Review of Classification Based Intrusion Detection System

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***Abstract*-.The use of internet is increasing day by day. It is necessary to monitor network traffic for the suspicious activities or vulnerabilities. A vulnerability (intrusion) represents a weak spot in the network that might be exploited by a security risk. Risks are the possible impacts and consequences of unaddressed susceptibilities. Intrusion detection is one major research problem in the security of networks, whose aim is to identify unusual access or attacks to secure internal networks. In literature, intrusion detection systems have been approached by various machine learning techniques. KDD99 dataset is more than 15 years old, but it is still widely used in academic research, Machine Learning Research (MLR) and Intrusion Detection Systems (IDS) in order to investigate intrusions in IDS. This paper presents the effect of features and classifier approaches in an IDS system.**

Keywords - Intrusion Detection System, Smart Intrusion, Remote to Local access.

I. INTRODUCTION

The security of the network has become a significant and essential requirement of the society in order to hide confidential information that flows over distinct type of networks. Consequently, network security presents a big major challenge in the technology of internet so as to protect the confidential information from network attacks. A network attack is virtually any unauthorized activity on a computer system network. Finding an attack depends upon the defenders possessing a clear knowledge of how problems work. Generally, such undesired activity absorbs network solutions designed for various other uses, and always threatens the security of the network and/or its data. Suitable designing and deployment of a proper network intrusion detection system shall help in blocking the intruders. The process of detecting Intrusion over the system of the network is considered as the most significant target for prevention of unauthorized access [1] [2]. The mechanism of intrusion detection is generally based on an efficient analysis required to form a defence for the network in order to find the number of system-based attacks system. The operation of IDS popularly started its operation in 1990. The process of IDS act as a security alarm where it provides an alarming state in case of any kind of violation in the form of messages, emails or audio-vedio [6] [25]. The IDS is designed as a tool for securing the system from various types of malwares or intrusions interrupting the working of the system [7]. The main function of IDS is to inspect the various types of attacks done on the system and thereby providing a defence mechanism to fight against these attacks in such a way that it also provides information about the intrusions. So, IDS provides a mechanism that deals with the safety of current network security system [11][22]. The following figure.1 explains the general structure of an intrusion dectection system. To increase the performance of IDS, soft computation is used. The term "soft computing" refers to the process of different methods to get the best possible finite results [12] [13,23]. The various distinct forms of soft computing methods used in IDS detection such as Support Vector Machine [SVMs], Artificial Neural Network [ANNs], Genetic Algorithms [GA], Bayesian Networks, and Fuzzy Logic. Also the eminent technology of Artificial Intelligence and the machine learning processes has resulted in accuracy and thereby providing the best suitable results as per the requirement. It has shown a great success in the IDS mechanism. In case of human eyes the reseachers use the AI techniques to identify the intrusions that is the main reason why the researchers use the data mining processes and the artificial intelligent techniques to explore the feasible intrusions [18] [19].

