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Cloud Computing Customer's Satisfaction System Using Adaptive Neuro Fuzzy Model

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Abstract

The discovery of cloud Computing changed the concept of IT world. Cloud has been rapidly expanding its root around the globe and the country. Cloud Computing provides an easy, convenient and transparent service that is most widely used by the users (e.g. individual and organizations). Being, widely spread in organizations world-wide, organization related policies are not widely considered. Organizations have different policies according to the nature of work and the security of information like end-users policy, security policy, usage policy, etc. IT world is still demanding the complete study on trust of Cloud Computing. This paper will focus on defining a trusted model for Cloud Computing Customers Satisfaction for describing various issues in usage of Cloud Computing. An Adaptive Neuro Fuzzy model is developed to overcome the presently available ambiguous customer's satisfaction assessment.

Keywords: Cloud Computing, Adaptive Neuro Fuzzy Inference System (ANFIS), Customers Satisfaction.

1. Introduction

This model has been developed considering ^[2] Security and Privacy, Policy, Dependency (loss of control), Cost, Decreased flexibility and obstacles in evaluating Customers' satisfaction. It helps management in providing gap analysis between existing analysis and the desired ones. In the recent past traditional applications were very expensive and complicated for an Organization. Variety of hardware and software were required to run these applications. Resulting, huge expenditure incurs in terms of hardware/software purchasing or expenditure incurs on in-house application development, expenditure on skilled/unskilled manpower and expenditure on hardware/software maintenance, monitoring, up-gradation, management cost, data storage costs, etc. To manage these hardware and software a team of experts is always required to install, configure, run, test, secure, and upgrade them.

It was felt by the researcher to develop a new technology which reduced the overall cost of IT concepts; this new technology was Cloud Computing. The Cloud Computing (CC) is a paradigm that provides IT services through Internet. The name cloud computing was inspired by the cloud symbol that's often used to represent the Internet in flowcharts and diagrams.

Cloud computing is basically a resource that can be utilized online to maintain the business's platform. Cloud computing is always advancing and changing each year so that it will work better for personal uses and business uses ^[3]. Cloud Computing technology is low cost, on-demand standard configurations that meet the needs of a broad customer base. Cloud Computing provides three main technology platform strategies i.e. Platform as a Service (PaaS), Software as a Service (SaaS), and Infrastructure as a Service (IaaS). There are various tools and features that users will be able to track when using the cloud computing resource. These features/tools would include over the internet for a low and cost effective price like Testing, Building applications, Developmental Stages, Network equipment(s), Hosting Maintenance etc.

2. Cloud Computing Deployment Models ^[13]: According to the usage & deployment, the cloud computing deployment models are divided into four categories-

a) Public Cloud

Public cloud applications, storage, and other resources are made available to the general public by a service provider. These services are free or offered on a pay-per-use model. Generally, public cloud service providers like Amazon AWS, Microsoft and Google own and operate the infrastructure and offer access only via Internet (direct connectivity is not offered).

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b) Community Cloud

Community cloud shares infrastructure between several organizations from a specific community with common concerns (security, compliance, jurisdiction, etc.), whether managed internally or by a third-party and hosted internally or externally. The costs are spread over fewer users than a public cloud, so only some of the cost savings potential of cloud computing are realized.

c) Hybrid Cloud

Hybrid cloud is a composition of two or more clouds that remain unique entities but are bound together, offering the benefits of multiple deployment models. By utilizing hybrid cloud architecture, companies and individuals are able to obtain degrees of fault tolerance combined with locally immediate usability without dependency on internet connectivity. Hybrid cloud architecture requires both on-premises resources and off-site (remote) server-based cloud infrastructure. Hybrid clouds lack the flexibility, security and certainty of in-house applications. Hybrid cloud provides the flexibility of in house applications with the fault tolerance and scalability of cloud based services.

d) Private Cloud

Private cloud is cloud infrastructure operated solely for a single organization, whether managed internally or by a third-party and hosted internally or externally. Undertaking a private cloud project requires a significant level and degree of engagement to virtualize the business environment, and it will require the organization to re-evaluate decisions about existing resources. When it is done right, it can have a positive impact on a business, but every one of the steps in the project raises security issues that must be addressed in order to avoid serious vulnerabilities. They have attracted criticism because users still have to buy, build, and manage them and thus do not benefit from less hands-on management, essentially the economic model that makes cloud computing such an intriguing concept.

In this research, the Neural Networks and Fuzzy concepts are combined. The Neural Networks and Fuzzy logic has their strengths. Explicit knowledge Representation from Fuzzy Logic with training algorithms from Neural Nets [4].

	Neural Nets	Fuzzy Logic
Knowledge Representation	Implicit, the system cannot be easy interpreted or modified(-).	Explicit, verification and optimization is easy and efficient(+++)
Trainability	Trains itself by learning from the data sets (+++)	None, You have to define everything explicitly(-)

3. Training Fuzzy Logic Systems with Neuro-Fuzzy [4]

many alternative ways of integratin neural nets and fuzzy logic have been proposed in the scientific literature. The first artificial neural net implementation dates over 50 years back. Since then, most research dealt with learning techniques and algorithms. One major milestone in the development of neural net technology was the invention of the so-called error back propagation algorithm about ten years ago.

