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Effective Web Service Discovery Model Using Neural Network Approach

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***Abstract*—Web service is the most interesting research area in Service Oriented Architecture (SOA). Finding a suitable web service at right time is a potential issue, needs to be addressed by the researchers. Available techniques for web service discovery are not proved to be efficient enough neither to discover the right and suitable services nor to find the services in time. The client will request the service according to their needs, situation, and environment conditions. The services are discovered based upon requests of the clients and the contexts. Context aware service discovery aims to find the exact services based on the contexts at which the requests were given by the service consumers. Just-In-Time will provide the right service in right time to the right users. This work proposes a framework for JIT-Oriented web service discovery using Neural Network. The effectiveness of the system is improved by means of neural network. The system will learn from its experience to predict user requirements and provide the services accordingly.**

***Index Terms*—Context-awareness, Just-In-Time (JIT), Neural Network, Web Service Discovery.**

I. Introduction

Web Service (WS) is basic building block in Service Oriented Computing (SOC). WS is a software system designed to support interoperable machine-to-machine interaction over a network. It provides a ubiquitously supported framework for business-to-business interaction based on existing web protocols and open XML standards [25]. WS consists of three components i.e. Service Consumer, Service Provider, and Service Registry. The component interactions involve publishing, finding and binding operations (Figure 1). Service Consumer finds the service from the registry and bind service with the Service Provider. Services are published in registry and discover to the clients based upon their needs. The service providers create a service and publish in the service registry with a description. These service descriptions contain the semantic service profile and QoS parameters like max execution time, average execution time, max response time, average response time etc.

Web services are usually built using the technologies like XML (eXtensible Markup Language), UDDI [25], (Universal Description, Discovery and Integration) WSDL (Web Service Description Language) and SOAP (Simple Object Access Protocol).XML is the backbone of web services derived from SGML. XML is a platform, and markup language. WS operate by interchanging data that is in the form of XML. UDDI [24] is a repository used to expose the information about web service. UDDI is centralized, universal, totally open registry and platform independent. It is just like an electronic telephone directory which contains the information about services. There are three flavors of UDDI registries are available: Corporate/Private, Affiliated, and Public. Corporate UDDI registries are an internal registry, behind a firewall, that is isolated from the public network and data is not shared with other registries. Affiliated UDDI registry is a registry deployed within a controlled environment, but with limited access by authorized clients and data may be shared with other registries in a controlled manner. In public UDDI registries services are public to all users. And data are shared or transferred among the registries. WSDL provides a XML format for describing web services. It will provide information about web service like "where "and "how" the service is. WSDL describes only the syntactic interface of web services. SOAP is a peer-to-peer message exchange protocol for service interaction in a network using RPC. The main advantages of SOAP are platform independent and exchange of message using RPC.

In Service-Oriented Architectures (SOA) [22], service discovery is one of the hottest topics attracting researchers both from academia and industry. WS discovery is the process of satisfying clients by finding the services which are matching the requests of the client from available services in UDDI registry. UDDI allows three types of searching: Syntactical Keyword- based search, Cluster based browsing of web services and Distributed Hash Table based search. The Keyword-based search techniques are supported by UDDI which is the most existing service search engine. It is used to discover service based on keywords. This method of service discovery result in a huge number of services retrieved for the given keyword, which is very difficult for a user to identify the desired services, best suiting for the requirements. Because many services may not match with the client's request. So many a times, the user gets irritated on seeing huge list of irrelevant services and this is the major drawback of keyword-based searching techniques [3]. The client suffers from performance bottlenecks when too many users search the single registry at the same time. The classic approach of adding more servers or using load balancing technique is not an efficient solution. Clustering-based browsing [2] web service discovery is used to browse the matching service based upon cluster. Services can be clustered based on operation, and /or input/output of the services. Finding the right cluster is challenging in

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cluster-based browsing technique. If identification of the category is difficult or not possible, then broadcasting technique is used to find the services from all categories. So, the computation cost is very high if the system fails to fetch the exact category.

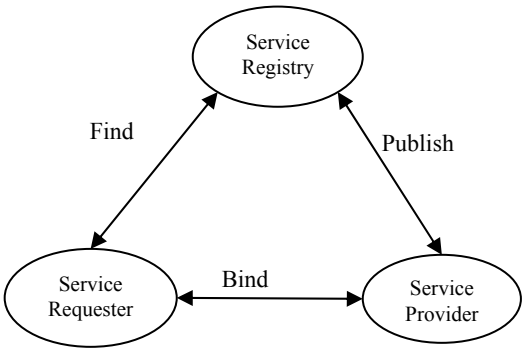

Figure 1 SOA Architecture

Distributed Hash Table (DHT) [3] is mainly used in Peer-to-Peer (P2P) environment to search services based upon keys. It is not an easy task to find the exact matching through the web service discovery In P2P method; each service is stored in peer node. Services are located by giving a key. DHT is used to maintain the keys. DHT method is very complicated and difficult to support. In P2P based infrastructure each web service is considered as a peer. Decentralized web service discovery approaches use either structured or unstructured P2P infrastructure. In Unstructured P2P system, due to lack of any structure, location mechanisms face significant problem related to availability and scalability. In structured infrastructures, the basic idea is to use hashing in order to distribute a set of keys to each peer, each key corresponding to a specific resource.

Context-awareness refers to an idea where computing system can both sense and react based on their environment. Context aware computing is a computing paradigm in which applications can discover and take advantage of contextual information. Dey [17] defined context as *"Any information that can be used to characterize the situation of an entity. An entity is a person, place or object that is considered relevant to the interaction between a user and an application, including the user and applications themselves"*. Context-awareness helps to collect information on user's physical information or emotional state. Analyze the information, either by treating it as an independent variable or by combining it with other information collected in the past or present and perform some action based on the analysis.

Neural Network is a machine learning technique. It is an interconnected group of artificial neurons uses a mathematical or computational model for information processing based on a connectionist approach to computation. Due to their parallel computing nature of neurons, it can perform computations at a higher rate compared with classical method. Neural network has adaptive nature. Due to this adaptive nature, system will adapt to the environment and input. It will produce the output depends upon its input. The output of one node will be the input of another node and the final result or output depends on the complex interaction of all nodes.