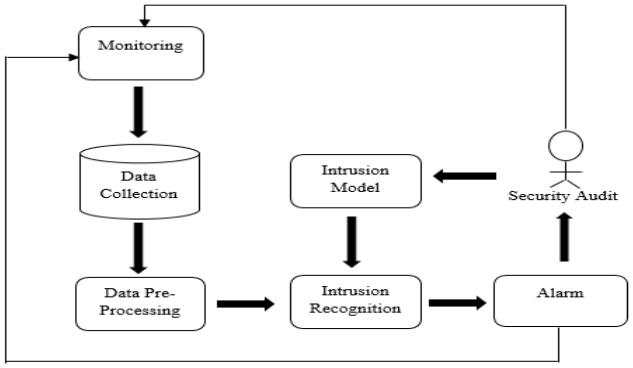

Figure 1: Basic structure of IDS

The process of model classification associated with intrusion detection and feature selection is presented with the help of operational effective analysis. Further, the analysis involves reduction of various dimensions of dataset (NSL-KDD). Then by using the approach of machine learning, we turn into in a position to model the process of Intrusion detection for locating the attacks over the machine system and also to enhance the strategy of intrusion detection utilizing the data in captured type. In response to increase in number of hidden (new) attacks, the main objective of the above mentioned models is the development of the system for the purpose of detecting intrusions, and these model would be able in detecting previously and new hidden (unseen) type of attacks through features of existing attacks as well as the basic property of signatures [5] [19] [23]. The valuable and significant informational data gets influenced by the hackers of the system and is accountable to a large or maximum number of attacks over the system of the network. The Intrusion (harmful activity) enters either in a system or the server of system with the help of an attacker by the method of forwarding the packets of malicious form to the user of the system and then by steals, modifies or corrupts secret information or significant information. The process of sending the malicious packet over the network for conducting misact or illegal work is known to be system attack. The intrusion activity may take over the server or the system due to already existing vulnerability or weakness of the system like misconfiguration of the system, program defects or user misuse [9]

[16, 18]. So to detect the intrusions over the network we have some of the important forms of IDS which identifies the traffic-data and its changing activities by using an algorithm (single class). But some of the single-class algorithms are not able to fetch a good detection rate and does not provide a low occurrence of the false alarms. So, the working methodology is based on using an intelligent hybrid technology comprising of different sets of classifiers which are helpful in enhancing the productivity of the system in an intelligent way. In case of IDS mechanism numerous forms of data mining approaches such as Genetic Algorithms, Classification, Artificial Neural Networks (ANN), Decision Trees, and clustering have been used in the mining of data for the development in the field of IDS also the SVM i.e. support vector machines technology provides the best technique for classification of the clean as well as the intrusive form of data [4] [9] [17] [20]. The SVM technology deals with high class accuracy in detecting the data intrusions. To avoid redundancy, inadequacy and the noisy data forms there is an urgent need to go for selection i.e. feature based [7]. The basic operation of an intruder is to search the faulty operative conditions in the network or the systems. So, an intruder helps to find out the best optimized solutions to identify the intrusions in the data. The main requirement of the IDS is not only to encounter the intruders in the data path but also to supervise the intruders of the data. The most important security aspects of an intrusion detection system consist of maintaining the following conditions [21] [24] [28].

1. Confidentiality: Only an authorized user can detect the system.
2. Availability: Here, the computer technology provides various forms of resources and the access to the legal users of the system without disturbing the working operation of the system.
3. Integrity: The information must be protected from any kind of malicious act

1.1Smart Intrusion

A smart intrusion can be made by using multiple kinds of vulnerabilities combined together. In a network of global type, millions of large servers of the network exist and wide number online-based services run in the network of the system, but such type of networks attracts the attackers and requires an intelligent model of intrusion detection as a defensive part for the system of the network [2] [6] [25]. A smart or an intelligent system attack or intrusion involves the following steps:

1. Information Collection: It involves the collection of information about a specific target which includes a deep knowledge and detailed structure about the end-user who is fooled by the attacker of the system. This is usually done with help of query-based tools such as ‘‘nslookup”, “whois”, or by using various commands of the in command-based prompt in order to get domain name server, addresses of IP etc. [3] [17].
2. Scanning and Probing: It involves the process of scanning the host target and it further checks the unprotected or unguarded area over the system and seeks for the delicate amount of information.
3. Remote to Local access: It achieves the access of user-based system with the help of Remote to Local (R2L) type of attack such as guessing of the password, sniffing of the network, buffer-based overflowing attack, etc. In the process of R2L attack, an individual who is not known to the user-based machine sends the packet in order to gain access (local) of user-based machine for executing command over a target of the system. This type of attack can be performed with the help of using the vulnerabilities of the system, by using the open ports of the password guessing, target machine, etc. [3][12]
4. User to Root access: In such type of attack of a system, a simple system-based user mainly tries to have system root access with the help of using the vulnerabilities of the system. These kind of attacks are similar in appearance as that of an attack of R2L type but here the attacker of the system is a normal machine user and tries to have machine-based root access [8].
5. Launch type of attacks: It represents the final presentation of the attack being made by the attacker of the system such as stealing of secret or hidden information, modification of web-based information.

1.2 Algorithms used in IDS Classification

The process of classification can be used to look for the predetermined result. It forecasts the prospective course for every information item [28]. This assigns the informational data into target classes. For instance it is utilized to recognize the credit risk as large, low, and medium.

