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Development and Analysis of Intelligent System that can Provide for Superior Computer and Network Security

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ABSTRACT: Numerous advances have been made in developing intelligent systems, some inspired by biological neural networks. Artificial neural networks (ANNs) are designed to solve a variety of problems in pattern recognition, prediction, optimization, associative memory, and control as well as network security. Data Encryption Standard method (DES), which is a widely-used method of data encryption are becoming more vulnerable to security breaches and can easily be hacked by an intruders. This article presents the best technique to develop the intelligent system that will provide for superior computer and network security. Perceptron algorithm trained by back propagation algorithm can overcome some of the draw backs of data encryption standard method.

KEYWORDS: intelligent system, superior computer, network security, artificial intelligence

I. INTRODUCTION

Conventional approaches have been proposed for solving computer security problems. Although successful applications can be found in certain well-constrained environments, none is flexible enough to perform well outside its domain. ANNs provide exciting alternatives and many applications could benefit from using them. [1, 2, 3]
Numerous efforts to develop "intelligent" programs based on Von Neumann's centralized architecture have not resulted in general-purpose intelligent programs. Inspired by biological neural networks, ANNs are massively parallel computing systems consisting of an extremely large number of simple processors with many interconnections. ANN models attempt to use some "organizational" principles believed to be used in the humans.[4]

An artificial neural network is a system based on the operation of biological neural networks, in other words, it is an emulation of biological neural system. Although computing these days is truly advanced, there are certain tasks that a program made for a common microprocessor is unable to perform; even so a software implementation of a neural network can be made.
Another aspect of the artificial neural networks is that there are different architectures, which consequently require different types of algorithms, but despite to be an apparently complex system; a neural network is relatively simple.

Artificial neural networks are among the newest signal processing technologies nowadays. This field of work is very interdisciplinary, but the explanation given here will be restricted to an engineering perspective.

In the world of engineering, neural networks have two main functions: Pattern classifiers and as non linear adaptive filters. As its biological predecessor, an artificial neural network is an adaptive system. By adaptive, it means that each parameter is changed during its operation and it is deployed for solving the problem in matter. This is called the training phase.

An artificial neural network is developed with a systematic step-by-step procedure which optimizes a criterion commonly known as the learning rule. The input/output training data is fundamental for these networks as it conveys

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the information which is necessary to discover the optimal operating point. In addition, a non linear nature makes neural network processing elements a very flexible system.

II. LITERATURE SURVEY

In [5]Authors defined Network management as the monitoring, testing, configuring, and troubleshooting network components to meet a set of requirements defined by an organization. These requirements include the smooth, efficient operation of the network that provides the predefined quality of service for users. To accomplish this task, every computer network uses a network management system which uses hardware, software, and humans to accomplish the desired objective. The functions performed by a network management system can be divided into five broad categories viz: configuration management, fault management, performance management, security management, and accounting management.

Security management is responsible for controlling access to the network based on the predefined policy. It is difficult to deny the importance of security in data communications and networking. In most cases, security in networking is based on cryptography which is the science and art of transforming messages to make them secure and immune to attack. Cryptography can provide several aspects of security related to the interchange of messages through networks. These aspects are confidentiality, integrity, authentication, and non-repudiation.

According to [6], system and network technology is a key technology for a wide variety of applications. Security is crucial to networks and applications. Although, network security is a critical requirement in emerging networks, there is a significant lack of security methods that can be easily implemented. In essence, there exists a communication gap between the developers of security technology and developers of networks. Network design is a well-developed process that is based on the Open Systems Interface (OSI) model. The OSI model has several advantages when designing networks [7]. The Open Systems Interconnect (OSI) model was developed circa 1981 by the International Standards Organization (ISO).

The OSI model comprises seven functional layers, which provide the basis for communication among computers over networks. The seven layers of the OSI model, from the highest to the lowest, are Application, Presentation, Session, Transport, Network, Data Link, and Physical layers [7]. It offers modularity, flexibility, ease-of-use, and standardization of protocols. The protocols of different layers can be easily combined to create stacks which allow modular development. The implementation of individual layers can be changed in a network design by making other adjustments, and allowing flexibility in development. There could be various methodologies to manage the complexity of security requirements. Secured network design does not contain the same advantages as network design.

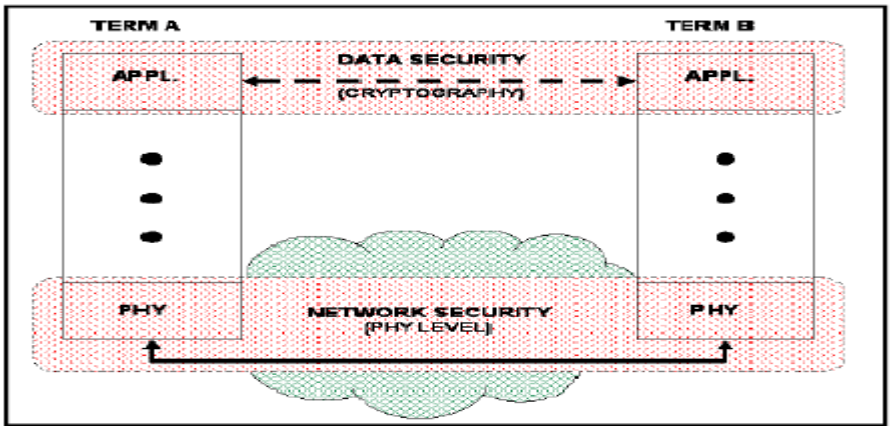

Figure1. OSI model data security and network security functions [8]

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III. INTELLIGENT SYSTEM DESIGN

By experience, it is not necessary to be a programmer nor have deep knowledge about complex neural network algorithms in order to design a neural network. There are wide ranges of neural network software out there, and most of them are of good quality. The suggestions for those looking for the answer on neural network design are to acquire all required tools. Good software will save thousands of hours of programming as well as efforts in learning complex algorithms.

