

# Research Methodologies On Semantic Web Services Using Machine Learning Algorithms

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## ABSTRACT:

Over the years, web service discovery has evolved continuously. There are many resources available that provide information about the various methods and techniques used to improve web service discovery. Literature has reported a lot of effort and researchers continue to contribute to improving web service discovery. This paper examines the work of several prominent researchers in this area by using methods based on machine learning. Machine learning is one area that researchers can study to produce consistently precise estimates. Machine learning "learns" from a set of projects completed to determine the best estimate. This paper will help researchers carry out further research and give an outlook on future trends in research.

**Keywords:** Web semantics Web Ontology Language the web-based service specification language Web services modeling language model of web services, neural networks, fuzzy logic ontology quality of service.

## 1 INTRODUCTION

Multiple web services can be interconnected and interoperable to perform tasks, provide data, carry out business activities, and take actions according to user's requirements. Both end-users and application developers have many benefits from the web service paradigm. Because code reuse is possible and services can be loosely coupled between them, the web service model makes business application development and interoperation much easier. This allows users to create, configure, and manage their own web services. To fully utilize the potential of web services, however, the web service paradigm needs to be supported by a reliable discovery mechanism. Web service discovery is the most critical task of the web service model. It is useless if the web service cannot be found. The interaction between service requester and service provider. Service providers are businesses or organizations that offer web services with specialised business operations or functions. A web service registry is a broker who

provides search and registry functions using a Universal Description, Discovery and Integration (UDDI [1]), which is the most widely used method to locate services online.

UDDI allows you to search for a service using syntactically keyword and category-based web search. UDDI is supported and used by many organizations. UDDI provides a framework to describe web services. There are many models available for describing web-services, including web service description language [1], web model language (WSML) [3], web modeling ontology [WSMO] [2], and web service modeling ontology for semantics [OWL-S]. The semantic web initiative is the basis for WSDL, WSMO, and OWL-S. Semantic Web Services are a promising research direction to improve integration of applications within and beyond enterprise boundaries. OWL-S and WSMO both have the goal of providing the technical and conceptual means to create semantic web services. This will improve the cost effectiveness, scalability, and robustness of existing solutions. WSMO is a direct link between a service, its capability, and its interfaces. This includes service choreographies and groundings. WSMO is built on four main elements: Ontologies (goals), Web Services (web services), and Mediators. OWL-S provides rich, expressive descriptions as well as well-defined semantics. OWL-S describes characteristics of a service (upper ontology) using three top-level concepts: Service Profile and Service Grounding. OWL-S can also be extended to UDDI to facilitate service discovery.

Recent research has shown that machine learning models play a major role in web service discovery. Machine learning algorithms can easily transform web service features into the format that can be used. Machine learning is a popular method for web service classification. There are many approaches that have been proposed in the literature. Automated web service classification remains a hot field of research. There is still much to be done in order to improve efficiency and effectiveness. This paper will present the work of several researchers and their methods for discovering web services using machine learning models.

The following structure is used to organize this paper: Section 1 briefly introduces the concept of web service discovery. It also discusses the various methods to publish and discover web-services. We briefly discuss the current issues in web discovery in section 2. Section 3 explains the various machine learning methods used in web service discovery. Section 4 discusses un-supervised machine learning techniques that are used by researchers, while section 5 concludes this work, and also includes future scope.

## **2 DISCOVERY OF LATEST TRENDS AND CHALLENGES IN WEB SERVICES:**

Researchers have developed many standards, architectures, and algorithms to achieve their current vision of semantic web. Ontologies have been used by researchers to discover web service information. They found that it was the best approach to semantically enrich web service content, improve web service standards, and give structure to web services. To describe web services and their resources, OWL-S,

WSMO and DAML are based on ontologies. They are used to replace web services that already exist by adding semantics that can be understood by machines.

At the moment, web services can be found in repositories like UDDIs or Web portals (e.g. X methods [4], Web service x [5], and web service list [6] are some examples. The methods for discovering potential web services.

- i) Use central repositories like UDDI's
- ii) Techniques for Web crawling
- iii. Search on specific web portals

Although there aren't many public UDDI's, organizations have the option to discover web services using private UDDI Business Registers (UBR) or search engines that are maintained by individual organisations. To aid in the discovery of web services, there are many syntactic based standards like SOAP, WSDL, and UDDI. (<http://seekda.com>)[7].

## **2.1 Research Trends in Web Service Discovery**

This paper explains that UDDI registry's limitations have not led to it being adopted as widely as was expected. Web service discovery is difficult with standards such as UDDI and WSDL.