Task of classification

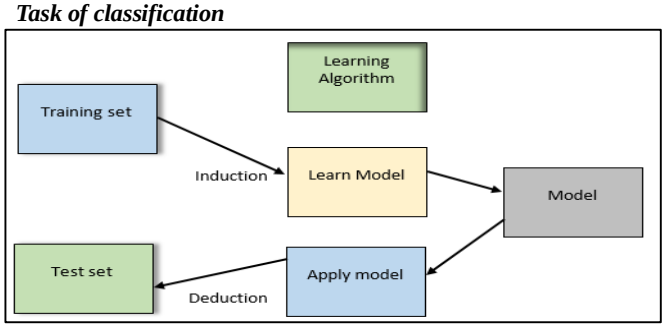

Figure 2 Classification Tasks

Classification techniques

1.2.1 Naïve Bayes Algorithm

The Naïve Bayes classifier is a supervised learning method for classification. The training and testing of data are very easy. The training of the classifier deals with the estimation of conditional probability distribution of each attribute in the class. In case of IDS, the naïve bayes protocol calculates the possibilities of a fraud given for a specific attribute and stores this probability then. This process is repeated for every attribute, and the period of time taken up to calculate the kind of probabilities for every attribute is presented. In the testing stage, the quantity of period taken up to estimate the likelihood of the given class for instance in the worst case is proportional to ‘n’, the real number of attributes. Yet, in most detrimental case, the proper time taken for testing phase is identical to the phase of training.

1.2.2 Support Vector Machine (SVM)

The SVM, originally a kind of pattern classifier predicated on a statistical technique of learning for the process of classification and regression with a number of kernel features, has been effectively put on numerous design recognition applications. Lately, it has been also put on the security-based information to safeguard intrusion recognition. Support Vector Machine is becoming the most famous approaches for anomaly invasion detection because of their good property of generalization and the capability to conquer the problem of dimensionality. Another great aspect of SVM is that it is useful for obtaining global minima of the actual risk using strength risk minimization, because it can easily generalize very well with kernel tricks in high-dimensional spaces under even little training test conditions [11][24]. The SVM may select suitable setup guidelines since it will not depend on classic empirical risk such as for example neural networks. One of major benefit of working with SVM intended for IDS is usually its velocity, as the ability of detecting intrusions in current is essential. SVM scan find out a more substantial group of patterns and also scale better, as the category complexity will not depend on the dimensionality of the characteristic space. SVMs have the also capability to update the

training patterns dynamically whenever there exists a new design during the process of classification.

1.2.3 Decision Tree

Decision trees are popularly represented as the techniques used for the learning of the machine. A decision tree is usually composed of three of the basic elements:

- A branch or an edge equivalent to the one of the possible attribute-based values this means one of the test attribute outcomes.
- Specification of a decision node test attributes.
- A leaf named as an answer node is comprised of the class to which the object belongs.

Intrusion detection can be viewed as category issue exactly where each user or connection is recognized either among the attack types or simple predicated on some existing informational data. The issue of intrusion detection is solved by decision trees because decision tree usually lean the model coming from the arranged dataset and may sort out the brand new data item among the classes specified found in the dataset. Decision trees may be used like a misuse intrusion detection because it can learn a model predicated on trained data and will predict the near future information among the attack types or perhaps normal on the basis of the discovered model. Decision trees work very well with huge data models. That is crucial as huge amounts of information flow throughout computer systems. The power of Decision trees makes them within real-time attack detection. Decision trees construct simple interpretable models useful for any security officer to examine and modify the system. These versions may also be utilized in the rule-based models with minimum control. The decision trees accuracy is yet another useful method for breach detection. There will usually be some new attacks on the machine which are small variations of identified attacks following the models of intrusion detection. The capability to detect these types of new attacks can be done because of the generalization decision trees accuracy.

