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Adaptive Neural Fuzzy Interface System for Cloud Computing

M. Mohan Vamsi, S. P. Shantharajah
SITE, VIT University, Vellore,
Tamilnadu, India

Abstract— Cloud computing is an improving area in research and in industry, which consists of distributed computing, internet, web services and virtualization.One of the most important technologies to load forecasting in the cloud computing is to ensure the maximize utilization of the system resource. Under the premise that the load is known in the next level, the cloud computing node can assign the physical machines in advance, and hence reduces the waiting time of the task, which also reduces the cloud computing node's resource consumption. A neural fuzzy technique called Adaptive network based fuzzy inference system (ANFIS) has been used as a prime tool in the present work. Using this hybrid method, at first an initial fuzzy model along with its input variables are derived with the help of the rules extracted from the input output data of the system that is being represented. Next the neural network is used to fine tune the rules of the initial fuzzy model to produce the final ANFIS model of the system. In this proposed work ANFIS is used as the backbone for the load balancing in the cloud computing.

Keywords—Cloud Computing, Data Mining, ANFIS, Load Balancing, Adaptive Fuzzy Interface, Hybrid ANFIS

I. INTRODUCTION

Adaptive network based fuzzy inference system (ANFIS) is a neuro fuzzy technique where the fusion is made between the neural network and the fuzzy inference system. In ANFIS the parameters can be estimated in such a way that both the Sugeno and Tsukamoto fuzzy models are represented by the ANFIS architecture. Again with minor constraints the ANFIS model resembles the Radial basis function network (RBFN) functionally. This ANFIS methodology comprises of a hybrid system of fuzzy logic and neural network technique. The fuzzy logic takes into account the imprecision and uncertainty of the system that is being modeled while the neural network gives it a sense of adaptability.

Cloud computing is a new pattern of large-scale distributed computing. It has stimulated computing and data away from desktop and manageable PCs, into large data centers [1]. It has the ability to connect the power of Internet and wide area network (WAN) to make use of resources that are available remotely, thereby providing cost-effective solution to most of the real life requirements [2]. It gives the scalable IT resources such as applications and services, in addition to the infrastructure on which they control, over the Internet, on pay-per-use basis to regulate the capacity rapidly and easily. It helps to occupy changes in demand and helps any organization in stay away from the capital costs of software and hardware [3] [4]. Therefore, cloud computing is a structure for enabling an appropriate, on-demand network access to a common pool of computing resources.Cloud service is divided into three models. They are,as shown in Fig. 1.

Cloud Software as a service (Saas): The competence provided to the consumer is to make use of the provider's applications consecutively running on a cloud communications. The applications are easy to get from several client devices throughout a thin client interface such as a web browser. The consumer does not deal with the fundamental cloud infrastructure.

Cloud Platform as a Service (Paas): The capability provided to the consumer is to arrange on the cloud communications consumer formed or obtained applications created by means of programming languages and tools sustained by the provider. The consumer does not supervise or control the fundamental cloud structure, but has control over the applications and perhaps application hosting environment configurations.

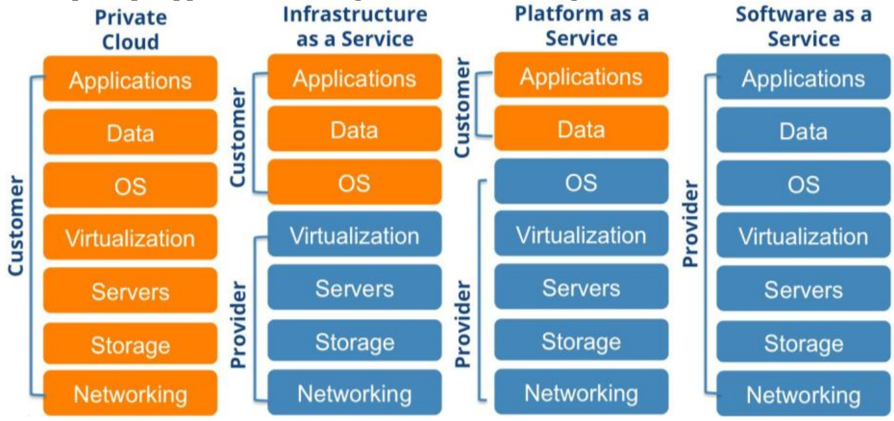

Figure 1 Cloud Service Models

Cloud Infrastructure as a Service (Iaas): The capability provided to the consumer is to stipulation processing, storage space, networks, and other basic computing resources where the consumer is capable to deploy and run random software, which contains operating systems and applications. The consumer does not control the underlying cloud communications but has control over operating systems, deployed applications, storage and perhaps limited control of select networking components.