Just-In-Time (JIT) [23] is indeed a philosophy rather than a series of techniques. It is first used by Ford Motor Company during 1920s.but this technique is adopted and published by Toyota Motor Corporation of Japan in 1954. It was implemented in order to reduce the wasteful overstocking in production. Basics of the concept are that the company produces only what is needed, when it is needed and in the quantity that is needed. The company produces only what the customer requests, to actual orders, not to forecast. Its ultimate aim is to achieve perfection in manufacturing through continuous improvement and elimination of all waste. Use of JIT philosophy is valid in any manufacturing environment, regardless of the level of advancement in the technological hardware. For example it can also be applied for material management in hospitals and non stock system

The goal of JIT is to reduce delivery lead times, to cut inventory, to reduce the amount of defects, to improve productivity and to make sure that products are delivered on time. It is based on the idea that holding too much stock or too many finished goods accounts to waste of money, and that a manufacturing business can work more efficiently by ordering only the materials it requires to complete an order, rather than stockpiling.JIT will help to reduce the product cost by greatly reducing manufacturing cycle time, scrap, inventories, pace requirement, material handling and elimination of non-value adding operation (waste). JIT improves product quality through fast detection and correction of defects. JIT philosophy is implemented in many areas like healthcare sector for material handling and administration setting in much company.

JIT philosophy can also be applied to web service discovery to eliminate irrelevant services to produce efficient services to service consumer. In web service discovery, JIT helps to improve the effectiveness and efficiency of web services. When the system is combined with JIT philosophy, flexibility of web service discovery system can be high. The proposed system, web service discovery is combined with context awareness to get more exact service to the requirements of customer. It helps to identify the context of the consumer. Some recent application shows that JIT is eminently suited to non-manufacturing situation as well as service and administrative work situation. The main advantage of JIT is elimination of waste, and in our context JIT will help to eliminate irrelevant services to satisfy client requirement. JIT will help to produce effective service to consumer. The effectiveness can be further improved with help of neural network.

S.Sioutas [3] proposed a new structured P2P overlay network infrastructure designed for web service discovery. It provides support for processing exact match queries of the form "given a key, locate the node containing the key" and range queries of the form 'given a key range, locate the node /nodes contain the keys that belongs to this range". Here they maintained the services using distributed hash table. It is very difficult to maintain the keys for large number of buckets. Jiangang Ma, Yanchun Zhang [2] proposed a clustering probabilistic semantic approach; here k-means algorithm is

applied to eliminated irrelevant services. After removing irrelevant services with respect to the query, PLSA technique has been applied to the remaining dataset for clustering the services. Then efficient services can be selected based upon semantic approach. Deniz Balci [5] proposed a system for emergency service system using Just-In-Time (JIT). He applied JIT philosophy to improve service system has been investigated at the Adult Emergency Services (AES), Gazi University. This system helps to eliminate waste, increase patients' satisfaction and service quality. Stephen J.H Yang [17] proposed a Java Expert System Shell (JESS) Enabled Context Elicitation system featuring an ontology-based Context model that formally describes and acquires context information pertaining to service requesters and web services. A JESS-enabled context elicitation technique is designed for collecting contextual information. This paper proposed a context aware service oriented architecture for providing context-aware web service request and discovery.

II. Proposed Work

WS has emerged as one of the distributed computing technologies. It adopts open standard interface and protocols which are likely used as basic software building blocks in service-oriented application. Web service is the best solution for remote execution of functionality. This was partly due to web services-related properties such as operating system and programming language independence, interoperability, ubiquity and possibility to develop loosely coupled system. As the web grows in both size and diversity, there develops an increased need of automation aspects of web services such as discovery, execution, selection, composition and interoperation.

Web service discovery is based on registries that make available information concerning functionalities, interfaces, creator, pricing, etc. UDDI adopts a centralized, client-server model. Web services are registered in a UDDI registry and client are able to search it in order to find the appropriate solution to the problem. UDDI specifies a relatively accepted standard for structuring registries that keep track of service description. These registries can be searched manually and accessed programmatically via a standardized API. JIT means production and conveyance of necessary units in necessary quantities at necessary time. JIT is not a one-time effort. It embodies the ethics of continuous improvement, which needs to be supported by all levels of staff in the production team. JIT helps to breakdown large process into small process and it helps in reducing the complexity of the system.

The proposed work is to provide an intelligent search for the relevant web service for the given set of requirements of the service consumer and based on the contextual information which is an input from the environment. The proposed intelligent search is planned at the consumer's end. This framework (Figure 2) provides intelligent search to the consumer with the help of neural network. Neural network adjusts the weight of each node in the network by the trail and error method. There are three types of consumers: Naive User, Application User, and Service Brokers . Naive User will concentrate only on function of service. They don't care about non functional attributes. Application User will concentrate about both functional and Non-Functional attributes. Application User will create the application for enterprise. Service Brokers User will act as a broker for creating application and to compose the services for creating such application. Service Registry is a repository. It consists of service ID, service type, attribute set, user interface, program interface, description, URL, cost, etc. It maintains a database that gives service description of all the services. When the Service provider registers their service in the service registry, then that service is considered as an universal service. At any time, and anywhere valid service consumer can access these registered services. Service Manager checks the authentication and authorization of service provider using Trust Manager Lookup manager will look up the services. Service manager will provide exact matching services to consumer to satisfy their requirements. Service manager will provide the required services to the service consumer, so the effectiveness of the system can be increased in hybrid JIT oriented web service discovery system.

From the figure 2, the consumer provides the set of inputs to system. In the proposed system, Input encoder will help to convert the user input into input vector. Artificial Neural Network (ANN) accepts only vector values. Inputs will be either real number or Boolean value. The resultant input vector is passed on to the ANN. Number of input and output nodes are defined by the designer of the network. But the number of hidden nodes and layers are not dependent to designer of the network. Normally one hidden layer is better to reduce the complexity of network. The weight is adjusted in network based on trail and error method. It will get experience and adjust the weight for each node. ANN produces the output as vector form. The vector contains the suggestion for desired services. This suggestion is passed to the Service Manager. Service Manager retrieves the services from Service Registry. The retrieved services are sent to Lookup Manager. Context-Aware Finder is used to filter out the irrelevant services based on the contextual information received from the environment. User's context can be retrieved from user current situation. In order to understand the users' query, it's more necessary to understand users' background information. User Context information can be gathered based on time, location of the user, situation of the user, history and the user preference. User information is retrieved from their profile. Service context can be derived from service description. Service context can be matched with user context to eliminate the irrelevant services. After eliminating irrelevant services, service filter helps to eradicate the irrelevant service from relevant services so that the user will get more exact service. The more exact services are return back to the service manager. Service manager return the services to consumer. Finally, the desired services are provided to consumer. The JIT philosophy will helps to increase the effectiveness in web service discovery.