1.2.4 Grey Wolf Optimization Algorithm

Bio-inspired modern algorithm represents the algorithm of grey wolf optimization (GWO). This main concept of the algorithm is to simulate the behaviour of wolf's existing in packs. Wolves form a critical social dominance hierarchy. Here, Alpha is called as the leader level which is responsible for the pack-based decision making process [17]. The persistence of wolf pack is dependent over the decisions of alpha. The second subordinated level of wolves is represented by Beta. The operation of beta is used for the purpose of making decisions for the alpha or the other type of activities. The third level subordinated wolves are presented by Delta. This member-based category usually involves scouts, elders, hunters, sentinels, and caretakers. In case of IDS, An integral problem in category is to select top features of the input training data where the process of learning occurs. As not every feature of the trained dataset contributes equally to the task of detection, addition of inappropriate feature may contribute redundancy and noise in the designing of classifiers, selecting good subset features will be critical to boost the classifiers-based performance [5]. Vitally feature assortment has two objectives the first is minimizing the attributes and the other is to increase the classification-based accuracy. The mechanism of existing feature suffers from large computation price but GWO is less costly. The GWO helps in exploiting the mutual index information as a function relying on fitness is used to find answer with small redundancy that serves as insight to the next phase of optimization which usually may be the category of classification.

1.3 Need of ANN used in IDS

Invasion systems have already been the main topic of substantial research for many years to boost the inadequacies and inconsistencies of already existing strategies, from fundamental detectability of the assault to the prevention of pc misuse. This continues to be a challenging problem nonetheless today to classify and identify the familiar and unfamiliar malicious network actions through intrusive behavior identification (anomaly detection) or design coordinating (signature-based or misuse detection). For the meantime, the amount of network attack incidents continues to grow. There are some of the reasons that lies behind the basic requirement of ANN methodology:

1. ANN improves the features non-linearity by its hidden layer.
2. ANN using different kernel, so mapping of features in high dimension and improving overlapping of features.
3. Ann use biased parameter, so improve learning and reduce error and increase accuracy.

1.4 ANN and its variants

1.4.1 Auto encoder

An auto associator, auto encoder or Diabolo systems like MLP i.e. multilayer perceptron, with an output an input layer and a number of concealed layers linking them. Nevertheless, the output level gets the same quantity of models (units) in the form of the insight (input) layer. The purpose is usually to rebuild its inputs (rather than producing a good value of target). Consequently, auto encoders are actually unsupervised models of learning. A great auto encoder can be used for unsupervised learning of well-organized coding's typically intended for and for learning generative of information and the purpose of decreasing the dimensionality of the system

1.4.2 Probabilistic

Four-layered feed forward neural network (NN) is represented by probabilistic neural network represents (PNN). Input, output, hidden, and summation/pattern is used to form layers. Algorithm used by PNN involves the probability distribution function of every class is usually approximated with a nonparametric function and a Parzen window. After that, using PDF of each and every class, new input-based class possibility is approximated and Bayes' rule is utilized to set aside it towards the class with the best subsequent probability [10]. It had been produced from the Bayesian network [11] and Kernel Fisher discriminant evaluation also known as statistical algorithm [12]. It really is utilized for recognition of a design and the process of classification.

1.4.3 Hopfield

The Hopfield (such comparable attractor-based) networks is of historical curiosity though it is not really a RNN in general, as it isn't designed to process the sequences of patterns. Rather it needs stationary inputs. RNN in reality is where all contacts are symmetrical. It assures that it'll converge. In the event the connections will be trained or qualified working with Hebbian learning. The Hopfield network is capable of doing as strong content-addressable memory space, resistant to alteration-based connection

1.4.4 Boltzmann machine

The Boltzmann equipment could be regarded as a loud Hopfield network. It is among that equipment which is used to show the first sensory (neural) systems for the learning of latent factors or variables (concealed units). Learning process of Boltzmann machine was initially slow for simulation purpose, however with the use of contrastive divergence algorithm training for the products of specialists and Boltzmann devices is boosted.

1.4.5 Self-organizing map: SOM as self-organizing map uses the learning process of unsupervised form. A couple of neurons figure out how to map points within an insight space to coordinate within

a resulting output space. The insight (input) space can possess different topology and dimensions from the resulting output space, and SOM efforts to reserve these processes.

1.4.6 Learning vector quantization (LVQ):LVQ can be considered as a neural network architecture. In a distance-based classification scheme prototypical representatives of the classes specified together with an appropriate distance measure.

