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A Distributed Decisive Support Disease Prediction Algorithm for E-Health Care with the Support of JADE

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Abstract:
A Distributed decisive support disease prediction system for E-Health Care with the support of JADE (java agent development environment). The proposed solution supports the doctors to access the patient details from anywhere in the world easily. Due to the data diversity, it is not possible to maintain all the patient details in a single location. This solution makes easier to access the patient details independent of location and it produces decisive support information for doctors. Sometimes the doctor may not be sure about any disease that the patient get affected, in such situations the doctor need some assistance about other patient history with similar symptoms. For example cough and cold may be a symptom for fever but those symptoms also supports for other unfamiliar diseases also. So that the doctor can't take any decision by simply seeing few symptoms, on that stage the doctor may need to access patient histories of other hospitals or branches. The Jade framework makes easier to access the data instantly within short time. This framework maintains many containers and different agents to fetch different data from different location. Using those mobile agents all the data from remote locations is fetched and we use modern support and count methods to make decision. For the purpose of decision support, this methodology proposes a new support and count methods. It maintains a different patient database, whenever a new query is made then use database initially and also whenever fetch data from remote location it will be updated to related database also. Using the patterns or symptoms of the patient framework calculates probability value for each disease in order to predict by which the patient has affected. This solution reduces the time of moving agent from and to and increases the efficiency of the system.

Keywords: *Mobile Agents, Agent Creation, E-Health Care, Agent Management, Decisive Support algorithm, FIPA, JADE.*

I. INTRODUCTION

Nowadays there are various researches for medical solutions due to the increase of population and also the incoming of new kind of diseases. Day to day people are suffering with new diseases which cannot be identified by the doctor for prolong period. Still there are researches to identify diseases in a faster manner and to find solutions to them. In many cases the doctor's were find difficulty in identifying a disease or concluding a disease with the symptoms the patient have, because same set of symptoms may be support to more than one disease. For example cough and cold are symptoms of ordinary fever and also that are symptoms for tuberculosis. With these problems the doctors could not take a decision with the patient symptoms to proceed with treatment. Here, propose a decisive support disease prediction system for E-Health care using JADE environment. Java Agent Development Environment provides various features to create multiple agents using which an application can perform remote computation. It acts as a middleware between the application layer and data base layer. It is very useful in peer to peer and distributed environment where the data is distributed in many places. The agents developed using this environment can communicate with other agents and control them as necessary. The agent management system is used to control the lifecycles of other agents in the platform. The jade has functionalities to handle the events to be generated and handled, according to the event generated there are message can be fetched from the event and based on the generated message agent communication between other agents is carried out. Basically the environment has a main container where all agents are created and registered. The agents in the main container are controlled by another agent so it is launched very first and has a graphical user interface. The other containers in the distributed environment have to be registered first, so that

the distributed environment can be formed. The other containers can be registered using a command Boot with parameters container, host which specifies the internet protocol address of the machine where the main container runs. Once all other containers are registered with the main container then everything is ready for computation. Each ACL message contains agent id and other persistent values used by the agent to perform computation in the remote location. The agent location is identified by the location parameter using which the agent can distinguish between its home container and remote container. The agent performs the specified computation by identifying its location. The mobility behavior provided by the Jade environment makes easier to reduce the processing load in huge data processing environments and it reduces the time and scalability of the application. There may be any number of agents can be generated depend on the work load of the application and sent for remote execution.

The Agent Management System is responsible for the movement of agents from one location to other location with the help of ACL messages. Whenever an agent wants to move from one location it has to generate an ACL message, so that the agent will be moved to remote location by the Agent Management System. Decision support algorithm provides the benefit of getting into a conclusion about a patient by which he affected. It generates a probability value by which the decision is taken and it uses support and count methods to calculate the probability. There are various methods for decision support like apriori, frequent pattern etc. We propose a new one which generates probability with the support of frequent patterns.

II. LITERATURE REVIEW

Java agent Development environment has been used for various purposes. Its main area of application is networking and network security. There have been many publications with the help of JADE. Also the applications of jade extended to the area of data mining also. A Distributed framework using jade mobile agent environment is proposed to support the administrators to manage the network from the intrusions which are coming from inter and intranet [13]. The administrator will be able to analyze the kind of network threat coming to the network and according to that he can change the rules. It uses snort intrusion detection system and used alert database to store alerts.

New mobile agent based intrusion detection system is proposed which contains Intrusion Detection System on every network location [12]. It has a mobile agent environment to support distributed computing and each segment in the network has a sensor which captures the packets coming to the network and mobile agents move from different location and captured packets are delivered to the IDS using the agents. The intrusion detection system identifies the correctness of the packet.Spynet: This framework provides a solution to investigate crimes initiated by genuine users of the network [14]. It uses scattered network traffic data to identify the crimes. It uses the agents as a design unit in the distributed environment, so that the processing time, usage of bandwidth and overhead generated by communication. In this system additional agents can be created to reduce the work load, so that it reduces the scalability and increases the efficiency.

