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# Detection and Classification of Attacks in NIDS

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***Abstract:***

Rapid advancements in network technology come at the cost of insecure data. The intruder is attempting to read data being transmitted across the network. The goal behind reading the data is to observe packets and produce traffic in order to disrupt communication. Various studies are being conducted in order to detect and prevent these assaults from occurring on the network. To detect network threats, intrusion detection techniques such as fuzzy clustering, genetic algorithms, artificial neural networks, and others are utilised. ANN is the approach with the best detection rate among these. The back propagation algorithm of the Multilayer Perceptron and SVM are used in this system. These methods are used in these techniques. The intruder's whereabouts is tracked using a self-organizing map. As a consequence, the method is 90.43 percent efficient. The suggested system is made up of several modules, such as packet collection across the network, data preprocessing, and feature extraction. The suggested system consists of several modules, including packet collecting over the network, data preparation (i.e., extracting the feature to apply), and classification of the connection as normal or assault. We can either kill the process or shut down the system completely. Alternatively, we can use SOM to track down the location of that IP address.

***Keyword: MLP, DDOS, NIDES, ANN, ISA, BPN***

## I. INTRODUCTION

The communication technology has some benefits and drawbacks, and the internet's primary function is to offer communication and secure transmission. To identify current intrusion on the network, several techniques such as firewalls and intrusion detection systems are used. The firewall is in use, but it is not observing packets in depth enough to detect an intrusion. To detect an incursion, we must first observe packets and then determine whether they are normal or attack packets. It's also crucial to know the attacker's IP address and location. Using Multi Layer Perceptron, I created a network intrusion detection system based on artificial neural networks (MLP). The implemented system in many earlier research has been a neural network capable of recognising normal or attack connections; however, in the current study, a more general problem is explored, in which the attack type is also recognised. This capability enables the system to recommend appropriate countermeasures. The suggested system is made up of several modules, the first of which monitors network packets. If any suspicious packets are detected, the data is processed, which includes being labelled and forwarded to the feature extractor. This module collects feature vectors from network packets and delivers them to the classifier module, which then compares the sample to previous samples. If the sample matches, the alarm is triggered. The false positive and false negative rates are calculated to determine whether the connection is normal or intruder.

## II. LITERATURE SURVEY

1. In order to provide better performance using ANN there are lots of research are performed some techniques uses fuzzy clustering, class association, SVM and some techniques uses expert system with ANN[1].
2. James Cannady stats that the misuse detection with artificial neural network the paper describes the misuse kind of detection of intrusion but the drawback of the system is it require accurate training of data which is very crucial task. And the rules are not hard coded so implementer has to design the rule and then implement it. But it fails to detect other attacks [2]. Some systems has MLP for detecting Probe attacks it was able to detect probe kind of attacks but the rest of the attacks are not to be detect by the system[7].
3. The Christos Siaterlis Basil Maglaris stated that the MLP can be used to detect DDOS kind of attack it can detect all kind of attack but still the various accuracy is required to detect those. But the other attacks call root to local, user to root, and probe kind of attacks was developed in that system [8].
4. The scholar Debra Anderson, Thane Frivold, Alfonso Valdes states that This version is designed to operate in real time to detect intrusions as they occur NIDES are a comprehensive system that uses new statistical algorithms for anomaly detection, as well as an expert system that encodes known intrusion scenarios. NIDES are itself a sensitive application and have security requirements in addition to those of the systems whose use is being monitored. If an intruder can read the NIDES rule base, then the penetrated site and other sites using a substantially similar rule base could be jeopardized, especially if such knowledge is shared among the intruder community. Although this system isnot more reliable than the proposed system [10].

## III. PROPOSED SYSTEM ARCHICTURE

The proposed system, which uses multi layer back propagation to classify these assaults, can detect and classify all types of attacks. The existing System can identify seven distinct types of attacks, while the proposed system will detect 10 different attacks from different categories.

The positive sides of the ANN are they can provide the ability of faster information processing. It is capable of classification and detection of kind of attack also it has and the ability of self learning and self organization. The NIDS can analyze the network captured packets and detect whether it would be an intrusion or not [1].

A back propagation algorithm (BPA) uses the Delta Rule, calculating error at output units, while error at neurons in the layer directly preceding the output layer is a function of the errors on all units that use its output. The error in the output node(s) are propagated backward through the network after each training case. The better idea to use the back propagation is to combine a non-linear multi-layer perceptron-like system capable of making decisions with the objectiveerror function of the Delta Rule [4]. Back Propagation Neural (BPN) Network architecture is is one of the most popular network architectures for supervised learning. Analysis is carried out on Internet Security and Acceleration (ISA) server 2000 log for finding out the web documents that should not be accessed by the unauthorized. From the architecture, the diagram of system includes several modules, which has shown in Figure.