1.4.7 ANN Using feed forward neural networking

This research using probabilistic feed forward neural network. It improves the classification accuracy by gradient descent and regularize over fitting other ANN variant not able to regularize the training model and not improve the accuracy.

III. RELATED WORK

Dias GV et.al [1] conducted a study indicated an intrusion-based detection system in text to SVM methodology that combines an algorithm (hierarchical clustering), feature-based selection method and the technique of SVM. The algorithm i.e. used helps in providing the support vector machine with maintaining an abstracted form of high level of trained examples obtained from the trained set-up of KDD Cup 1999. The study indicates high level performance of SVM based technology which further resulted in a reduced form of training-time. The method of feature-based selection was adopted to remove the un-necessary features of the training set in order to maintain the levels of accuracy. The KDD cup-1999 dataset was mainly used to analyse the system being proposed in the research. When the system was compared with the other forms of data set, the experimental analysis showed that the result based on the performance analysis was not so good as compared to KDD Cup-1999 dataset. So, the methodology based on this dataset showed better analysis in detection of probe and DoS based attacks, maintaining accuracy globally. Cannady et.al [2] proposed a study on the process of misuse detection which is defined as a process to recognize the instances of different types of attacks by measuring the unexpected activity and the activity that is going currently. Mostly, the present processes based on misuse detection uses a technology of rule-based systems with the aim to identify the provoked nature of the attacks known to us. But the above process was less reliable to guess the forms of distinct attacks done on the system. The use of ANN technology gave a potential to search and identify the activities of the network that rely on the incomplete, non-linear, and limited amount of sources. Kemmerer et.al [3] presented a study by framing a simple question of why there is a need of intrusion detection system. Suppose, the owner of a house is out of town and he has locked his home with all the windows and doors closed. But, there is someone outside his home who wants to enter. Firstly, he rings the bell and checks the main door if it is locked or not then after sometime he checks the windows of the house that too are locked which makes sure that the house is safe. So, the question is why an alarming bell is installed. This question particularly sticks to the IDS. Why there is a need to plant the detection systems if the security is tight and secure. The reason to install these detective systems is that the intrusions still exist because sometimes the people may forget to lock their doors or windows, the same case occurs with the computer based networks which do not provide us 100% security of the system to work accurately. So, based on this study the researchers has tried to explain the techniques based on IDS to deal with these kind of intrusions available in network. Steven T et.al [4] conducted a study on an application of STATL that represents a descriptive language based on a transition-based attacking system that is constructed to support the IDS. This form of descriptive language describes a process of penetration done to the computer network implemented by a hacker. These type of penetrations includes attacking activities performed by the hacker. The STATL description is used by the IDS to extract the stream events and the ongoing intrusions occurring in the system. As the IDS works under distinct environments such as Windows NT, Linux etc. and the domains like the host or the network. So, this extensible form of language helps in dealing with different targets as required. This language basically describes both the host and the network attacks. Here, in this paper an IDS based tool-set i.e. based on the descriptive language has been executed. This tool-set depicts various favourable and the desires results. There is a deep study of syntax based on the STATL language. Common real examples of both the network and the host are also described in the paper. Pi-Cheng et.al [5] conducted a research based on two of its issues related to the IDS designs. The two issues include the selection based on optimization of rule-based selection and the discovery in case of attack. This type of approach provides a connection between the junked packets. An algorithm is implemented for the attack identification and the rule based selection. The study is performed on the threats and describes the relationship for an application based web-server and the gateway. The algorithm is implemented over a signature-based IDS for having the better form of results. Cavusoglu et.al [6] conducted a research on security systems of IT. The information technology firms rely on various forms of technologies such as IDS and the firewalls to manage the risks of the organizations. There exists some most interesting facts related to security alerts in IT industries. This paper presented a study to demonstrate the values of IDS adopted in an IT company. The configuration of IT was represented by the true-positive and the false-positive rates which further consists of determining the negative or the positive rates of an organization. It was shown specifically that an organization or a firm experiences a positive-rate from an IDS based on one of the condition that the rate of detection is more than the critical value. When a firm experiences a positive or a negative value, an IDS prevents the occurrence of hackers that means an IDS targets the hacker's activity whether the alarm is positive or negative as the rate of detection is same. The results so obtained showed that the positive rate detected by an IDS is the result of increased amount of deterrence enabled by its improved detection. The use of optimized form of IDS indicates that the firm experiences a value i.e. non-negative in nature. Chebrolu, Srilatha et.al [7] conducted a research on IDS that examined all the features of data in order to detect misuse or intrusion patterns. Most of the features used in the process may be of superfluous form or it may share small quantity to the process of detection. The study purpose was to determine unique input-based features in modelling intrusion detection system i.e. effective and efficient computationally. An investigation was done on the performance basis on the basis of feature-selection algorithm. The first one was the Bayesian networks (BN) and the other was the CART i.e. classification and regression trees including an ensemble of both the CART and BN. The results have shown that the input based feature selection mainly required to model an IDS i.e. light in weight, effective and, efficient for real scenario detection techniques. In the end, the researchers proposed an architecture i.e. hybrid in nature for joining the different feature-selection algorithms for current scenario intrusion detection. Kim, Dong Seong, et.al [8] conducted and proposed a methodology based on Genetic Algorithm to revamp Support Vector Machines based Intrusion Detection System. The SVM denotes a technique of novel-classification that indicates a high class performance in various applications. The security-based researchers have designed IDS based SVM technology. Here, the fusion of SVM and GA is used to boost the global performance. This type of inter-mixing resulted in an "optimal detection model" for SVM classifier where