Definition: 1 Let 'W' be the proposed Intelligent Service Search system. It can be defined as a set of elements {I, X, S, O}, where

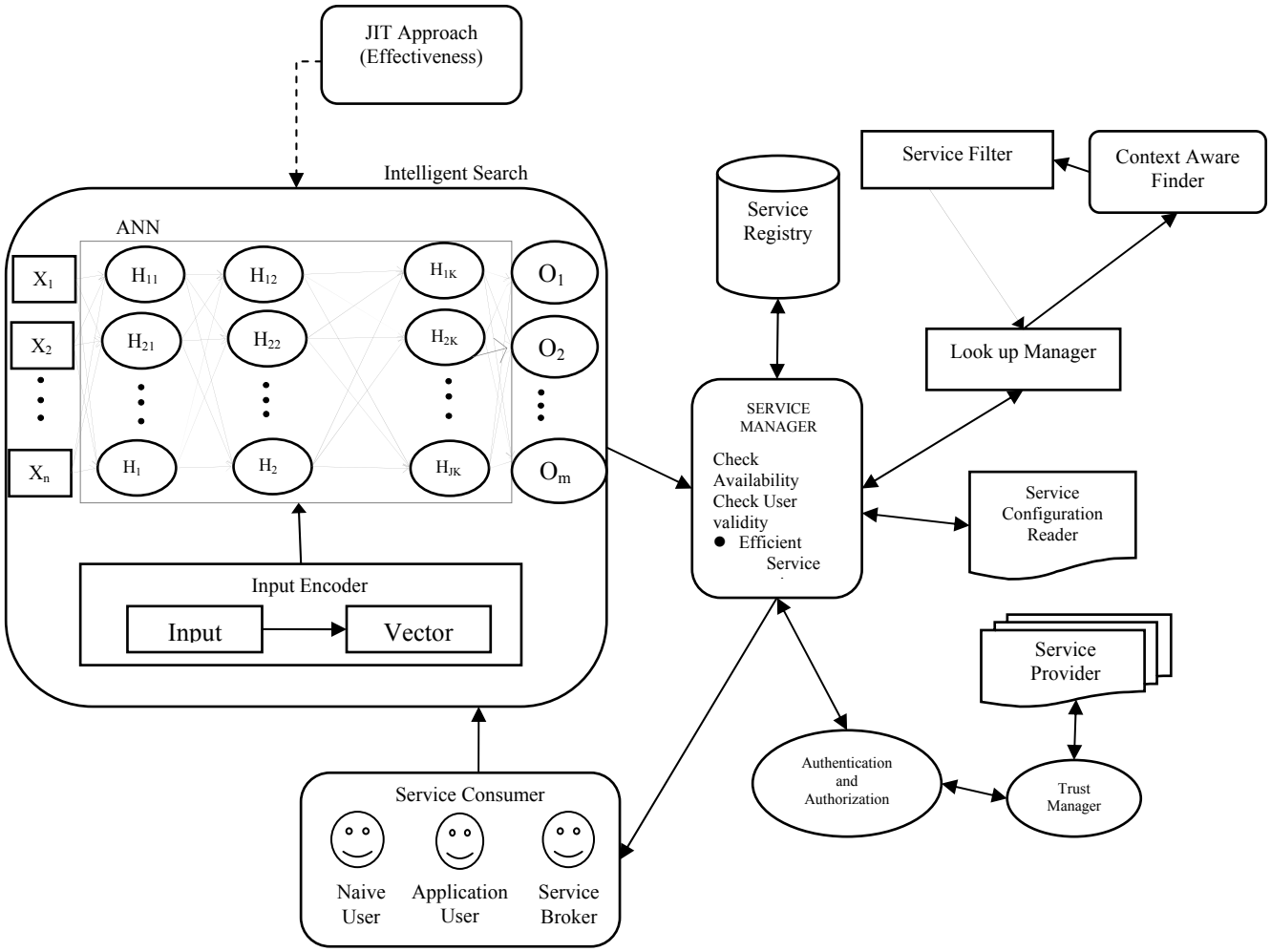

Figure 2 Architecture of Hybrid Model for JIT- Oriented Effective Intelligent Service Search

- 'I' is the set of inputs (I_1, I_2, I_3…….I_n), where 'n' is the number of elements in the inputs.
- 'X 'is the input vector (X_1, X_2, X_3……..X_n) for ANN, where 'n' is the number of elements in the vector.
- 'S 'is the set of suggestions (S_1, S_2, S_3, S_k) ,where k is the number of elements in the suggestions. 'S' value may be real number or Boolean.
- 'O' is the set of desires output services (O_1, O_2, O_3….O_m) from the proposed system to the consumer. It is the collection of desired services. 'm' is the number of desired services.

Definition: 2 Let 'IS' be the intelligent Search module. It can be represented as

$$IS= \left\{ \begin{array}{l} X_1,X_2,X_3\text{……..}X_n \\ H_{11},H_{12}.H_{13}\text{……..}H1_i \\ W_{11},W_{12},W_{13}\text{.....}W_{1i} \\ H_{21},H_{22},H_{23}\text{……...}H2_j \\ W_{21},W_{22},W_{23}\text{……..}W_{2i} \\ \text{……} \\ H_{k1},H_{k2},H_{k3}\text{……..}H_{kl} \\ S_1,S_2,S_3\text{….....}S_m \end{array} \right\} \quad (1)$$

where,

- 'X' is the input vector to the ANN .'n' is the number of input elements.
- 'H' is the Hidden nodes in artificial neural network. 'i' is the number of nodes in 1st layer. 'j' is the number of nodes in IIst layer. And so on.' k' is the number of layers in the network.
- W' is the weight is passed to each node in network. Each weight has different value. Based upon input and output the weight can be modified.
- 'S' is the output vector. It gives set of suggestions to the Service Manager. 'm' is the number of elements in suggestion set. It will be either real number or Boolean values.