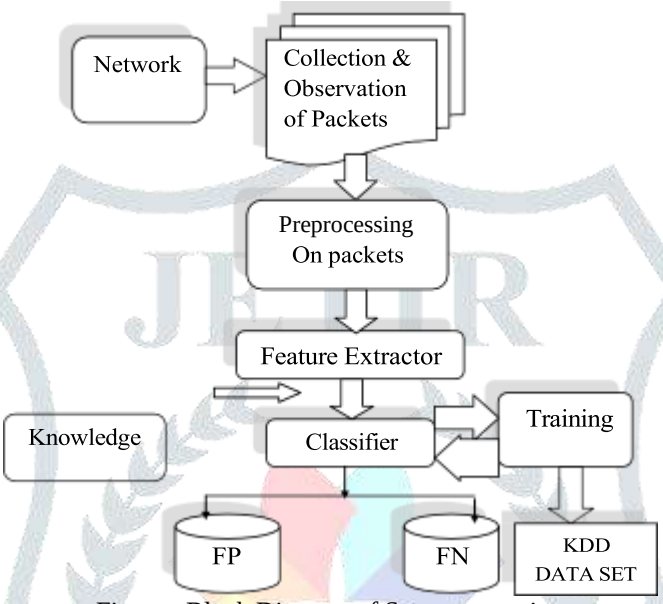



Figure: Block Diagram of System overview

There are several modules that introduce the network intrusion detection system based on the artificial neural networks architecture. They are as follows

***A. Packet monitor*:** It monitors network stream real time and collect packets to serve for the data source of the NIDS.

***B. Preprocessor*:** In this phase, network traffic collected and processed for use as input to the system.

***C. Feature extractor**:* It extracts feature vector from the network packets and submits the feature vector to the classifier module. Feature vector extracted feature which serves for the description of the packet. Whether the feature vector can describe the network stream correctly and efficiently or not. It affect on the efficiency and correctness of the NIDS.

***D. Classifier:*** It analyze the network stream and to state a conclusion whether intrusion happens or not. Classifier module is the most important in neural network model; The Classifier uses a three layers neural network. The dimension of the input layer is the number of the features selected, and the dimension of the output layer is the number of sorts that can be classified by the Classifier.

The transfer function: *Logsig(x)* = 1/(1+ exp (-x)) can be used in the Classifier model.

The learning function: *transfer* function can be used in the Classifier which works based on Back-propagation algorithm. Initialization of the weight: Any values form 0 to 1 can be assigned as weights and that are applied randomly to the nodes [1].

***E. Decision**:* It detect whether the intrusion happens, or not this module will send a warning message to the user.

***F. False positive and false negative**:* False positive is nothing but it is an event when the system generates alarm for such situation which is a normal event. And the false negative is an event when alarm is not generating even the intrusionis detected.

***G. Knowledgebase**:* This module is used for the training samples of the classifier phase. That is KDD Cup'99 Intrusion Detection Dataset (KDD). The dataset is the collection of network related information that consists of a number of basic features: duration of the connection, protocol type, such as TCP, UDP or ICMP, service type, such as FTP, HTTP,

Telnet, status flag, total bytes sent to destination host, total bytes sent to source host, whether source and destination addresses are the same or not, number of wrong fragments, number of urgent packets. Each record consists of 41 attributes and one target. The target value indicates the attack name. There are 41 features for each connection.Specifically, "a connection is a sequence of TCP packets starting and ending at some well-defined times, between which data flows from a source IP address to a target IP address under some well-defined protocol".

***H. Dataset:*** The following table shows the trained sample of attacks in KDD cup data set of a particular kind of attack.

## IV. IMPLEMENTATION

The implementation of the system contain basic server client connection one by one we can add client to the system. After connection establishment of the connection we can transfer packets over the network then the data set is loaded and classified in various categories. The client systems then get scanned trough the port scanning tool to find the network traffic and data transmission on network. We can also scan a single port and find the connection details that details wecan pass to back propagation algorithm to find whether this is attack. Then the IP location is find out using SOM approach which is modified approach. the all processes running on that server we can see kill and as well as we can shutdown the system. The algorithm are back propagation and kohen self organizing map.