Web server with multi agent for medical practitioners by jade technology is proposed to support processing of bio signals like ECG, EMG, and EEG [19]. It helps the practioners to interact with other specialist to come to a conclusion. In this a multi agent system is proposed for content based retrieval of multimedia data [5]. It uses existing agent software components to fulfill the client requirements by adapting retrieved components. It has various levels as group, agent, module and code. Each level has its own responsibility and used for various purposes. Agent Based Software Engineering [7], proposed a method for Multi Agent System design, to reduce the time complexity in designing the multi agent system. It uses domain ontology and internal structure of the agents to design the multi agent system. By using this design of multi agent system will become easier with reduced cost. It reduces overall time and internal structure.

Multi agent Systems: A Modern Approach to Distributed Artificial Intelligence [2] is proposed, to get an intelligence using multiple agents which works in distributed manner. The evaluation of trust and reputation is computed with the interacting agents with dynamic behavior [15]. Here trust computation is performed dynamically and the agent should pass the trust computation process to perform its process in the remote location. This methodology reduces the risk of malicious agents attack, and also a load balancing algorithm is specified.With the help of mobile agents a distributed intrusion detection system is proposed in [18]. Here intrusion detection system runs on various locations of the network and captures the attack and logs to the database. The mobile agents are responsible for initializing the intrusion detection system, and fetching the log data from remote location. The administrator could control the IDS remotely with the help of mobile agents and he can infer some knowledge to improve the performance of the network.

III. EXISTING SYSTEM

There are various existing methodologies for the prediction of medical diseases, few of them have been discussed here. Prediction of medical diseases using radial basis function [20] is proposed by Hannan. They used artificial neural network and they trained 300 patient's symptoms. The radial basis function is used to predict the heart disease. A cardiovascular disease prediction system using genetic algorithm and neural network [21], used multilayered feed forward neural networks are used and genetic algorithm is used to determine the weight in less number of iterations. Improving the disease prediction using ontology [22], perform disease prediction based on crisp DRG features and fuzzy membership of patient diagnoses in the DRG groups. ICD-9 ontological similarity approach is used to compute fuzzy membership. In [23], an intelligent disease prediction system using data mining is discussed, using decision tree, naïve bayes and neural network. The methodologies here discussed are centralized in nature and more time consuming due to the amount of data to be processed. Keeping all those data in a single location makes the system scalable and more chance for single point failure. To overcome all those factors, here propose a distributed decisive support system for E-Health Care.

3.1 Proposed System

The proposed system contains four parts namely web server, web container, main agent container, remote container. The input to the web server through the web page symptoms given by the practitioner and output is through the web page as disease and probability values from the web server forwards the query and data to the main web container.

3.2 Multi-Agent Controller

Whenever a query rises, it identifies the location information about the other agent containers and number of agents necessary to process the query, to avoid unnecessary movement of agents to and from where no relevant data available.

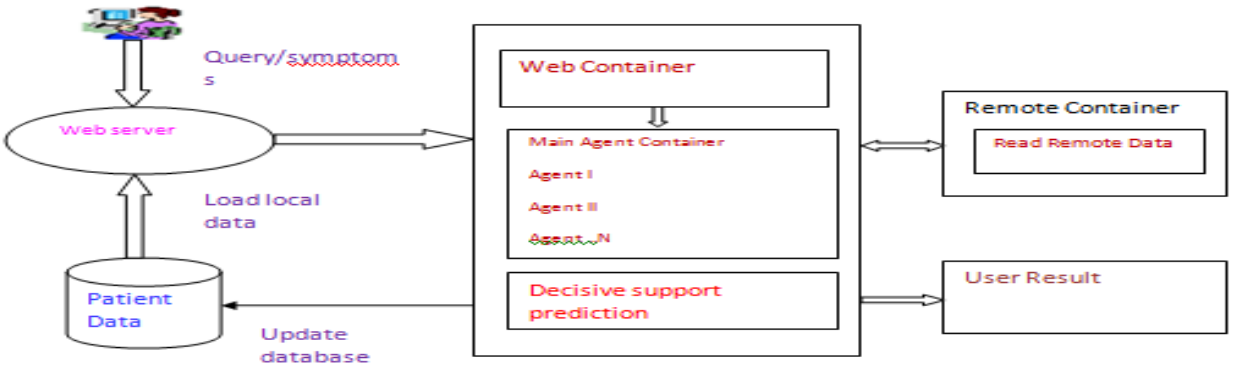

Figure1: System Architecture

The agent controller moves the agent only to the location where relevant data about the query is available. It generates the agents and moves them to remote container. The mobile agent reads the data from the remote data base when it reaches the remote container. After reading it once again returns to the main container and returns the data it read from the remote location.