this method not only represented the "optimized-parameters" for SVM but it also resulted in an "optimal-featured set" among the data-set. A demonstration was done to check the feasibility of the method by performing experiments on data-set named KDD 1999 for detection of intrusions in the system. Carl, Glenn, et.al [9] proposed a study based on detection using Denial-of-service (DoS) techniques that includes change-point detection, activity profiling, and a signal analysis (wavelet-based) that further faced a major challenge to analyze the attacks on network that generated from the sudden unexpected activities or flash-events. This survey of techniques and testing results provided a mechanism to identify DoS based flooding attacks. As the detectors used in the process are quite good but none of them has shown the complete accurate detection. The adjoining of various methodologies with smart and intelligent network handlers would definitely produce excellent results. Kim, Jungwon, et.al [10] conducted a research on the use of artificial immune systems in IDS which is an interesting concept that relied on two main reasons. Firstly, the immune system of a human provides the best protection. Secondly, the present techniques used for maintaining the computer security are less reliable and complex in nature. Here, the researchers have used various distinct algorithms for the development of the systems and the best possible outcomes. The analysis has been done based on the important developments within this area of research, in addition to forming suggestions for future research options. Panda, et.al [11] worked on the mining techniques if the data that are applied in designing the IDS in order to secure computational resources against access i.e. unwanted.

Table.1 Existing Scheduling Model.

Author's Name	Year	Methodology Used	Proposed Work
Kemmerer et.al	2002	Intrusion Detection System	Presented a study by framing a simple question of why there is a need of intrusion detection system.
Pi-Cheng et.al	2005	Signature-based IDS	Conducted a research based on two of its issues related to the IDS designs.
Kim, Dong Seong, et.al	2005	IDS based SVM	Conducted and proposed a methodology based on Genetic Algorithm to revamp Support Vector Machines based Intrusion Detection System.
Zhang, J., et.al	2008	KDD'99 data-set the Knowledge Discovery and Data Mining	Proposed new frameworks that involved the use of a data mining algorithms such as the hybrid-network-based IDSs, misused random-forests, and an anomaly detection.
Panda, et.al	2008	KDDCup'99 IDS	Worked on the mining techniques if the data that are applied in designing the IDS in order to secure computational resources against access
Chenfeng Vincent, et.al	2010	Collaborative Forms Of Intrusion Detection Systems (CIDS)	Worked on attacks that are coordinated in nature similar to DDoS i.e. distributed-denial-of-service attacks, worm-outbreaks, and large-scale scans, that occur in simultaneous way in case of multiple-networks.
Kamarularifin Abd Jalil, et.al	2010	Machine Learning Intrusion Detection	Proposed their study on technology of network security that has become a supreme method for the protection of information or the data.
Huwaida Tagelsir Elshoush, et.al	2011	Collaborative Forms Of Intrusion Detection Systems (CIDS)	Focused on proper prevention of attacks that were linked to the computer-based systems.
Shi-Jinn Horng, et.al	2011	KDD Cup 1999 set Concept of SVM	Proposed a model on SVM methodology i.e. based on the system of intrusion detection that joined an algorithm of clustering representing a hierarchical structure, a technique of SVM, and the procedure of simple feature selection.
Norrozila Sulaiman, et.al	2012	WEKA Environment	Conducted a study on using smart and intelligent form of approaches based on data-mining to observe the intrusions occurring in the networks (local).
Deepika P. Vinchurkar, et.al	2012	Support Vector Machine Methodology	Conducted a research on Intrusion Detection Systems that consisted of high-level security of networks and thus provides the system dealing with security of network and the intrusion based attacks.
Chirag Modi, et.al	2013	IDS/IPS in Clouded environment	Conducted a survey on different intrusions that affected the integrity of cloud- resources, confidentiality, availability, and the services linked.

