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Applications to Audit Decision Problem using Neural Networks

M. Poornima[#1],C. Kuyin*[2]

[#1]*Assistant Professors, Department of Commerce with Computer Applications,*
JayarajAnnapackiam College for Women (Autonomous), Periyakulam, Tamilnadu, India,
[#1]poornimaramaki16@gmail.com
[*2]mesiachinna@gmail.com

***Abstract*— We investigate the possibility of applying artificial intelligence to solve an audit decision problem faced by the public sector when targeting firms for further investigation. propose that the neural network will surmount quandaries faced by a direct cognizance acquisition method in building an expert system to preserve the expertise of senior auditors. A clarification of the neural system hypothesis is furnished with respect to multi-and single-layered neural systems. Insights uncover that the neural system performs positively, and that three-layer systems perform superior to two-layer neural systems. The outcomes emphatically recommend that neural systems can be utilized to distinguish firms requiring further auditings.**

***Keywords*— Artificial Neural Networks, Layers of Networks, Learning Process, Audit domain, Computational Intelligence in Audit.**

I. INTRODUCTION

The spread of using computers in many business units in economic activity has significantly developed in recent years. Such a development is due to the recent changes occurred in business units , industrial firms, information technology, computer technology, and the changes in vocational, governmental, and economic institutions surrounding the firms the most significant developments in recent years so-called artificial intelligence and its applications in computers and auditing in particular.

Artificial intelligence is defined as a use of computer in the reproduction of human insight via human information based computer programs through which a decision can be reached similar to human decision. However, Decision-Making cannot be based on information only. Artificial Neural Network is a artificial intelligence application that have started an intriguing subject since fifties as researchers have attempted to make programs that invigorate neural systems work in the human mind and associated them together so as to make a specific learning process, yet they were not able do as such in light of the fact that the equipment around then was not skilled to process enough amount of neural networks to reach something stimulates human intelligence and the brain function was unknown at that time.

The interest in artificial neural networks has restored in late eighties because of the need to process information in a way that animates human personality, the advancement in PC innovation and nervous system science that brought about more prominent comprehension of human brain structure. Recently, the accounting research has tended to use artificial neural networks in managing different bookkeeping issues in the light of the ongoing charges that fake neural systems based techniques are superior to usual statistical methods such as regression analysis and differentiation analysis. As conventional statistical methods need data with assumptions or certain conditions such as (normally distributed data and equal variance and covariance matrixes of that data). Actually, these assumptions rarely exist in data, as a result, some researchers have questioned these methods reliability while artificial neural networks models do not need such assumptions existence that created using examples of solutions to problems in a specific practical field, which has led to rapid spread of such models and has become generally-accepted by researchers.

As a result of IT spread, inspecting needed to profit this advancement in giving auditing services. In this paper, I will discuss the concept and types of artificial neural networks and favorable circumstances and drawbacks of use of neural systems and the most critical applications in inspecting.

II. ARTIFICIAL NEURAL NETWORKS

Artificial neural networks or connectionist systems are computing systems vaguely inspired by the biological neural networks that constitute animal brains. The neural network itself is not an algorithm, but rather a framework for many different machine learning algorithms to cooperate and process complex information inputs.

In like manner ANN executions, the flag at an association between artificial neurons are a real number, and the output of each artificial neuron is computed by some non-linear function of the sum of its inputs. The associations between artificial neurons are called 'edges'. Artificial neurons and edges normally changes as learning continues. The load increments or diminishes the quality of the flag at an association. Artificial neurons may have a limit with the end goal that the flag is possibly sent if the total flag crosses that edge. Commonly, artificial neurons are accumulated into layers. Diverse layers may perform various types of changes on their sources of info. Signs travel from the primary layer (the input layer), to the last layer (the output layer), conceivably in the wake of crossing the layers on various occasions.

A. Single-Layer Network

By associating different neurons, the genuine processing intensity of the neural networks comes, though even a single neuron can perform generous dimension of calculation. The most well-known structure of interfacing. The simplest form of layered network is shown in figure 1. The shaded nodes on the left are in the so-called input layer. The input layer neurons are to only pass and distribute the inputs and do no computation. Thus, the only true layer of neurons is the one on the right. Each of the inputs $x_1, x_2, x_3, \ldots, x_N$ is related to every artificial neuron in the output layer through the connection weight. Since each estimation of outputs $y_1, y_2, y_3, \ldots, y_N$ is determined from a similar arrangement of input values, each output is fluctuated dependent on the association loads. Although the presented network is fully associated, the genuine natural neural system might not have every conceivable association - the load estimation of zero can be spoken to as "no association"

