A Novel way to Reprioritize Cloud Computing Process Requests with Extended Parameters using ANN

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Abstract: Cloud computing is one of the most promising technology. When using hybrid cloud we all don't know in which order the processes will be submitted to the private and public cloud. As some processes need to be more secure than other processes. Private Cloud is meant for security and privacy than public cloud. They need some mechanism that how these processes will be executed on private cloud or public cloud. So better is to prioritize the processes. A novel way is presented where an Artificial Neural Network model is designed to reprioritize the cloud computing processes with extended parameters. ANN being an Artificial Intelligence Technique is meant for accuracy. The results shows that the proposed technique helps in improving accuracy

Keywords: Cloud Computing, Hybrid Cloud, Resource Provisioning, Artificial Neural Network

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I. INTRODUCTION

Cloud Computing is one of the emerging web based technologies in IT industry. It has become a hot topic from the recent years. Cloud Computing, as the name implies, is the process of computing that contains so many hardware and software resources that can be delivered to the customers on the basis of resources requested[1].These resources are provided to the consumers as services. The consumers of these services don't know where the resources are located .Just they use these resources and pay on the basis of resources requested.

As per NIST "Cloud Computing [2] is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g. Networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction".

The main advantage of Cloud Computing is reduced investment costs of infrastructure and resources [3].The customer in need of hardware and software resources need not to spent on these costly resources and maintaining infrastructure. Rather, they can arrange these resources from the cloud service provider. The cloud service provider allocates resources when needed by the customers and de-allocate when they are no longer required.

A lot of advancements are coming in the field of Cloud Computing.

Artificial neural network (ANN):

Various Artificial Intelligence Techniques like Fuzzy Logic, Artificial Neural Network and Genetic Algorithm are there which always prove themselves in real life applications. Artificial neural network (ANN) like human brain is an information processing system that works in the same way as our brain works while processing information. Like human beings, ANNs consist of interconnection of neurons. Another similarity between the two models is that both brain and ANN learn by examples. Neural Network when trained is like an expert that is used to make predictions and also answer the queries. The conventional systems work on instructions. ANN is an artificial intelligence tool that emulates the learning and decision making abilities of human brain. ANN do not work on instructions. While training the ANN, it is critical to provide appropriate dataset to the network otherwise it will be wrongly trained and will give wrong results. It works according to the training given to the model. While training, if the model is trained with the input set and output set, it will give output corresponding to the input but if the model is given input which is not in the training set then it will give output corresponding to taught input that is very less different from patterns in training model. Other similarity is like in human nervous system, learning involves adjustments to the synaptic connections between the neurons. Same thing applies in ANN; where learning of model involves adjustments to the weights that exists between inter connection between the neurons.

Various learning algorithms are used for teaching ANN model. These are as follows:

- **Supervised Training:**
  It is a types of training/leaning algorithm in which the model is taught about inputs and outputs. The training will go on and weights will be adjusted accordingly while learning. After training, the machine will be able to give output to a new input according to the things learnt. So this algorithm is like a teacher that train the model unless it is able to give expected responses .Various popular supervised training algorithm used are: Back-Propagation net, Hebb net etc.
- **Unsupervised Training:**
  In this type of training algorithm, input is provided to the model but output is unknown. On the basis of observation of input patterns this type of training algorithm makes classification for outputs. Example of unsupervised training algorithm is Kohonen self-organizing map (SOM).
- **Reinforcement Training:**
  Another category of training algorithm is re-enforcement training algorithm where input is given to the model with only the direction whether the output attained is correct or not. The network will improve its performance with this indication and training process will be continued unless a desired level of performance is achieved

Types of Neural Network
The following are the various types of network used:

- **Feed Forward Networks:** The simplest form of neural network is Feed Forward network. As the name implies, in feed forward network the flow of information and data is only in one direction that is starting from input layer moving to hidden layer and finally to output layer. There is no back step or loop of information. Neural Network with no hidden layers are also known as Single Layer Perceptrons. Neural Network with one or more than hidden layer are known as Multilayer Perceptron. Neural Network applies in X-Ray image fusion **[4].**Other applications are in the field of computer vision and speech recognition.
- **Recurrent Network:** In contrast to Feed Forward Network, Recurrent neural network allows the movement of information to forward and backward direction. Here, output of each neuron is saved in it so that it can be used later to improve performance and decrease error rate. Recurrent network applies for the conversion of text to speech converter **[5]**.