A. Working principle of Intelligent Search System

Effective Intelligent search system working can be divided into five stages. These stages are.

1) Request Stage (Req): Consumer requests the services by providing input to intelligent system to get desired services. The input for this stage can be defined as {I_1,I_2,I_3…..I_n}. Overview of this stage can be defined as Req⇒I= {I_1, I_2, I_3…..I_n}.

2) Encoding Stage (Enc): Input encoder converting the user input into vector. Input of this stage can be defined as $\{I_1,I_2,I_3\ldots..I_n\}$ and produce the output as $\{ X_1, X_2, X_3\ldots\ldots..X_n\}$.. The overall working of intelligent search is illustrated in figure 3. Overview of this stage can be defined as

$$Enc \Rightarrow \{ I_1, I_2, I_3\ldots..I_n \} \rightarrow \{ X_1, X_2, X_3\ldots\ldots..X_n \}$$

3) Execution Stage (Exe): The input vector is passed into ANN and it will adjust automatically based on the weight and produce the set of suggestions. The input for this stage can be defined as $\{ X_1, X_2, X_3\ldots\ldots..X_n \}$ and construct output can be defined as $\{ S_1, S_2, S_3\ldots\ldots\ldots S_k \}$. The overview of this stage can be defined as

$$Exe \Rightarrow \{ X_1, X_2, X_3\ldots..X_n \} \rightarrow \{ S_1, S_2, S_3\ldots S_k \}$$

4) Service Retrieval Stage (Srs): Service Manager fetches the services with the help of suggestion vector based on output of ANN. The input for this stage be defined as $\{ S_1, S_2, S_3\ldots S_k \}$. Irrelevant services are eliminated by Context Aware Finder; unwanted services are eradicated by Service Filter. The Output defined as $\{ O_1, O_2, O_3\ldots O_k \}$. The overview of this stage can be defined as

$$Srs \Rightarrow \{ S_1, S_2, S_3\ldots\ldots S_k \} \rightarrow O_1, O_2, O_3\ldots\ldots O_k \}$$

5) Termination Stage (Ter): The Service Manager returns the more relevant service $\{ O_1, O_2, O_3\ldots\ldots O_k \}$ to the Service Consumer.

Ter=>list of services= $\{ O_1, O_2, O_3\ldots..O_{k}\}$

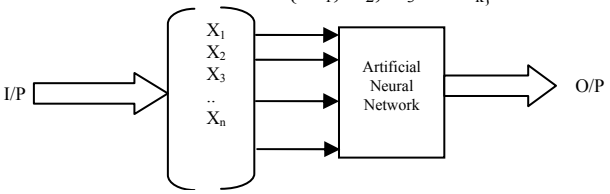

Figure 3 Overall Working of Intelligent Search

III. System Analysis

The intelligent search aims to provide desired services to the consumer. ANN provides suggestion about types of services to fetch from registry. The following scenarios will provide more details about it.

A. Scenario 1: Intelligent Search in Travel

Let us consider the scenario; Mr. Bean, Manager for a small company residing in India has to attend conference in Australia. The mode of transport from India to Australia may be either through airlines or by ship. The proposed system, suggests the consumer about the convenient and comfortable service, using intelligent search. The system retrieves user PNR, date, time and destination as input from user. The system learns with the help of neural network to suggest whether the customer can travel either by airlines or ship or any other mode of transport. According to the customer's scheduled conference date the system will check and infer that it is better to choose airlines instead of ship which may be a direct flight or connecting flight which ever is feasible to the customer. Based on his prior travel information the system will book his flights either in economy class or in business class. The proposed system retrieve the services based on suggestion of ANN. Context Aware Finder eliminate the irrelevant services from the retrieved services. Service filter eradicate the irrelevant services to get more exact services. Service manager will retrieve the desired services and update the customer. The intelligent search will be applied to the system in order to fetch the effective service to the consumer. This can be illustrated in figure 4 and 5.

1) Working Principle of Traveler Intelligent Search System

The working principle of Traveler intelligent search system consists of five stages. This is illustrated in figure 4. The stages are

a) Requesting Stage (Req): The Traveler (consumer) requests the service by providing set of inputs to the system. The input can be defined as $\{I_1 ,I_2, I_3, I_4\ldots I_n\}$. That input set is {PNR, Distance, Date and Time}. PNR is the user identity number. Distance is defined as distance between source and destination of journey. Date and time attribute represent the Departure date and time. User input I_1 is passed into Input Encoder. Overview of this stage is defined as

$$Req \Rightarrow Input= I_1= \{PNR, Distance, Date, Time\}$$

b) Encoding Stage (Enc): In encoding stage, user input is converted into vector. i.e. The user input set {PNR, Distance, Date, Time} is converted into input vector $\{X_{(PNR)}, X_{(Distance)}, X_{(Date)}, X_{(Time)}\}$ and produce as {5, 2000, 15, 8}. The resultant vectors either a real number or Boolean value. Because ANN accept either real number or Boolean values. The input vector I_2 is passed into ANN for retrieving suggestion vector. I_2 is defined as {5, 2000, 15, 8}. This stage can be defined as

$$Enc \Rightarrow I_2= \{X_{(PNR)}, {}_{(Distance)}, X_{(Date)}, X_{(Time)}\} \rightarrow \{5,2000,15,8\}$$

c) Execution Stage (Exe): The input vector 'X' be defined as $\{X1, X_2, X_3\ldots\ldots..X_n\}$ passed into ANN to get a suggestion set. The weight is adjusted automatically in ANN and retrieves the set of suggestion $\{S1, S_2, S_3\ldots\ldots\ldots S_k\}$ as output. i.e. input vector {5, 2000, 15, 8} is passed into ANN and produce suggestion vector as output O_1 is defined as {1, 0, 0, 0}. The values for suggestion set are {Flight, Ship, Train, Road}. The value for each element will be either 1 or 0. The value "1" suggests to use a particular travel commodity else 0. For this example, the ANN suggests to take fight travel. The output can be defined as {1, 0, 0, 0}. The output of ANN also is vector. It may be a single output or set. This suggestion set is passed to Service Manager as input. This interaction can be defined as