II. LITERATURE SURVEY

1) Y. Zhao et al. [5] explained the problem that happens in intra-cloud load balancing with substantial hosts by adaptive survive migration of virtual machines. A load balancing model is introduced by the author to reduce virtual machines migration time by shared storage, to balance load with servers based on their processor or IO usage, etc. and to remain virtual machines' zero-downtime in the process. This algorithm guarantees that the migration of VMs is at all times from high-cost physical hosts to low cost host but considering that each physical host has sufficient memory which is a weak assumption.

2) V. Nae et al. [10] presented an eventdriven load balancing algorithm for real-time Massively Multiplayer Online Games (MMOG). This algorithm once receiving capacity events as input, analyzes its components in context of the resources and the global state of the game session, thus producing the game session load balancing actions. It is accomplished of scaling up and down a game session on multiple resources according to the variable user load but has occasional QoS breaches.

3) Z. Zhang et al. [7] discussed about a load balancing system based on ant colony and complex network theory (ACCLB) in an open cloud computing group. It uses small world and scale-free features of a composite network to attain improved load balancing.

4) X. Liu et al. [8] introduced a lock-free multiprocessing load balancing solution that keep away the use of shared memory in difference to further multiprocessing load balancing solutions which is used to share memory and lock to maintain a user session. It is achieved by modifying Linux kernel.

5) J. Hu et al. [9] discussed about a scheduling approach on load balancing of VM resources that make use of historical data and present state of the system. This approach attains the better load balancing and condensed dynamic migration by means of a genetic algorithm. It helps in determine the problem of load-imbalance and high cost of migration therefore achieves better resource utilization.

6) A. Bhadani et al. [6] presented a Central Load Balancing Policy for Virtual Machines (CLBVM) that balances the load equally in a distributed virtual machine/cloud computing environment. This strategy enhances the performance of the system but not considering fault-tolerant of the system.

III. PROBLEM STATEMENT

Cloud computing services are becoming omnipresent and serve as the primary source of calculating power for different applications like activity and personal computing applications. It has many benefits all along with some fundamental problems to be resolved in order to improve reliability of cloud environment. Also that, these problems is associated with load management, tolerance and different security issues in cloud environment. In this paper introduces a better load balancing model for the public cloud based on the cloud partitioning concept with a switch mechanism to select different strategies for different situations. Adaptive neuro-fuzzy inference system (ANFIS) based load balancing algorithm is proposed to the load balancing strategy to improve the efficiency in the public cloud environment.

IV. PROPOSED SOLUTION

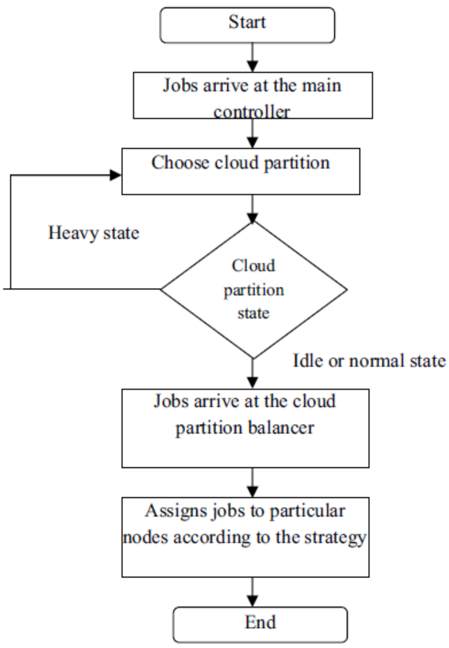

Fig. 2 Job Assignment Strategy

Algorithm for assigning the jobs to cloud partition as shown in Fig. 2

Step 1: jobs arrive at the main controller
Step 2: choosing the cloud partition
Step 3: if cloud partition state is idle or normal state then
Step 4: jobs arrive at the cloud partition balancer.
Step 5: assigning the jobs to particular nodes based on the strategy.
Step 6: process ends.