- **Radial Basis Function Network (RBFN):** This type of network is a category of multilayer feed-forward network that uses radial basis function as transfer function in the neurons of hidden layer. This type of neural network is applied in Power Restoration Systems **[6].**
- **Neuro-Fuzzy Networks:** Using fuzzy logic in neural network is a concept of Neuro Fuzzy Networks. Here, Fuzzy Inference system is employed in the neural network. Various steps of Fuzzy logic like Fuzzification, inference engine, rules evaluation and defuzzification etc. are simulated on the layers of neural network **[7].**
- **Modular Neural Network:** Modular Neural Networks is a grouping up of different networks working independently to give output. Each neural network has a set of inputs. These networks do not interact with each other. The advantage of a modular neural network is that it breakdowns a large computational problem into smaller sub-problems while decreasing the complexity and number of connections and helps in reducing time while solving a problem **[8].**

2. Need of neural Network: In this section, various general and Fuzzy Logic based applications are explained:

2.1 General Applications

A trained neural network is like an expert that helps in making predictions and helps us in taking decisions by providing answers to our "What-If" questions"
Software defect is a problem in software that causes the software to produce incorrect output. Defect prediction at early stages is essential otherwise it will lead to increase in development, testing, maintenance cost and decrease in customer satisfaction. The main objective here is to predict the software faults using artificial neural network. The network is trained and tested using neural network. Then again network is trained and tested using Bacterial Foraging Optimization algorithm(BFOA).Both performances in terms of accuracy are compared and comparison is shown.BFOA algorithm is used for learning neural network to select the best architecture of the neural network and for producing fault free software by identifying fault prone software modules.**[9].**Also Levenberg-Marquardt(LM) algorithm based neural network is used for prediction of faults at early stages of Software development lifecycle. The accuracy of the proposed technique is compared with the polynomial function based neural network for predicting faults in software and the result shows that the proposed technique has a high accuracy level and also minimize the cost of the project**[10].** An Artificial Neural Network is popular for providing efficiency and accuracy in getting

results.ANN is also used in designing an intelligent Chessboard. All the items of Chess board are trained individually.ANN is used to train the chessboard to make it intelligent enough so that it can guide the user where a particular piece can move that means the possible movements of chessboard pieces. Back Propagation Algorithm is used to train pieces of chessboard. **[11]**.Neuro-Fuzzy method is also used for predicting vehicle fuel consumption **[7]** where the model take the input in the form of automobiles data and gives output in the form of fuel consumption in miles per gallon. The technical data of cars of different brands are collected where model is trained with the training set and some data is used for testing purpose. It has been observed that two features i.e. weight and year affects the output the most. The fuel consumption increases with the increase in weight and decrease in year. Neural Network is currently used in medical field **[12]**. In this field, Convolution neural network is used for training of Content based medical image retrieval system. The results obtained are used to get multimodal medical images for different body organs of human beings with good accuracy. Neural Network also has been used in Power Electronics and motor drives **[13]**

2.2. **Neural Network applications in cloud computing**

A fuzzy Neural Network based Job scheduling algorithm is proposed where the Fuzzy logic is used to convert the classified inputs into linguistic variables. The genetic algorithm in neural network is used for mapping the system resources with the tasks.Defuzzification process is used to convert the linguistic variables to the crisp values. The proposed algorithm is implemented on Cloud Sim and compared with the traditional Berger model. The result shows that the proposed technique results in reduction in bandwidth utilization and completion time thereby enhancing performance **[14].**

As a load predictor, time delay neural network performs well in grid computing for future workload prediction. The results of the research also show that the proposed model does almost 9 times less over allocation than the static model**.** Neural Network has proved itself for predicting future network loads **[15].** For adequate provisioning of resources, one has to predict the resource requirements in future in advance**[16].**Various machine learning techniques i.e. Neural Network(NN),Support Vector Machine(SVM) and Linear Regression(LR) are successfully used in predicting future resource needs**[17].**A Neural Network based Error and Recovery Monitoring System is provided for Cloud Computing for reducing costs as compared to traditional error recovery practices where the approach is to maintain duplicate data centre and servers for the recovery of data which leads to increasing costs**[18].**Various artificial intelligence techniques like Neural Network and Fuzzy

Logic are used to process huge data i.e. Big Data. So a multilayer neural network based on Map Reduce to process Big data is used. Back Propagation algorithm is used to train the neural network. The proposed algorithm results in better speed and convergence rate than that of existing algorithm **[19].**

So above is the introduction to the Cloud Computing and the tool used for improving accuracy. Rest of the paper is organized as follows: Section II contains Problem Statement. Section III contains Design and simulation. Section IV contains Results and finally conclusion.