$$Exe \Rightarrow O_1=\text{set of suggestion}= \{5, 2000, 15, 8\} \rightarrow \{1, 0, 0, 0\}$$

d) Service Retrieval Stage (Srs): Service Manager retrieve the desired services based upon suggestion set $\{ S_1, S_2, S_3\ldots\ldots\ldots S_k\}$. From the suggestion, the Service Manager retrieves the services depends upon I_3 from

registry. I_3 be defined as {Type of services}. Lookup Manager retrieves the more relevant services by applying context of the user.It can be done by context aware finder. Service Filter helps to filter the irrelevant services. Service manager return desired service O_3 is shown to the consumer. O_3 is defined as {O1, O_2, O_3…….O_k}. i.e. The flight services are fetched from registry and applied in favor of the context for user on those services. Service Filter filters the irrelevant travel services from relevant services. Overview of this stage is defined as

Srs $\Rightarrow O_3$=set of services= {1, 0, 0, 0} → {O_1,O_2,O_3...O_k}→{O_1,O_2,O_3...O_j}

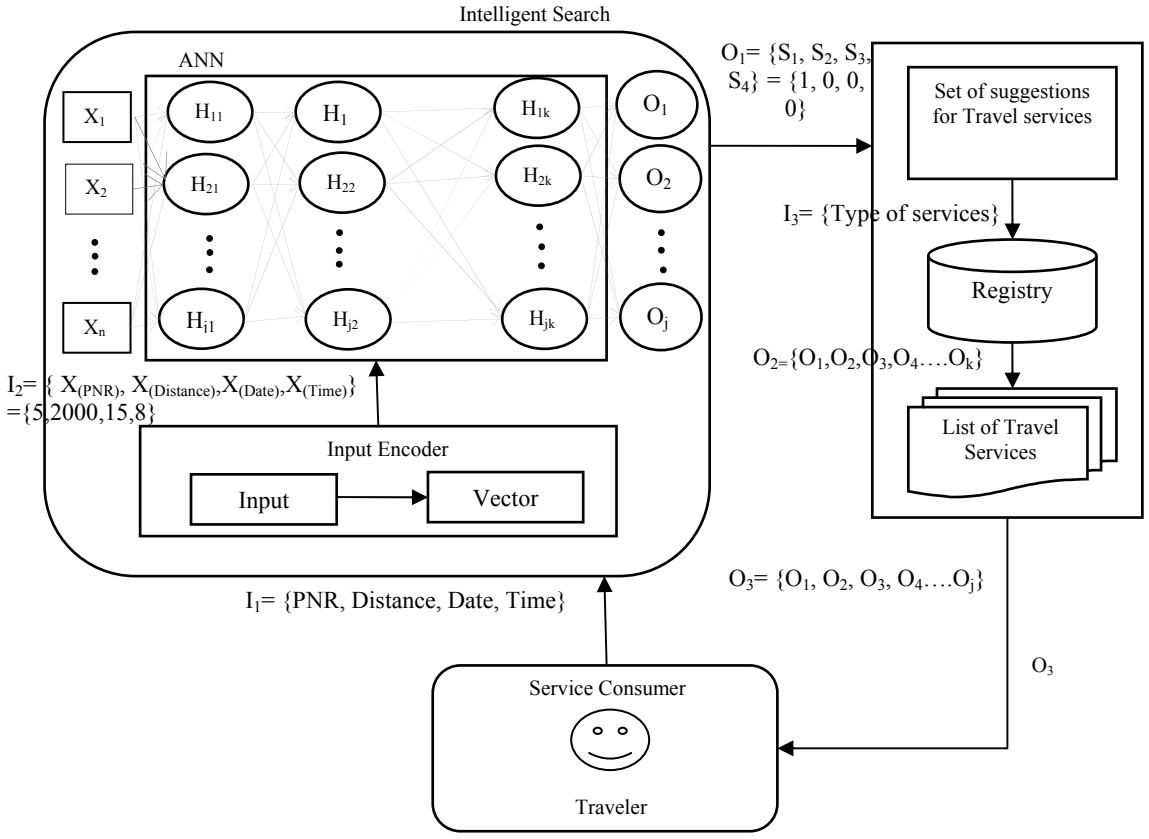

Figure 4 Intelligent Search for Travel System

Ii=Input Information flow
I1=Set of Inputs={PNR, Distance, Date, Time}
I_2= Set of Input Vector={ $X_{(PNR)}$, $_{(Distance)}$,$X_{(Date)}$,$X_{(Time)}$} ={5,2000,15,8}
I_3= {Type of services}

O_i= Output Information Flow
O_1=Set of Suggestions= {S_1,S_2,S_3,S_4} = {1,0,0,0}
O_2= Set of Services= {O_1,O_2,O_3….O_k}
O_3= Set of Travel Services={O_1, O_2, O_3, O_4….O_j}

e) Termination Stage (T): The service managers return the desired services to the traveler (consumer). The list of travel (fight) services is shown to consumer. The working of this stage is defined as

T $\Rightarrow O_3$=list of desired services = {O_1,O_2,O_3,O_4….O_j}

2) Interactions in Intelligent search system

The traveler (consumer) requests the travel services to the Intelligent Search System (ISS) by providing input values is represented as I_1. 'I_1' be defined as {PNR, Distance, Date and Time} .ISS will receive the request from traveler and it passed it into Input Encoder. Input not in vector form. Input Encoder convert the input into vector. i.e. input set { PNR, Distance, Date and Time}is converted into {$X_{(PNR)}$, $X_{(Distance)}$,$X_{(Date)}$,$X_{(Time)}$} . And produce the output as {5, 2000, 15, 8}. This resultant vector is considered as O_1 is input I_2 to ANN. ANN accept either real number or Boolean values. The input I_2 is processed in ANN and produce set of suggestions {S_1, S_2, S_3, S_4} as output O_2. O_2 is input to Service Manager for fetch the particular type of services from registry. That service is processed by Lookup Manager to by applying context awareness. The retrieved services are matching with user context. So that irrelevant services can be eliminated from list of services. Service Filter used to filter the irrelevant services from relevant services. The resultant services sent input I_4 to the consumer. This interaction is illustrated in figure 5.