Designing and implementing intelligent systems has become a crucial factor for the innovation and development of better products for the society. Such is the case of the implementation of artificial life as well as giving solution to interrogatives that linear systems are not able to resolve.

The most popular class of multilayer feed-forward networks is multilayer perceptrons in which each computational unit employs either the thresholding function or the sigmoid function. Multilayer perceptrons can form arbitrarily complex decision boundaries and represent any Boolean function. The development of the back-propagation learning algorithm for determining weights in a multilayer perceptron has made these networks the most popular among researchers and users of neural networks.[4]

The ANNs learning algorithms can be divided into two main groups that are supervised (or Associative learning) and unsupervised (Self-Organization) learning.[9,10,11] Supervised learning learns based on the target value or the desired outputs. During training the network tries to match the outputs with the desired target values. It is presented with an example picked at random from the set and the synaptic weights of the network are modified to minimize the difference between the desired response and the actual response of the network produced by the input signal in accordance with an appropriate statistical criterion. The training of the network is repeated for many examples in the set until the network reaches a steady state, where there are no further significant changes in the synaptic weights. The previously applied training example may be reapplied during the training session but in a difference order. Thus the network learns from the examples by constructing an input-output mapping for the problem at hand.[11]

Unsupervised learning method is not given any target value. A desired output of the network is unknown. During training the network performs some kind of data compression such as dimensionality reduction or clustering. The network learns the distribution of patterns and makes a classification of that pattern where, similar patterns are assigned to the same output cluster. The Kohonen Self-Organizing Map (SOM) network is the best example of unsupervised learning network.[11]

For simple Perceptrons performing classification, it was noticed that the decision boundaries are hyper planes, and can learn as the process of shifting around the hyper planes until each training pattern is classified correctly
Somehow, we need to formalize that process of “shifting around” into a systematic algorithm that can easily be implemented on a computer

The “shifting around” can conveniently be split up into a number of small steps.
If the network weights at time t are $w_{ij}(t)$, then the shifting process corresponds to moving them by an amount $Dw_{ij}(t)$ so that at time t+1 we have weights $w_{ij}(t+1) = w_{ij}(t) + Dw_{ij}(t)$. It is convenient to treat the thresholds as weights, as discussed previously, so we don’t need separate equations for them

PERCEPTRON ALGORITHM

- Step 0: Initialize weights and bias
  –For simplicity set weights and bias to zero
  - Set learning rate $\alpha(0<=\alpha<=1)$ (ŋ)
- Step 1: While stopping condition is false do steps 2-6
- Step 2: For each training pair s:t do steps 3-5
- Step 3: Set activations of input units
  $x_i=s_i$

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- Step 4: Compute response of output unit
  $y\_in=b + \Sigma x_i+w_i$
  y = 1 if Y _ in > ø
  0 if – ø < y _in < ø
  -1 if Y_ in < -ø
- Step 5: Update weights and bias if an error occurred for this pattern
  if y! =t
  $w_i(new)= w_i(old) + \alpha t x_i$
  $b(new)=b(old)+ \alpha t$
  else
  $w_i(new) = w_i(old)$
  b(new)=b(old)
- Step 6: Test stopping condition
  – if no weights changed in step 2, stop, else, continue

IV. NETWORK SECURITY SYSTEM AND ANALYSIS

The security problem is considered here as the problem of keeping communications over the network private. In other words, a secure network allows only the intended recipient to intercept and read a message addressed to her/him. Thus, protection of information is required against possible violations that can compromise its secrecy (or confidentiality). Secrecy is compromised if information is disclosed to users not authorized to access it.[12]

V. DISCUSSION AND RESULTS

ANNs work very well in the Intelligent System that can provide for Superior Computer and Network Security. However, there is conclusive evidence about their superiority over conventional system.

Developments in ANNs have simulated a lot of enthusiasm and criticism. Some comparative studies are optimistic, some offer pessimism. For many tasks, such as developing an intelligent system, no one approach dominates the others. The choice of the best technique should be driven by the given application's nature. We should try to understand the capacities, assumptions, and applicability of various approaches and maximally exploit their complementary advantages to develop better intelligent systems. Such an effort may lead to a synergistic approach that combines the strengths of ANNs with other technologies to achieve significantly better performance for challenging problems. As Minsky recently observed, the time has come to build systems out of diverse components. Individual modules are important, but we also need a good methodology for integration. It is clear that communication and cooperative work between *researchers working in ANNs and other disciplines will not only avoid repetitious work but (and more important) will stimulate and benefit individual disciplines.

VI. CONCLUSION

Network security is the ongoing process of exercising due care and due diligence to protect information, and information system, from unauthorized access, use, disclosure, destruction, modification, disruption or distribution. As the computer network grows, the artificial neural networks are of notable importance. In particular, artificial neural network models have been always deeply considered because of their wide range of usage. However, it was found that the neural network satisfy the necessary conditions for providing computational strength and safety that has always been a serious problem.

In this work, new approach based on artificial neural networks was provided, which were trained by back propagation algorithm and this technique was developed to ensure that the information over the computer network is

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difficult to hack. A neural network is used to learn the decryption mechanism. Finally, the results showed that after training the artificial neural networks, it can be used effectively as a decryption function.

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