II.PROBLEM STATEMENT

Here, we have taken the concept of Resource Provisioning in hybrid cloud environment. When the cloud processes are submitted for resources, we want to give them priority in which they will go to public cloud and private cloud. High priority processes will go to private cloud for resources as private cloud is more secure as compared to public cloud.

III.DESIGN AND SIMULATION

We have started the above work by taking three input parameters for defining clubbed priority i.e security, age and execution time .On the basis of above input parameters, data is collected from IT experts regarding output in the form of clubbed priority. The input file and output data set is prepared. We have taken an Artificial Intelligence tool Neural Network to prove accuracy in the field of cloud computing. As said earlier, Neural Network learns with examples. So, prior to simulation, training of model is required. So we have divided the entire process into two phases:
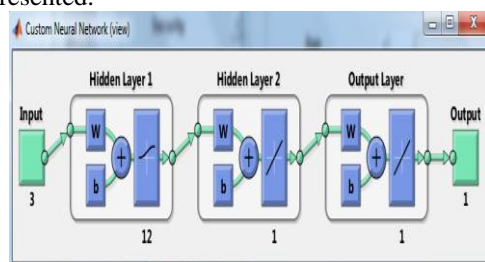
- Training
- Simulation

Training: For training, we have taken Feed Forward Network. The model contains three layers i.e. Input layer, Hidden Layer and output Layer fully connected to each other. The hidden layer contains 12 neurons. The model is trained with input and output files. Once trained, the model will be ready to give outputs to the new inputs which are not in the given input data. As we have discussed earlier at input layer, the input to each neuron which is going to middle layer is multiplied, bias is added to it to get the output for a neuron of middle layer then the activation functions are applied to get the particular neuron to fire. Same thing applies at middle layer. The input of the particular neuron of middle layer is multiplied with the weight and get added with the bias to get the output at the output layer and the activation function is applied to get the particular neuron to fire. The final output which we get

may be the output which we had not expected. To compute the error, the output we get is subtracted from the expected output. So we have to minimize this error to get the correct output or closer to correct output. Now the Back Propagation algorithm [20] applies. The factor δ is back propagated from output layer to the middle layer and the weights will be reinitialized and then the factor will be propagated back from the middle layer to the input layer by again reinitializing the weights. The process will be continued until we will get desired output or output closer to the desired output. Various Learning algorithms are available out of which we have chosen Back Propagation Network algorithm and for Back Propagation algorithm we have chosen Levenberg Marquardt method to train the network.

Simulation:

I have used MATLAB for simulation of above approach. When the neural network is built, its sample screen shot is presented.


After constructing the neural network model, the proposed model is trained with input data and target data. When trained, the position is like this:
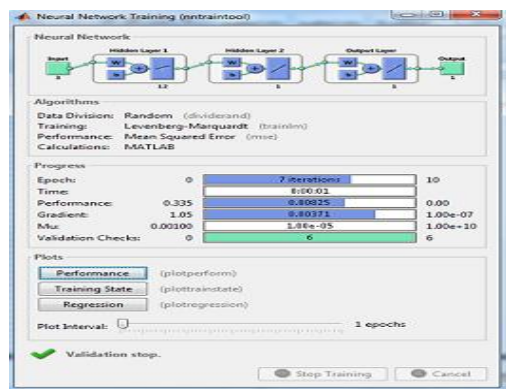
After training of the model, the model is able to give answers to the queries of the users. For simplicity I have designed a GUI for training of the model and for calculating the allocated priority. The sample screen shot is given below:
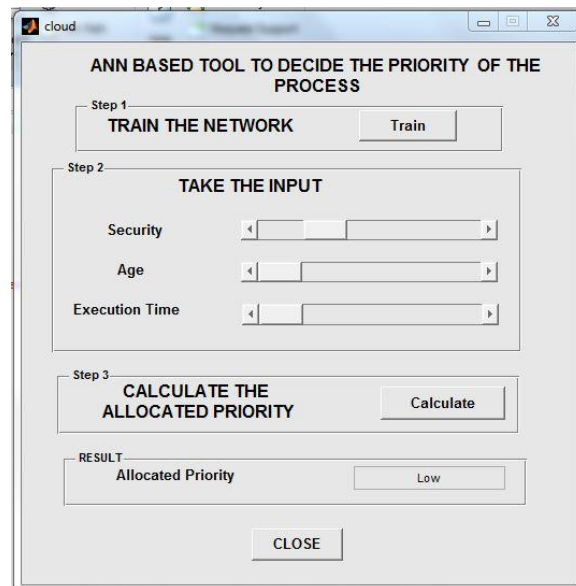
Step 1 will train the network
Step 2 will take inputs in the form of security, age and execution time
Step 3 will calculate final priority o
n the basis of inputs and training given to the model and the result will be shown as above.