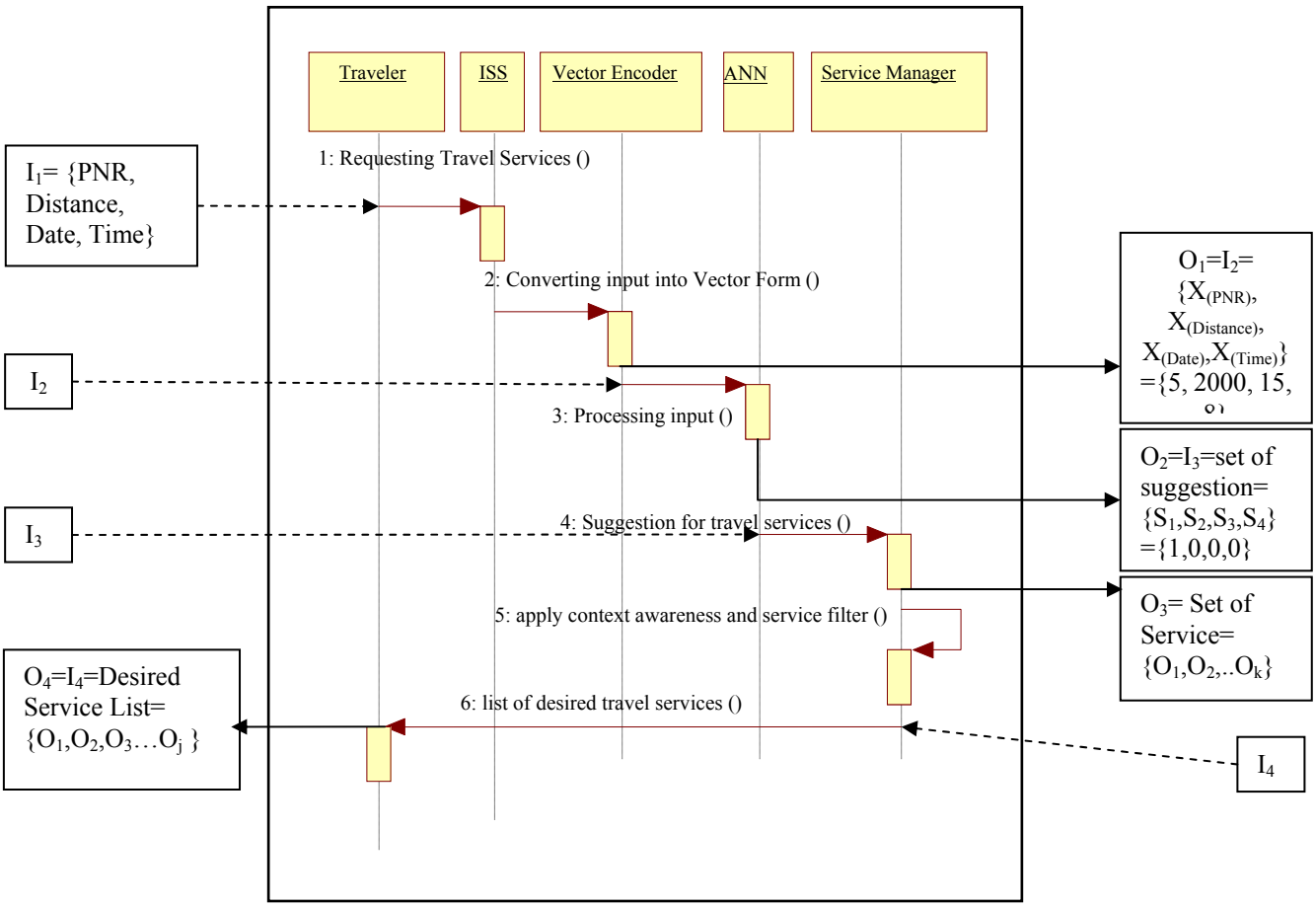

Figure 5 Interaction Diagram of Travel Intelligent System

B. Scenario 2: Intelligent Search in Stock Market Recommendation System

Consider this scenario in Stock Market recommendation System, Mr. Bean wants to invest his share into share market. He requests Stock adviser services from stock market system to get desired Stock Broker for investing the amount. The System provides an intelligent search for fetching the necessary services to him. It compares with the past sensex, success and failure of company details and provides a suggestion of Stock Broker list to him by using system intelligent. System learns from its past experience by using trail and error technique. Mr. Bean wants to invest for 5000$ in banking sector and duration is short term in single share value. JIT will helps to provide effective services to Mr. Bean. This system provides Stock Broker details to invest his share. Services are discovered based upon some constraints. The system gets input from retailer (Consumer). The inputs are amount to invest for share, Duration of investment, Sector of the investment and share values are gathered from retailer and etc. The system will check based upon the sector. The sector may be banking sector, IT sector, etc…and it will check based on Invest duration. It will check whether it is long tem or short term or daily basic share. So, the systems apply trail and error method to find the Stock Broker. This scenario is illustrated in figure 6 and 7.

Definition 3: Let 'SR' be a stock market recommendation system. 'I' be the input for this system. 'I' be defines as a set of elements {A, D, ST, V…}, where

- 'A' is the capital amount for share investment.
- 'D' is the duration for investment. They are three types of investment. 'D' is defined as {D_1, D_2, D_3…. D_i }.where 'i' is the number of investment duration .
- 'ST' is the Sector Type. Customer can invest their capital in any sector. 'S' is defined as {ST_1,ST_2,ST_3..ST_j}, where 'j' is the number of sector.
- 'V' is the share value. Share value is depends on different share. 'V' is defined as {V_1,V_2,V_3..V_k}, where 'k' is the number of share values.
- 'B' is the Stock Broker. It can be defined as {B_1, B_2, B_3….B_n}, where 'n' is the number of Stock broker.