## **2.2 Current Challenges in Web Service Discovery**

It is difficult to find the right service for you. These are some of the challenges currently facing web services discovery:

There are many services that can be found on the internet

Non-standardization of WSDL format

UDDI matching only supports keyword matching and does not permit retrieval of Web services that have similar functionality.

It is difficult and time-consuming to develop a common ontology that can be used for a variety of web services.

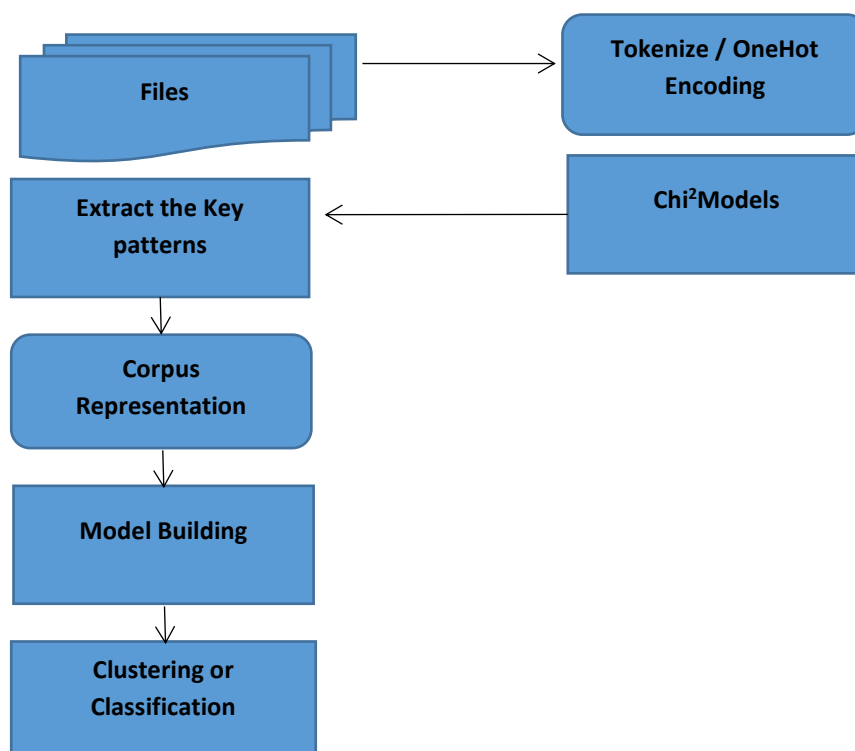
Manual annotation of web service.

## **3 POPULAR TECHNIQUES OF MACHINE LEARNING APPLIED IN WEB SERVICES**

Some researchers have proposed different architectures that use machine learning to improve web service discovery. We can identify three primary kinds of models that use machine learning in web service discovery. These are supervised, semi-supervised and unsupervised. The following sections will provide additional information about these

machine learning models used in web service discovery. Naive Bayes, Decision Tree [DT Decision Tree [DT Decision Rules [DR Naive Bayes, Decision Rules [DR Association Rules, Neural networks (NN) as well as Support Vector Machines, are among the most popular models.

Figure 1 shows the use of machine learning models in web service classification. A model is used to classify service requests. The SVM method is used. The functional descriptions are extracted from the WSDL document of web services to create a feature vector. The WSDL file of web services is used to create the feature vector. Nonfunctional features, also known as QoS, are sometimes also extracted in order to improve the process. Tokenization vector, stemming and filter stop words are used to preprocess the extracted features. To create better training data. These feature vectors serve as training data for machines learning models to aid in classification.



**Fig : 1 Machine learning model in web service classification process**

**Table 1 Unsupervised machine learning based web service discovery**

Proposed Approach	Authors
Service pattern mining	Qianhui et al. (2006) [8]
Semantics and clustering	Nayak and Lee (2007) [9]
Filtering and clustering	Abramowicz et al. (2007) [10]

Keyword clustering and ontology	Zhou and Li et al. (2008) [11]
WordNet and Linear Discriminant Functions	Sotolongo et al. (2008) [12]
Clustering semantic approach	Jiangang et al. (2008) [13]
Service clustering	Zhou and Li (2009) [14]
Service mining on web	Zheng and Bouguettaya (2009) [15]
Web service clustering using text mining techniques	Wei and Wilson (2009) [16]
Algorithm for semantic web services clustering and discovery	Ying (2010) [17]
Probabilistic methods for service clustering	Gilbert et al. (2010) [18]
Clustering WSDL documents	Elgazzar et al. (2010) [19]
Semantic web mining	Ramu et al. (2011) [20]
Similarities using matrices	Chandramohan et al. (2011) [21]
QoS oriented cluster algorithm	Feng et al. 2011 [22]
Semantic Web service clustering- Single-Linkage Thinking	Fa-Gui Liu et al 2013 [23]
Semantic FP-Tree based technique	Omair Shafiq et al. 2014 [24]
Similarity using both ontology learning and machine learning	Rupasingha A et al. 2015 [25]
novel hierarchical recurrent neural network	Shengpeng Liu et al. 2017 [26]
A semantic thing retrieval system	Jaehak Yu et al. 2018[27]
Deep semantic analysis	Sikha Bagui et al. 2019[28]