V. EXPERIMENTS AND RESULTS

For simplicity, it is assumed that the fuzzy inference system under consideration has two inputs and one output. The rule base contains the fuzzy if-then rules of type as follows:

If x is A and y is B then z is f(x,y) where A and B are the fuzzy sets in the antecedents and z = f(x, y) is a crisp function in the consequent. Usually f(x, y) is a polynomial for the input variables x and y. But it can also be any other function that can approximately describe the output of the system within the fuzzy region as specified by the antecedent. When f(x,y) is a constant, a zero order fuzzy model is formed which may be considered to be a special case of fuzzy inference system where each rule consequent is specified by a fuzzy singleton.

If f(x,y) is taken to be a first order polynomial a first order fuzzy model is formed. For a first order two rule fuzzy inference system, the two rules may be stated as:

Rule 1: If x is A1 and y is B1 then f1 = p1x + q1y + r1
Rule 2: If x is A2 and y is B2 then f2 = p2x + q2y + r2

Here type-3 fuzzy inference system which is used. In this inference system the output of each rule is a linear combination of the input variables added by a constant term. The final output is the weighted average of each rule's output.

The algorithm is illustrated to maintain the load in Virtual Machine of cloud :

```
Begin
   Connect_to_resource ()
   L1
   If (resource found)
   Begin
   Select neuro – fuzzy_connection ()
   Return resource to requester
  End
   Else
   Begin
   If (Anymore resource available)
   Choose_next_resource ()
   Go to L1
   Else
  Exit
  End
   End
```

When the cloud partition is normal, tasks are arriving much faster than the idle state and the situation is far more difficult, thus a different strategy is used for the load balancing. Every user needs his jobs done in the shortest time, as a result the public cloud needs a method that can complete the jobs of all users with reasonable response time.

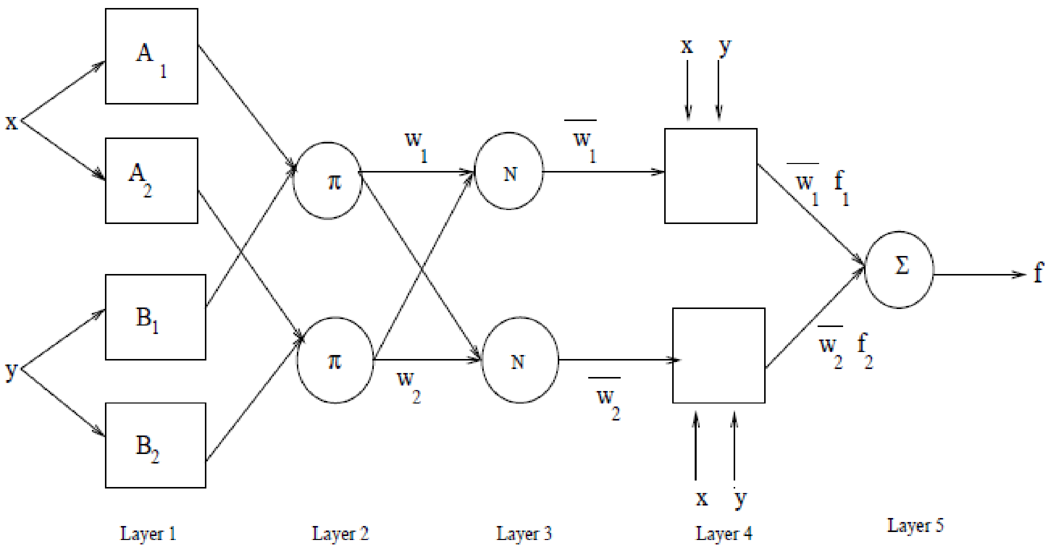

Figure3 Type-3 ANFIS

	Forward Pass	Backward Pass
Premise Parameters	Fixed	Gradient Descent
Consequent Parameters	Least-squares estimator	Fixed
Signals	Node outputs	Error signals

Two passes in the hybrid learning algorithm for ANFIS.

VI. CONCLUSION

Load balancing is one of the main challenges in cloud computing. It is required to distribute the dynamic local workload evenly across all the nodes to achieve a high user satisfaction and re-source utilization ratio by making sure that every computing re-source is distributed efficiently and fairly. Existing load balancing techniques have many disadvantages, therefore an efficient load balancing technique that can improve the performance of cloud computing by balancing the workload across all the nodes in the cloud along with maximum resource utilization is required. In this paper, proposed the new efficient load balancing technique using ANFIS based load balancing technique is used to obtain measurable improvements in resource utilization and availability of cloud-computing environment.