G. V. Nadiammai, et,al	2014	KDD Cup dataset	Focused upon the security issue of the networks and various developments in applications operating on distinct type of platforms capturing a consideration towards security of the network.
V. Manekar, et.al	2014	NSL-KDD dataset	Proposed Intrusion Detection System using data mining technique: SVM (Support Vector Machine) and PSO (Particle Swarm Optimization).
Shikha Aggarwal, et.al	2015	Hybrid Approaches	Worked on the need of the present world dealing with huge amounts of data i.e. transferred and stored from location or another.
B. Muthukumar, et.al	2015	Neighborhood Outlier Factor (NOF)	Proposed a study based on Intrusion Detection System (IDS) that presents an application of a software monitoring the activities of the system network generating reports to the management system.

The paper has presented unique well defined performance of data-mining algorithms of classifier such as Naïve Bayes, J48, and ID3 that were calculated on the basis of ten-fold-cross validating test. This type of data that has been used is KDDCup'99 IDS which further shown that the Naïve Bayes method is the most effective algorithm of learning based process, and the mechanism adopted for decision trees is more interesting for the purpose of detection. Zhang, J., et.al [12] proposed new frameworks that involved the use of a data mining algorithms such as the hybrid-network-based IDSs, misused random-forests, and an anomaly detection. The hybrid mechanism has improved the performance of detection with the combination of misuse advantages. Here, the detection analysis was done on KDD'99 data-set the Knowledge Discovery and Data Mining. In case of misuse-detection, automatic intrusions based patterns are built using the algorithm of random-forest over trained data-sets. Later on, the intrusions are usually detected by matching based on network activities opposed to the patterns. Whereas in case of anomaly-based detection, various forms of intrusions were detected by aberration (outlier) detection of the algorithm based on random-forests. In the end the patterns are built by the approach of random forest, the pattern relating outliers are obtained. The results demonstrate that the use of misuse detection approach was better than the approach of KDD'99 data-set that provided low false rate, high amount of detection rate that resulted in an overall increased performance of the IDS system. P. Garcia-Teodoro, et.al [13] conducted a study on IDS i.e. an anomaly based network technique which consists of protecting the system target against all the harmful activities. This paper starts with study and a method to review the anomaly based IDS. Further, the development of the system based on detection methods and various research projects are explained. The paper states the major challenges of anomaly based intrusion detection system, dealing with special issues based on its applications.

IV. CONCLUSION

The developing field of intrusion detection system using the concept of machine learning still requires a proper platform for research study. For comparison and evaluation of the model using single classifier may no longer be beneficial candidate in comparison to the baseline classifiers that uses the property of randomness. It would be valuable if different ensemble classifiers and hybrid classifier are compared in terms of prediction accuracy. By combining ensemble and hybrid classifiers sophisticated classifiers can be designed and examined. The main idea of combining multiple classifiers is to collaborate each other rather than the competition so, the combination of ensemble and hybrid classifiers may be beneficial for the purpose of intrusion detection.

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