1) Working Principles of Stock Market Recommendation System

The working principle of stock Market Recommendation intelligent search system is consisting of five stages. This is illustrated in figure 6. These stages are

a) Requesting Stage (Req): The seller requests the services from intelligent search system by providing set of inputs {A, D, S, V…}. The system will get many requirements from customer. For this scenario, I can be defined as {A, D, ST, and V}. 'A' is the capital amount. 'D' is a set of elements, can be defined as {long term, short term, daily base...}. ST' is a sector type, can be defined as number of elements as {Bank, IT, Medical…}. 'V' is the share values it can be defines as {200, 5000, 8000, 10000….}. System will get input I_1 can be defined as {amount, duration, sector, value}. The value for I_1 is {5000,2,1,2}. Overview of this stage be defined as

Req⇒Input= I_1= {amount, duration, sector, value}

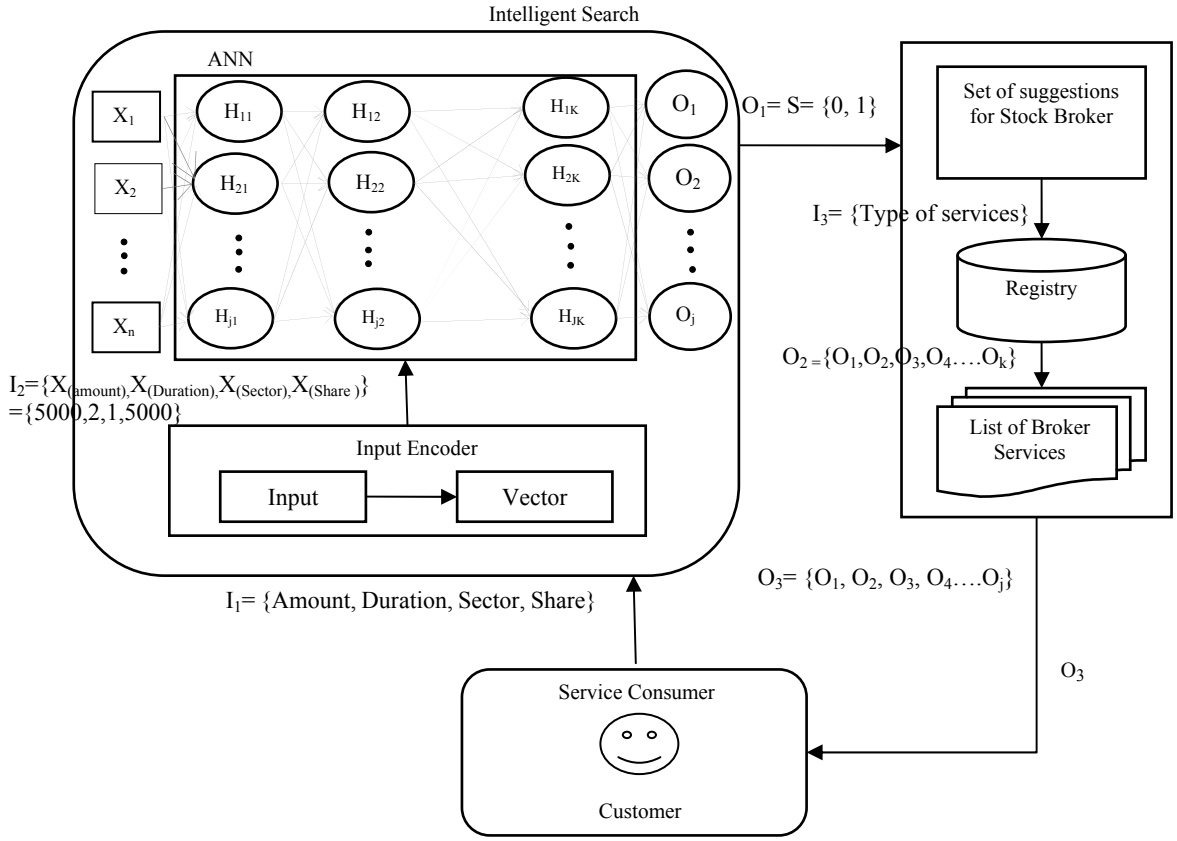

Figure 6 Intelligent Search for Stock Market Recommendation System

I_i= Input Information Flow
I_1=Set of Inputs= {Amount, Duration, Sector, value}
I_2= Set of Input
Vector={ $X_{(amount)}$,$X_{(Duration)}$,$X_{(Sector)}$,$X_{(Value)}$}={ {500
0,2,1,2}
I_3= {Type of services}

O_i= Output Information Flow
O_1=Set of Suggestions= {S_1,S_2,S_3,S_4} = {1,0,0}
O_2= Set of Services= {O_1,O_2,O_3...O_k}
O_3= List of Broker Services = {O_1,O_2,O_3...O_j}

b) Encoding Stage (Enc): In encoding stage, the input is converted into vector form. The input vector 'X' be defines as { X_1, X_2, X_3……..X_n}. Input {amount, duration, sector, value} is not in vector form. Input Encoder convert the input {$X_{(amount)}$,$X_{(Duration)}$,$X_{(Sector)}$,$X_{(value)}$} into input vector {5000,2,1,2} . This result is passed as input I_2 to ANN. This stage can be defined as

En c⇒ I_2={$X_{(amount)}$, $X_{(Duration)}$, $X_{(Sector)}$, $X_{(value)}$}→{5000,2,1,2}

c) Execution Stage (Exec): In Execution stage, the input I_3 is passed to ANN. Input Encoder converting inputs {PNR, Distance, Date, Time} into vector {500,2,1,2}, because ANN accept either Real numbers or Boolean values. This vector is processed by ANN by adjusting its weight in each node and produce set of suggestions 'S'. 'S' is in the form of { S_1, S_2, S_3……S_k}. S values either a real number of Boolean values. Consider that there is only three Share Brokers. System will suggest any one of best share broker based upon users' requirements. The output O_1 is {0,1,0}This stage can be defined as

Exec ⇒ O_1=set of suggestion= {500, 2, 1, 2} → {01, 0}

d) Service Retrieval Stage (SRS): Service retrieval stage is used to retrieve the desired services based on suggestion set S. Service Manager retrieves the particular type of services I_3 from registry. Those services are processed by LookUp Manager to eliminate the irrelevant services from relevant services by using context of the user. Service Manager produces the set of related services as output O_2. O_2 be defined as {O_1, O2, O3...O_j}. O_2 is passed into Intelligent search system as input I_4. Overview of this stage is