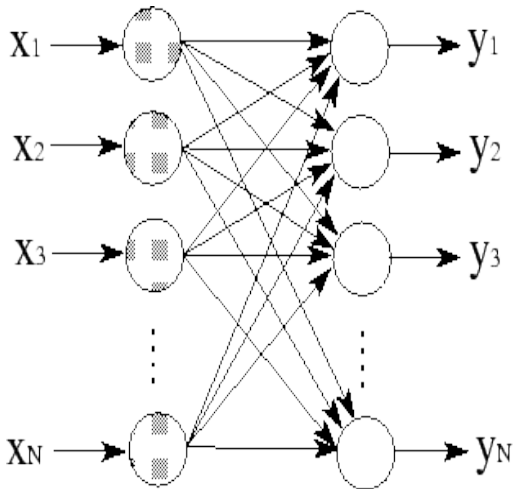

Fig. 1: Single Layer Neural Network

B. Multilayer Network

To accomplish more elevated amount of computational abilities, a progressively unpredictable structure of neural system is required. Figure 2 shows the multilayer neural network which distinguishes itself from the single-layer network by having one or more hidden layers. In this multilayer structure, the info hubs pass the in grouping to the units in the primary shrouded layer, and then the outputs from the main concealed layer are passed to the following layer, etc.

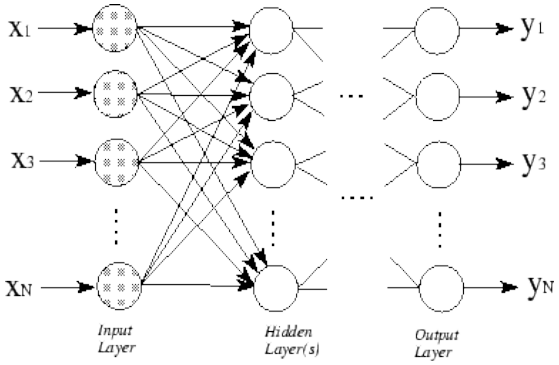

Fig. 2: Multiple Layer Neural Network

Multilayer system can be likewise seen as falling of gatherings of single-layer networks. The dimension of multifaceted nature in registering can be seen by the way that many single-layer systems are joined into this multilayer network. The designer of an artificial neural network ought to think about what number of shrouded layers is required, contingent upon intricacy in desired computation.

C. Learning Processes

Maybe, the most essential criticalness of a neural network capacity to get familiar with the approaching data and to improve the execution of handling data. The term learning refers to many concepts by various viewpoints, and it is difficult to agree on a precise definition of the term. In neural networks, we define learning as the following sequence of events:

- Stimulation by an environment in which the network is embedded.
- Changes in free parameters of the network as the result of stimulation.
- Responses in a new way to the environment for improved performance.

A Learning algorithm is a prescribed set of well-defined rules for learning of a neural network. There are numerous kinds of learning algorithms; the shared objective of learning is the amendment of connection weights.

There are two classes of learning: supervised and unsupervised learning.
requires an outer wellspring of data so as to modify the network. On the other hand, in unsupervised

learning, there is no outside specialist that disregards the way toward learning. Instead, the network is is balanced through interior checking of execution. In this thesis, we mainly deal with supervised learning since understanding the back spread system, which centers around regulated learning, is our objective.

III. ARTIFICIAL NEURAL NETWORKS IN THE AUDIT DOMAIN

Although it is not as frequent when compared to other branches of knowledge, the use of neural networks in the audit field is mentioned several times in the scientific literature, although the references cited herein are not the result of a comprehensive review. Calderon and Cheh (2002) analyze papers published in some categories: risk assessment (three pa- pers), fraud and error identification (six papers), and issue of going concern opinion (three papers), identification of situations where there is too much exposure to financial risks (three papers) and bankruptcy forecast (twelve papers). These authors state that neural networks may be superior to other techniques when data is available in large samples, the scale of values to be analyzed is large and associations among data are poorly defined and barely noticeable.

Garrity, O'Donnell and Sanders (2006), when defending continuous auditing and the use of computational intelligence, also highlight applications of artificial neural networks in the same areas mentioned by Calderon and Cheh (2002) and Koskivaara (2003). Cerullo and Cerrullo (2006) analyze the use of neural networks to predict fraud in financial statements, by using coefficients and information on resulting from analyses of the accounting statements themselves. The authors state that neural networks process large amounts of data to solve problems by recognizing trends and complex relationships, which are barely perceptible to other computational methods.