#### 4 FRAMEWORKS ON MACHINE LEARNING

In machine learning, there are two main situations in which the function can be defined as supervised or unsupervised. When learning with supervised supervision, the variables being studied can be separated into two categories: explicatory variables as

well as the one (or several) dependent variable. The aim of the research is to establish a relationship between the variables explaining the study and the dependent variable as it happens by regression analysis. To be able to use targeted data mining methods, the values for dependent variables has to be publicly available for a large part of the data.

#### 4.1 Semantic Web Service over cluster models

The method of clustering re-organizes the data set into various groups based on certain standards of similarity, thus making a complex issue an easier one that can be solved more quickly. Based on clustered service groups, a list of matching services may be found by comparing similarity between the query and the related groups, instead of finding the relationship between the queries and the services in the database. If the services that are returned aren't compatible with the query of the user, the next best cluster will be chosen , and the process goes on to the next round of computation.

#### 4.2 Some Prevalent Frameworks and Methodologies

A large amount of research has been published recommending various methods to improve the efficiency in Web search engine discovery. A method of Web service discovery which combines statistical and semantic associations using hyperclique pattern recognition has been proposed. Methods that use Singular Vector Decomposition (SVD) [25] along with probabilistic semantic analyses [20] are studied to find the similarities among various Web services to improve the efficiency of discovery. However , neither provide an empirical or conceptual analysis that shows that these techniques improve efficiency for Web search engine discovery. In [16], researchers proposed an expansion of SVD [15] to a support-based semantic kernel that could further improve the efficiency for Web service discovery through the use of random projections [20] for service discovery.

**Table 3 :Performance comparison of machine learning algorithms in web service classification**

Reference	Algorithm Used	Accuracy achieved	Remarks
Wardani Muhamad et al[2020]. [30]	Augmented KNN	80.72 %	KNN suggested better accuracy for classification of 80.72 percent over other methods.
	KNN	79.89%	
	Tree Augmented KNN	80.72%	

Xun Zhu et al.[2020] [31]	K-NN	41.74%	Random Forest algorithms have higher accuracy than other algorithms.
	Decision Tree	68.91%	
	Random Forest	82.19%	
Samiyuru Menik; Lakshmish Ramaswamy. [2021] [32]	HMM	84.26%	Hybrid Markov Models perform the out numbered.
	GMM	80.65%	
	Hybrid MM	87.57%	

It has been observed that the majority of the web-based research into service discovery focuses on the accuracy that can be achieved by various machine learning algorithms utilized to classify. The various studies have proven that accuracy that is high value can be achieved with a various algorithms. Table 3 compares the performance of machine learning algorithms ' performance in relation to accuracy of classification as seen in various studies.

## 5 CONCLUSION AND DISCUSSION

This paper offers a comprehensive overview the use of models based on machine learning utilized in web-based service discovery methods. We can see that all over the world huge research and development has been completed to improve the process of discovering services on the internet. It's not an easy task to discover wanted services that are rationally or in a context that meets the requirements of the customers.

The present research paper highlighted and summarized the most important aspects of work conducted by different prominent researchers using traditional machine learning methods. The majority of the research presented suggested that machine learning techniques together with keyword search and predefined categorization-based surfing, Natural Language Processing techniques semantic depiction of terms, and searching using non-functional parameters could be used in a variety of combinations to give various search methods in a flexible way. The research presented in this paper will prove helpful to web service developers in deciding on the best method of discovery for their web services. It can also help customers to select the most appropriate match for their service.

We conclude that, despite the amount of work completed it is necessary to get more accomplished to improve the efficiency and accuracy of the web service discovery match processes. Our study suggests that no single machine learning method can be

considered to be the most efficient method, and we believe there is room for advancement in existing research and tools. We observe a growing trend towards mixed approaches to tackle the issue of discovering web services in the problem. There are several areas that can be explored as shown below:

Methods for selecting features of Web Services could be improved to enhance the web service classification.

The use of classifiers that are optimized to enhance efficiency in terms of precision, accuracy, recall and time to train as well as testing.

More efficient use of ontology and semantics to improve the classification of web services informational retrieval, clustering and classification.

Methods for ranking the best web services according to customer's needs.

A highly efficient and effective combination (hybrid strategies) with machine learning algorithmic to improve outcomes.

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