SRT ⇒O_3=set of services= { 0, 1, 0} → {O_1, O_2,O_3...O_k}→{ O_1, O_2, O_3, O_4….O_j}

e) Termination Stage (Ter): In termination stage, the services manager sent the desired services to the consumer. The list of share services is shown to consumer as O_3. This stage working will be defined as

Ter ⇒ O_3=list of services = {O_1, O_2, O_3, O_4….O_j}

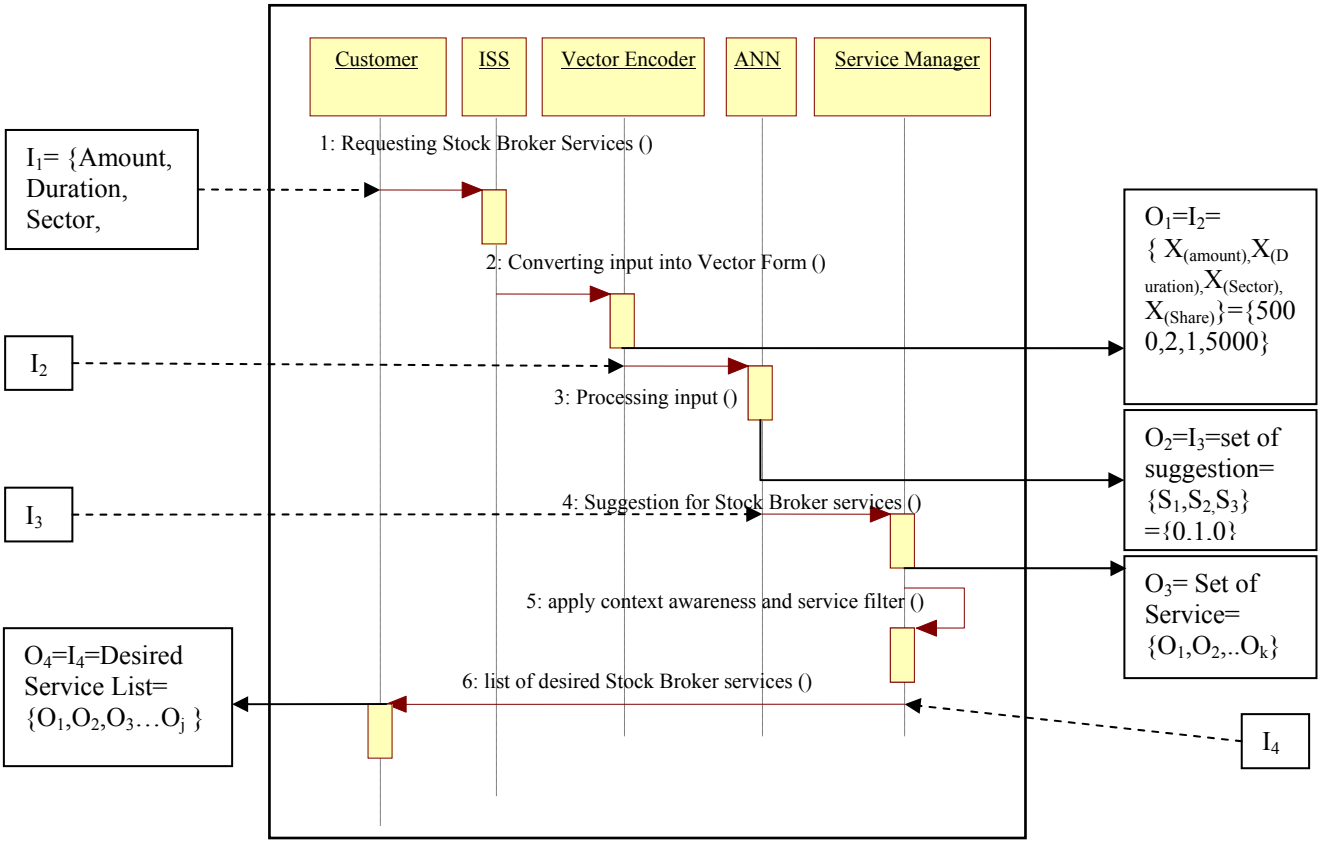

Figure 7 Interaction Diagram of Stock Market Recommendation System

2) Interaction between Client and Stock Marketing Recommendation System Client request the services to Intelligent Search System (ISS) by providing Input I_1. I_1 be defined as {Amount, Duration, Sector, Value}. Client request the Stock Broker services from ISS. ISS accept the client request and convert the input {Amount, Duration, Sector, value} into input vector X. The input vector X is either real number or Boolean value. This vector is considered as output O_1. X can be defined as $\{ X_1, X_2, X_3 \ldots\ldots X_n\}$.so, Input Encoder will accept the set {Amount, Duration, Sector, Share} and process this set $\{ X_{(amount)}, X_{(Duration)}, X_{(Sector)}, X_{(value\ )} \}$and convert into { 500, 2, 1, 2}. This input set is input I_2 to ANN. ANN will accept input vector and adjust the weight to get desired suggestion set S. S values also either a real number or Boolean values. S value of this scenario is {0, 1, 0} is consider as output O_2.This suggestion set is Input I_3 to the service Manager. Based upon this suggestion, Service Manager fetches the services from Service Registry. This resultant service is output O_3 from Service Manager. O_3 is represented by $\{O_1, O_2, O_3, O_4 \ldots O_k\}$. Fetched services are processed by Lookup Manager for refinement in list of services by applying context awareness in fetched services. The resultant services O_4 are shown to customer by service manager. This interaction is illustrated in figure 7.

IV. Conclusion

Effective service discovery is achieved using JIT philosophy. Context-awareness is utilized to find the perspective of users query. The system will discover the service based upon their consumer input. It helps to provide matching services to consumer by eliminating irrelevant services. Intelligent search is performed using Neural Network. Experience is fed as input to the intelligent search system. In scenario 1, Travel intelligent system, fetch desired services to traveler based upon their request. In scenario 2, the system provides the Stock Broker details to invest their money in share market to client. Using Neural Network web service discovery system will provide effective service to service consumer.

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