Application of Soft Computing Technique for Web Service Selection

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Abstract. One of the main challenges in service oriented architecture is the optimal selection and ranking of web services. The process of selecting relevant services from a service repository in a heterogeneous environment is a difficult task. Use of different search engines help in selection process by efficiently searching the service repository (like UDDI), peer-to-peer networks, service portals etc. Fixing up appropriate services is necessary because composition of these services leads to the development of a particular application. In this paper, soft computing technique such as ANN and Fuzzy logic are employed for optimal selection of web service with the help of the requisite attributes related to quality of service. A comparative study of performance of both the techniques based on error parameter has been made in order to help in critical assessment.

Keywords: Web Service, QoS, BPN algorithm, RBFN, PNN, Fuzzy logic.

1 Introduction

Web service is the basic building block of Service Oriented Architecture(SOA). It provides interoperable, reusable and loosely coupled services to client. Web service consists of three main component. i.e, Service Consumer, Service Provider, and Service Registry. Interaction between components occur through publish, find and bind operation [2]. Service provider builds the services and publish it in to service registry. Service consumer search services in service registry. Services are described using WSDL(webservice description language) [2].

The objective of this paper is to select the appropriate web service from the repository like UDDI using fuzzy logic [5] [4] and Artificial Neural Network [7]. Back Propagation Network (BPN) using gradient descent method [3]. Radial Basis Function network (RBFN) using Pseudo inverse Technique, and Probablistic Neural Network (PNN) for classification of web service have been applied [6]. In both the techniques i.e, fuzzy logic and ANN, web services are classified based on quality of service attribute. Accuracy of result obtained from both the methods is compared in order to critically access the performance.

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2 Literature Survey

There are quite a number of approaches available for QoS(quality of service) based discovery. Entropy Based discretization method is used for webservice selection [4]. Other approaches based on artificial neural network is used for ranking of web service but this paper provides the better result [1].

3 Methodology

Web service description and discovery is realized using universal description discovery and integration(UDDI). To define the QoS, nine QOS parameter such as Response Time(RT), Availability(AV), Throughput(TP), Success ability(SA), Reliability(RB), Compliance(CP), Best Practices(BPT), Latency(LC), Documentation(Doc) are considered.

Based on these nine QoS parameters service classification is done separately such as fuzzy logic and ANN [4]. The techniques considered are based on concept such as:

Fuzzy Logic is the multivalued logic. It consist of three phases i.e, Fuzzification, Fuzzy inference system, and DeFuzzification.

BackPropagation Network is a multilayer feed forward network. Network is trained using supervised learning Algorithm.

Radial Basis Function Network(RBFN). In RBFN weight as well as center both are learned and each hidden layer unit is represented as radial center $C_1, C_2, C_3, C_4 ....., C_h$.

Probablistic Neural Network(PNN). Probablistic neural network(PNN) is inherently a classifier. PNN is based on the Bayesian network and principle of statistical algorithm.

4 Results and Analysis

4.1 Fuzzy Logic

A set of nine attributes of QoS are used as a quality of service. That is used as input in inference system and the output is found as quality of web service(QoS). Each attributes is classified with four membership functions (Triangular Membership Function) i.e, Low, Medium, High, VeryHigh as input and poor, average, good, best respectively as output i.e, ranges form 0 to 1.

From the Fuzzy Rule based approach, web service is classified by the giving input value to the rule viewer that can generate the output.

The output is finally computed by defuzzification mechanism. The centroid method is applied to convert fuzzy set obtained from aggregation into crisp result. MatLab Tool is used for above calculation. It can generate the output of the above system in Rule Viewer.

4.2 Artificial Neural Network

ANN algorithms like BPN, RBFN and PNN used in this study consider nine QoS attributes as input. These nine inputs corresponds to input layer nodes in each ANN algorithm. However, number of hidden layers differs for each network.

In BPN, number of nodes present in hidden layer is considered to be greater than nodes of input layers. So number of hidden nodes considered to be fifteen in BPN.

In RBFN, hidden layer consisting of four radial center is taken. Since there are four different classes, Euclidian distance of a web service input vector(nine QoS attribute) from these radial center is calculated.

In PNN, hidden layer consisting of four hidden unit and each hidden unit corresponds to each class. In the summation layer, sum of output from each unit is calculated. Then at the output layer, maximum of all the output from summation layer is taken. Maximum value corrsponds to output class to which a particular web service belong. Calculated value is compared with the actual value (DataSet [1]) for the performance evaluation.

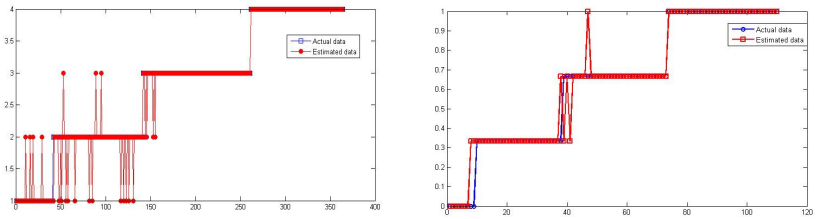

Fig. 1. Comparison of actual and estimated value of DATA in a. Fuzzy Logic and b. BPN

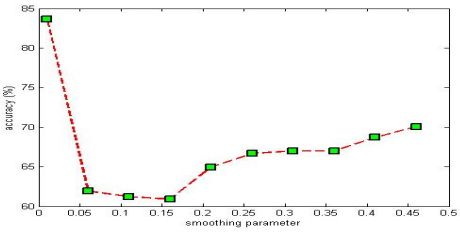

Fig. 2. Accuracy of PNN

Performance of Fuzzy logic and ANN are shown in figure 1 and 2. Matlab tool is used for calculating the Performance of Fuzzylogic and Python programming language is used for performance evaluation of ANN. Finally, Comparison of different technique are given in Table 1.

Table 1. Performance of Different Algorithm

Performance Evaluation Parameter	ANN	RBFN	Fuzzy Logic
MAE	0.0182	0.204	0.0687
MARE	0.0795	0.56	0.0358
RMSE	0.0779	0.26	0.2621
SEM	0.0234	0.06	0.0478

5 Conclusion

In this paper a method of optimal web service selection using soft computing technique like ANN and Fuzzy logic has been proposed. BPN, RBFN and PNN are used for classification of web services. Among these Neural networks accuracy obtained by the BPN is best. Accuracy obtained using PNN is moderate and RBFN accuracy is less than PNN. Rule based Fuzzy logic approach is used for classification of web services and it provides the accuracy better than RBFN. Problem with this approach is that as the no of attribute increase, service classification becomes more complex. Some other different machine learning technique like Neuro Fuzzy technique can be further applied for improving accuracy.

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