Every time, a question comes in the mind. Why Cloud Service is different from the traditional hosting? The main difference is [12], a cloud service has three distinct characteristics that differentiate it from traditional hosting. It is sold on demand, typically by the minute or the hour; it is elastic - a user can have as much or as little of a service as they want at any given time; and the service is fully managed by the provider (the consumer needs nothing but a personal computer and Internet access). Significant innovations in virtualization and distributed computing, as well as improved access to high-speed Internet and a weak economy, have accelerated interest in cloud computing.

4. Models

After various researches, researchers have begun from 2007 to exploit ways to use of cloud computing in types of Organizations. There are enough numbers of ambiguous studies in cloud computing field and after studying various research papers, books and generals, it is gathered that there are many definitions of cloud computing, which confuse the consumers in deciding the accurate meaning of the Cloud Computing and deciding for talking the services of cloud service providers. Some of the definitions are presented below:

Sl. No.	Author	Definition of Cloud
1	Wenjuan Li and Lingdi Ping, Xueze Pan (2010)	Cloud computing is a set of network enabled services, providing scalable, QoS guaranteed, normally personalized, inexpensive computing infrastructures on demand, which could be accessed in a simple and pervasive way
2	Gartner (2009)	Cloud computing is a style of computing in which scalable and elastic IT-enabled capabilities are delivered as a service to external customers using Internet technologies.
3	Mell and Grance (2009)	Cloud computing 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.
4	John Foley (2008)	cloud computing is the use of massively scaled offsite IT resources assembled virtually, accessed over the internet, used on demand in real time or near real-time on a pay-per-use or subscription basis, where the workloads are shared among multiple customers.
5	Vaquero <i>et al.</i> (2009)	Clouds are a large pool of easily usable and accessible virtualized resources (such as hardware, development platforms and/or services). These resources can be dynamically reconfigured to adjust to a variable load (scale), allowing also for an optimum resource utilization. This pool of resources is typically exploited by a pay-per-use model in which guarantees are offered by the Infrastructure Provider by means of customized SLAs.
6	Armbrust <i>et al.</i> (2010)	Cloud Computing refers to both the applications delivered as services over the Internet and the hardware and systems software in the data centres that provide those services.
7	Marin Litoiu (2009)	Cloud Computing is an emerging computational model in which applications, data, and IT resources are provided as services to users over the Web.
8	SUN (2009)	Cloud computing 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. This cloud model promotes availability and is composed of five essential characteristics, three service models, and four deployment models.
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The customer satisfaction is the primary goal of any marketing strategy of the Organizations as it reflects the service quality of a company. In 2012, there is amazing growth in the Consumer Cloud- the cloud computing for everyday users. There are three main categories in the Consumer Cloud: storage, sync, and notes. Dropbox, Apple's iCloud and Evernote (respectively) have been the most impressive performers in each category.

(Khajeh-Hosseini *et al.*, 2010) proposed a Technological Suitability Analysis to support decision makers in determining whether cloud computing is the right technology to support their proposed system. This model comprises eight simple checklist of questions for rapid assessment of the cloud's for an Organization. Proposed a model to evaluate user behaviour trust and evaluation strategy in the cloud computing by using fuzzy Analytic Hierarchical Process (FAHP) to evaluate security behaviour, identity re-authentication, expense behaviour and contract behaviour.

(Alhamad, 2011) present a model for each of the dimensions for IaaS using fuzzy-set theory and then use the neuro fuzzy-inference approach for developing an overall measure of trust value of the cloud providers. In proposed model the classification of cloud computing service requirements from the perspective of cloud consumers such as availability, scalability, response time, cost calculation, configuration of service and Security and privacy.

(Abadi, 2010) proposed a conceptual model of six categories- System Architect, The resilience process, Adaptability, Scalability, Availability and Service Reliability. This conceptual model is concerned about exploring and analyzing automated self-managed services for cloud's virtual resources. (Aumueller, 2010) in his master dissertation present a conceptual model mentioned principles and IT-compliance criteria such as Availability, Integrity, confidentiality and verifiability for Data Security in cloud computing.

5. Conclusion and future work

To evaluate cloud computing user's satisfaction, two main stages should be carried out: Firstly, a conceptual model is to be developed based on literature review and cloud computing experts to identify measurement criteria. Secondly, Adaptive Neuro-fuzzy inference system (ANFIS) architectures is to be designed. ANFIS is considered as a universal approximate. Adaptive neural fuzzy inference system (ANFIS) is based on fuzzy logic modelling and uses artificial neural network as the learning algorithm. The system can teach, change the data environment or respond to the remote stimulus for adapting to the change of data environment (Michael, 2005). ANFIS uses hybrid algorithm that consists of a combination between back-propagation and least-square estimation techniques (Jang, 1993). The techniques are implemented in artificial neural network as a learning algorithm that gives very fast convergence and more accurate in ANFIS target.

The ANFIS model is one of the perfect models in analysing the cloud computing customers' satisfaction. This research will provide more informative and reliable analytical results and also facilitates managers in rapid decision making. The model can facilitate systematic continuous quality improvement; it provides the means for manager to devise an improvement plan. Further research is necessary to compare the efficiency of different models for measuring user's satisfaction.

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