**MODULE 1: ALGORITHM FOR MLP***:* The algorithm of the system using MLP is as follows
Instead of back propagation algorithm for providing more efficiency we can also use

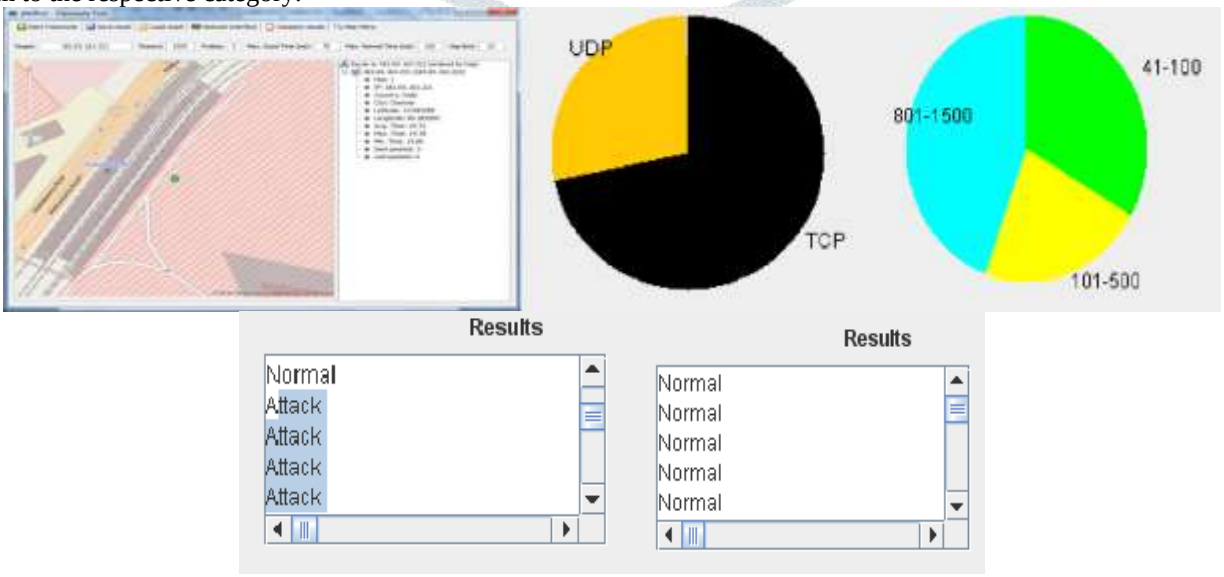
1. Select parameter C that restraints the influence of one data pint select the type of the kernel and the associated parameters.
2. Solve the dual Qp problem or an alternative formulation.
3. Determine parameters b by means of hyper plane equation.
4. Classify a new data point x point by passing it to the decision function.

**MODULE 2 : ALGORITHM FOR KOHEN SELF ORGANIZING MAP**

1. Set topological neighbourhood parameters. Set learning rate, initialize weight.
2. While stopping condition is false do 3 to 9.
3. For each input vector x, do 4 to 6.
4. For each j, determine squared Euclidean distance.
   Dij = $\sum(Wij - xi)^2$ where i=1 to n, and j=1 to m.
5. Find the index J , when D(j) is minimum.
6. For all units j, with the specified neighbourhood of j and for all i, updates the weights.
   wij(new) = wij(old) + α(xi -wij(old))
7. Update the learning rate.
8. Reduce the redius of topological neighbourhood at the specified time.
9. stop.

## V. RESULTS

The backpropagation algorithm provides 90.78% detection rate which is comparatively higher also it provides the classification according to the attack's category. The various methods provide higher detection rate but all they are facing problem while classification and accuracy so those all algorithms are attack specific i.e those algorithm provide detection for a specific category. the back propagation is an algorithm which provide detection for all kinds of attack also classifying them to the respective category.



## VI. CONCLUSION AND FUTURE SCOPE

In this project, neural networks are of use in an intrusion detection system. The user model developed here is the complement of a statistical model, because neural networks cannot adequately handle all the available data. The tight coupling between the neural net and the expert system is necessary to analyze the output of the net and propose explanations and a clear diagnosis to the security administrator. The deviations to the normal behavior of the user seem tobe diagnosed fairly quickly by the neural network. This capability is interesting since the goal of an intrusion detection system is to detect a potential intruder as soon as possible.

## VI. FUTURE ENHANCEMENT

It should be mentioned that the long training time of the neural network was mostly due to the huge number of training vectors of computation facilities. However, when the neural network parameters were determined by training, classification of a single record was done in a negligible time. Therefore, the neural network based IDS can operate as an online classifier for the attack types that it has been trained for. Although the classification results were slightly better in the three layer network, application of a less complicated neural network was more computationally and memory wise efficient.

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