3.3 Query Submission

The medical practitioner generates a query to the web server to get the disease probability for submitted query. He enters the set of symptoms and values of symptoms to through the web interface to the web server. For example if the patient affected by fever, it generates the temperature value ,and ECG details in case of chest pain , urine culture details in case of urinary tract infection (UTI) etc. Upon receiving such a query the web server reads the patient details and data from its local data base.

IV. DECISIVE SUPPORT PREDICTION ALGORITHM

The proposed algorithm reads both the agent fetched data and local data from the web server. First it identifies unique diseases from the dataset and unique pattern P_i from the whole data set D_s. For each pattern P_i in the data set Ds, It computes the number of matches N_i the pattern of symptoms with the whole data set D_s. The support value is the number of pattern matches it has with the whole data set.
For each disease K_i, the probability is calculated as follows.

$$P(K_i) = (N_i/T_i)*n*\log 0$$

N_i- the support value ie Number of pattern matches for a particular disease pattern.
T_i- total number of pattern for a particular disease pattern.
n- Number of agent locations we used.

2.1 Algorithm

Step1: Read all patterns from local and remote fetched.
Step2: Identify Unique Disease K_i.
Step3: For each Disease K_i Select patterns (M_i) from the whole set affected by Disease K_i. Match the symptoms with the pattern set (M_i). Count number of matches as support N_i. Count total number of patterns T_i. Calculate probability as

$$P(K_i) = (N_i/T_i)*n*\log 0. \text{ End}$$

Step 4: Sort the Disease probability values.
Step5: select the highest probability valued disease.
Step6: Stop.

2.2 Results and Discussion

The proposed methodology used many number of mobile agents and generates good results compared to other algorithms and methodologies. Here set of values provided as input for prediction and the results returned by the framework.

Table 1: Shows the efficiency of algorithms according to number of records used

No. of Patterns/Inputs	Prediction quality
1 million	78 %
2 million	85 %
3 million	92 %
More	95.5 %

widal	tiredness	tr	pressure	sugar	colastrol
2	2	102	0		33
3	4	100	0	158	
4	3	101			
1	2	102	0	168	43
3	4	100	0	156	
4	1	101		320	
2	2	102	0		21
3	4	100	0	158	
4	3	101			35
1	2	102	0	168	
3	4	100	0	156	25
4	1	101		320	
2	2	102	0		45
3	4	100	0	158	

Figure 2: Shows the data set used for prediction.

Multi Agent Based Disease Prediction Using (JADE)
SPECIFY SYMPTOMS VALUES

Widal	123
Tirednes	12
Temperature	102
Blood Pressure	0
Sugar	0
Collastrol	0
HP count	0

Figure 3: Shows the web interface for input

Figure 3. Shows a part of web interface intput and the remaining parameters has shown in the following Figure

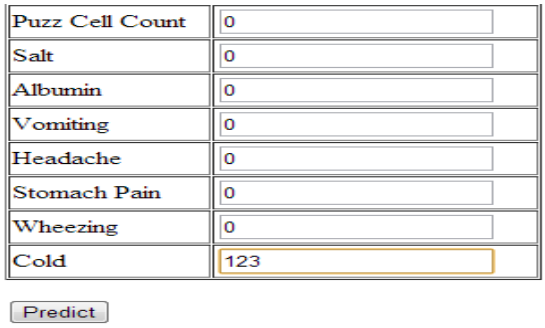

Figure 4: Shows the web input interface

Resultant Disease Probability Values

Disease	Probability
typoid	1.0
fever	0.0
uti	0.0
tubor	0.0
diaria	0.0
sugar	0.0
BP	0.0

Figure 5: Shows the result of generated probability values

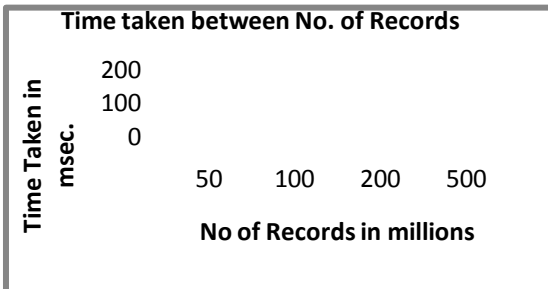

Figure 6: Graph shows the efficiency of algorithm

V. CONCLUSION

The proposed algorithm generates very good results. Here, 5 million records are used from 50 remote locations. This algorithm works faster even though more locations and containers and agents due to the reason why the main container maintains the meta data about the data exists in other locations, so that it moves only to particular locations where more data is relevant. This solution reduces the time and increases the efficiency of predicting disease.

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