the meaning of concepts and relationships between them in any domain.

Reasoning is based on the broad domain of Artificial Intelligence in which machines learn through experience. When viewed in terms of service discovery, the ontological representation can be queried using appropriate reasoning mechanisms. Since service provisioning follows Service Oriented Architecture, the discovery of services considers agent-orientation as another peer paradigm. Due to the varied level services offered by different providers, Quality of Service (QoS) factors that distinguish the functional and non functional features of a service are considered.

Based on the review of the current approaches of service discovery, following limitations are identified:

- Need for standard representation of services for efficient service retrieval
- Identification of appropriate techniques for discovery of relevant services from the right cloud based on consumer preferences
- Lack of methods to support dynamic discovery of services

This research work has formulated a dataset of experiences of consumers on healthcare services. Machine Learning based classification algorithms such as Decision Tree, Naïve Bayes and K-Nearest Neighbour are used for web service classification. Based on the performance measures of accuracy, precision and recall, Decision Tree and KNN work equally well compared to Naïve Bayes. This provides a form of preprocessing and results in the services being identified of their appropriate domains.

After classifying the services, reasoning methods are applied. Multivariate Gaussian model provides a probabilistic determination to discover services. It includes classification of services based on consumer satisfaction of service usage. Another method is Case Based Reasoning (CBR) where the experiences are saved as cases in a case base. Whenever a new request arrives, the case base is checked first and if a previous mapping solution exists, it is reused. Similarity based reasoning uses measures for measuring similarity of objects. Hence CBR has used such similarity measures for finding case similarity. Referring to the case base for existing solutions and reusing them reduces the time of developing a new solution.

Relevant services that are discovered can be ranked based on Quality of Service (QoS) factors. The research also considers the service expectations of the consumers that relate to the non functional QoS factors such as, availability, interoperability, automation, reliability and accuracy. Thus, the services that match the requirements are filtered and ranked based on QoS. Also, intelligent agents are used at different stages of discovery to automate the tasks.

In order to handle all these mechanisms together, an Artificial Intelligence (AI) powered QoS based architecture for Semantic Web Service Discovery in Cloud has been developed, with focus on the following key aspects: improving relevancy of the discovered services, improving accuracy and integrating dynamism and automation of the overall service discovery. The last part of the research evaluates the various components of the architecture using the measures such as accuracy, precision, recall and F-measure. Also, the performance of various reasoning methods applied for service discovery are assessed using Analysis of Variance Technique and other appropriate methods.