Taha (2012) justifies the use of neural networks in auditing and concludes that such neural networks are better than statistical methods for planning and conducting audits. From his perspective, neural networks may indicate which financial statements are most likely to contain substantial errors, guiding the auditor in relation to how in-depth audit tests are and providing further conditions to issue a more accurate opinion on these financial statements.

Although their study shows other very interesting findings, its results showed that the MLP neural network proved to have high ability to identify different types of audit opinions on the financial statements, achieving a success rate of over 87%, jointly considering modified and unmodified opinions. Finally, Byrnes et al (2014) defend the appropriation of data analysis techniques by auditing standards. From their perspective, technological developments, such as cloud computing, and the advances of data science contribute to enhance the effectiveness and efficiency of the audit work. They argue that the incorporation of computational intelligence enables continuous and predictive audits, more effective fraud detection and the safer issue of opinions.

These authors also point out several opportunities that are enhanced by the use of data analysis in financial audits, such as: the identification of risks associated with audit contracts (risks of bankruptcy and senior management fraud); the identification of risks of material errors and the performance of substantive tests and the identification of non-conformities in financial statements due to fraud. These applications support, almost entirely, the works carried out by the control bodies. In addition, pattern recognition using artificial neural networks, may be used in many other audit problems. Some examples are the identification of fraud in bidding and procurement public processes and the granting of benefits from government programs, the identification of personnel admission or pension registration deeds not qualified for such, as well as a tool for continuous and predictive audit of the Government's Accounts, part of the annual review of the President's government accounts. Therefore, the use of neural networks may be an important tool to improve the effectiveness, efficiency and even the economy of the works carried out by the institutions.

IV. FOSTERING THE USE OF COMPUTATIONAL INTELLIGENCE IN AUDITS

It has been well established that it is the duty of the Federal Court of Accounts (TCU) not only to control legality and compliance, but also to control efficiency, economy, efficacy and effectiveness of management actions in relation to individuals who use, collect, keep, manage or administer public monies, values and goods. To perform an audit in all its dimensions, the TCU has been granted several duties by constitutional and infra-constitutional norms, which, over time, have become quite complex and varied, demanding a timely, focused and intelligent action, in order to optimize the resources made available to it. Society, by becoming increasingly connected and aware of the need for greater transparency in the use of public resources, has increasingly demanded that government databases be made available.

TCU has often faced the need to properly handle this information and use it to assist its mission to improve the Government to benefit society. January/April 2016 41 In this scenario, the Presidency of the TCU, during the administration of Minister AroldoCedraz, decided to undertake actions to encourage the use of computational intelligence applied to audits. Two strategic guidelines, which were outlined for TCU's 2015-2021 Strategic Planning and approved by TCU Order 141 from April

1st, 2015, stand out in this context: (i) using control intelligence to identify on a large scale the risks of nonperformance or inadequate implementation of products and services and inducing such practices to other parties subject to jurisdiction; and (ii) developing comprehensive organizational competence to work with emerging technology resources and analyzing large databases (Big Data). At the tactical level, the 2015-2017 Audit Plan defines a line of action, which takes part in this movement, i.e., continuously monitoring, from the treatment of information databases, the use of public funds, in order to timely detect and correct possible diversions. An outstanding initiative associated with this movement was the launch, on September 28th, 2015, of the TCU Center for Research and Innovation (CePI). This unit, which had already begun its activities in January 2015, aims to promote applied research in the TCU and coordinate the Innovation and Co-participation Lab (coLAB-i). The coLAB-i aims to support innovative projects, ensure the knowledge management of developed solutions, coordinate cooperation activities and promote training activities and events in relation to topics at the frontier of knowledge.

V. CONCLUSIONS

As information technological changes occur at an increasing rate, auditors must keep pace with these emerging changes and their impact on their client's information processing systems as well as on their own audit procedures. This paper reviewed the current state of the ANN-applications connected to auditing purpose. The review is comprehensive but by no means exhaustive, given the fast growing nature of the literature. The main findings are summarized as follows:

The main application areas were material errors, management fraud, and support for going concern decision. ANNs have also been applied to internal control risk assessment, audit fee, and financial distress problems. New application areas like authority checking and analyzing minutes with an ANN could be considered. Commercial ANN pen-based systems and natural language interfaces are currently available. To develop an ANN to serve as either a hand-written character or speech recognition device and to integrate the ANN with existing software (for example, word processor, spreadsheet, etc.) may be helpful for power checking. An evaluator may examine minutes and different records of the substance with an ANN. This can be done either alone or simultaneously together with financial accounts' values. The ability to forecast a company's earnings may be useful in assisting management in developing an operating strategy or in evaluating the budgeting.

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