The performance of the model is shown as follows:

As shown below, best validation performance is at epoch 1. Now the system is trained and ready to give answers to the queries:
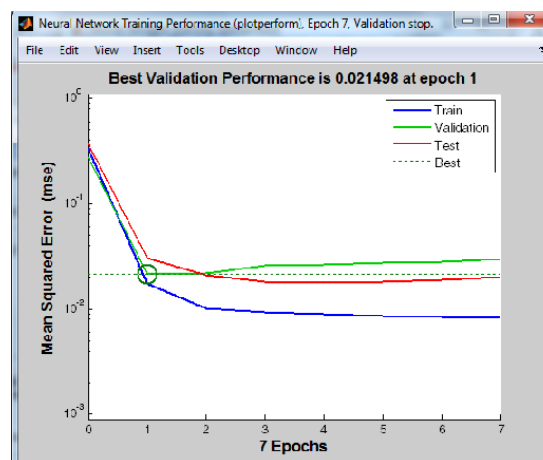
IV.RESULTS

Sr.No	Input Parameters			System Output	Expert1 Output	Expert2 Output	Expert3 Output
	Security	Age	Execution Time				
1	Very High	Very High	Medium	Medium	High	Very High	High
2	Very High	Very High	Low	High	Very High	Very High	High
3	Very High	High	Low	High	Very High	Very High	High
4	Very High	Medium	Very Low	High	High	Very High	Very High
5	Very High	Low	High	High	High	High	High
6	Very High	Low	Low	Very High	Medium	High	High
7	High	High	Very High	High	Medium	Medium	High
8	High	Low	Very High	Medium	Medium	Medium	Medium
9	High	Low	Medium	High	Medium	Medium	Medium
10	Medium	High	Very High	High	Low	Low	Low
11	Medium	High	Medium	Medium	Medium	Medium	Medium
12	Medium	High	Very Low	High	High	High	High
13	Medium	Medium	Low	High	Medium	Medium	Medium
14	Medium	Low	Medium	Medium	Low	Low	Low
15	Low	High	Medium	Medium	Low	Low	Low
16	Low	Medium	Low	High	Low	Low	Medium
17	Low	Medium	Very Low	High	Medium	Medium	Medium
18	Low	Low	Very Low	Medium	Very Low	Very Low	Medium
19	Low	Very Low	High	Medium	Very Low	Very Low	Very Low
20	Very Low	High	Medium	High	Low	Very Low	Low
21	Very Low	Medium	High	Medium	Very Low	Very Low	Very Low
22	Very Low	Medium	Very Low	Medium	Low	Low	Medium
23	Very Low	Low	Very High	Medium	Very Low	Very Low	Low
24	Very Low	Very Low	Very High	Medium	Very Low	Very Low	Low
25	Very High	High	Medium	High	Very High	Very High	High
26	Very High	Low	Very Low	High	Very High	Very High	High
27	High	Very High	High	High	Very High	Very High	High
28	Medium	Low	Very Low	High	Medium	Medium	Medium
29	Medium	Very Low	Very Low	Medium	Medium	Medium	Medium
30	Low	Very High	Low	Medium	Medium	Medium	Medium
31	Low	High	Low	High	Low	Low	Low
32	Low	High	Very Low	High	Medium	Medium	Medium
33	Low	Low	Medium	Low	Low	Low	Low
34	Very Low	High	High	Medium	Very Low	Very Low	Medium
35	Very Low	Medium	Low	Medium	Very Low	Very Low	Medium

In the results section, various results of the proposed model and the experts results are presented. The results contain the priorities given to the processes on the basis of parameters: security, Age and Execution Time.

V.CONCLUSION

A novel way to reprioritize cloud computing processes with extended parameters i.e. age, execution time and security is presesented.The cloud Computing based processes Artificial Intelligence is known for accuracy. Artificial Neural Network is used for improving accuracy in the field of cloud computing. Results of experts and ANN is compared and show the effectiveness of tool in cloud computing.

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