VII. FUTURE WORK

We do not claim the completeness of our load balancing system. Otherwise, certain constrains and assumptions to the domain area were considered, and the limited sets of data characteristics were considered in order to guarantee the desired level of confidence in the system when solving a bounded set of problems.Also this load balancing measures can be integrated with the cloud framework and can be extended to Artificial Intelligent and Intelligence Systems like speech recognition,finger print scanner,face detection algorithms etc…

REFERENCES

[1] Nidhi Jain Kansal, Inderveer Chana, published ,” Cloud Load balancing techniques: A step towards green computing”, IJCSI International Journal of Computer Science Issues, Vol. 9, Issue 1, No 1, January 2012.

[2] A.Bhadani, and S. Chaudhary, “Performance evaluation of web servers using central load balancing policy over virtual machines on cloud”, Proceedings of the Third Annual ACM Bangalore Conference (COMPUTE), January 2010.

[3] R. W. Lucky, “Cloud computing”, IEEE Journal of Spectrum, Vol. 46, No. 5, May 2009, pages 27-45.

[4] M. D. Dikaiakos, G. Pallis, D. Katsa, P. Mehra, and A. Vakali, “Cloud Computing: Distributed Internet Computing for IT,Scientific Research”, IEEE Journal of Internet Computing, Vol. 13, No. 5, September/October 2009, pages 10-13.

[5] Zhao Y. and Huang W. (2009) 5th International Joint Conference on INC, IMS and IDC, 170-175.

[6] Bhadani A. and Chaudhary S. (2010) 3rd Annual ACM Bangalore Conference.

[7] H. Mehta, P. Kanungo, and M. Chandwani, “Decentralized content aware load balancing algorithm for distributed computing environments”, Proceedings of the International Conference Workshop on Emerging Trends in Technology (ICWET), February 2011, pages 370-375.

[8] Xi. Liu, Lei. Pan, Chong-Jun. Wang, and Jun-Yuan. Xie, “A Lock-Free Solution for Load Balancing in Multi-Core Environment”, 3rd IEEE International Workshop on Intelligent Systems and Applications (ISA), 2011, pages 1-4.

[9] J. Hu, J. Gu, G. Sun, and T. Zhao, “A Scheduling Strategy on Load Balancing of Virtual Machine Resources in Cloud Computing Environment”, Third International Symposium on Parallel Architectures, Algorithms and Programming (PAAP), 2010, pages 89-96.

[10] V. Nae, R. Prodan, and T. Fahringer, “Cost-Efcient Hosting and Load Balancing of Massively Multiplayer Online Games”, Proceedings of the 11th IEEE/ACM International Conference on Grid Computing (Grid), IEEE Computer Society, October 2010, pages 9-17.

[11] ZHANG Lei, XU Dayu. Multi-step optimized GM(1,1)model-based short term resource load prediction in cloud computing. Computer Engineering and Applications, 2014, 50（10）： 65-71.

[12] Xu Dayu. On-demanded Resource Prediction and Optimal Resource Allocation Method Research in Cloud Computing Environment[D]. Hefei University of Technology,2014.

[13] López M, Valero S, Senabre C, et al. Standardization of short-term load forecasting models[C]// European Energy Market (EEM), 2012 9th International Conference on the. IEEE, 2012:1-7.

[14] Prevost J J, Nagothu K M, Kelley B, et al. Prediction of cloud data center networks loads using stochastic and neural models[C]// System of Systems Engineering (SoSE), 2011 6th International Conference on. IEEE, 2011:276 - 281.

[15] Sheng D, Kondo D, Cirne W. Host load prediction in a Google compute cloud with a Bayesian model[C]// SC Conference. IEEE, 2012:1-11.

[16] Rasheduzzaman M, Islam M A, Islam T, et al. Study of different forecasting models on Google cluster trace[C]// Computer and Information Technology (ICCIT), 2013 16th International Conference on. IEEE, 2014:414-419.

[17] Dan Yang, A Research on Design and Application of Kalman Filter[D]. Xiangtan University, 2014.

[18] Difu P, Hui L, Yanfei L. A wind speed forecasting optimization model for wind farms based on time series analysis and Kalman filter algorithm[J]. POWER SYSTEM TECHNOLOGY-BEIJING-, 2008, 32(7): 82.

[19] ZHANG H, YU Y, WANG Q. Modeling and Simulation Applying Adaptive Neural-Fuzzy Inference System (ANFIS) [J][J]. Computer Simulation, 2002, 4: 012.

[20] Du T. Forecasting Method of the Slope Displacement Based on the ANFIS Model[J]. JOURNAL-CHONGQING JIANZHU UNIVERSITY, 2005, 27(4): 55.570