PREDICTION OF NETWORK ATTACKS BY FINDING THE BEST ACCURACY USING SUPERVISED MACHINE LEARNING ALGORITHM

Dr.V.Prasanna Srinivasan[1], A.Anjana[2], K.Arumuga kumari[3], T.C.Keerthana[4]

[1]Associate*Professor, Department Of Information Technology ,R.M.D Engineering College*
[2,3,4]*Student, Department Of Information Technology ,R.M.D Engineering College*

Abstract - Generally, to create data for the Intrusion Detection System (IDS), it is necessary to set the real working environment to explore all the possibilities of attacks, which is expensive. Software to detect network intrusions protects a network from unauthorized users, including perhaps insiders. The intrusion detector learning task is to create a predictive model (i.e. a classifier) capable of distinguishing between "bad" connections, called intrusions or attacks, and "good" normal connections. To prevent this problem in network sectors need to predict whether the connection is attacked or not fromKDD Cup99 dataset using machine learning techniques. The aim is to research machine learning based techniques for better packet connection transfers forecasting by prediction leads to best accuracy. To propose a machine learning-based method to accurately predict the DOS, R2L,U2R, Probe and overall attacks by prediction results in the form of best accuracy from comparing supervised classification machine learning algorithms. Additionally, to compare and discuss the performance of various machine learning algorithms from the given data set with evaluation classification report, identify the confusion matrix and to categorizing data from priority and the result shows that the effectiveness of the proposed machine learning algorithm technique can be compared with best accuracy with precision, Recall and F1 Score.

Key Words: *Dataset, Machine learning-Classification method, Python, Prediction of Accuracy.*

1.INTRODUCTION

Machine learning (ML) may be a sort of AI (AI) that gives computers with the power to find out without being explicitly programmed. Machine learning focuses on the event of Computer Programs which will change when exposed to new data and therefore the basics of Machine Learning, Process of coaching and prediction involves use of specialized algorithms. It feed the training data to an algorithm, and therefore the algorithm uses this training data to offer predictions on a replacement test data. Machine learning are often roughly separated into 3 categories. There are supervised learning, unsupervised learning and reinforcement learning. Supervised learning program is both given the input file and therefore the corresponding labeling to find out data has got to be labeled by a person's being beforehand. It provided to the learning algorithm. This algorithm has got to find out the clustering of the input file. Finally, Reinforcement learning dynamically interacts with its environment and it receives positive or feedback to enhance its performance. At a high level, these different algorithms are often classified into two groups supported the way they "learn" about data to form predictions: supervised and unsupervised learning

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2. PROBLEM DESCRIPTION

Lately, an online network company in Japan has been facing huge losses thanks to malicious server attacks. They've encountered breach in data security, reduced data transfer speed and intermittent breakdowns in user-user & user-network connections. When asked, a corporation official said, "There's a big dip within the number of active users on our network. The company is looking are some predictive analytics solution to assist them understand, detect and counter the attacks and make their network connection secure. Think of a connection as a sequence of TCP packets starting and ending at some well-defined times, between which data flows to and from a source IP address to a target IP address under some well-defined protocol. In total, there are 3 major type of attacks to which their network is vulnerable to. But, 3 of them cause the maximum damage. In this challenge, you're given an anonymised sample dataset of server connections. You have to predict the type of attack(s) like Dos, R2L, U2R, Probe.

3. LITERATURE SURVEY

Title: Distributed Secure Cooperative Control under Denial-of-Service Attacks from Multiple Adversaries

Author: Wenying Xu , Guoqiang Hu

Year: 2019

This paper has investigated the distributed secure control of multiagent systems under DoS attacks. We focus on the investigation of a jointly adverse impact of distributed DoS attacks from multiple adversaries. In this scenario, two kinds of communication schemes, that is, sample-data and event-triggered communication schemes have been discussed and, then, a fully distributed control protocol has been developed to guarantee satisfactory asymptotic consensus. Note that this protocol has strong robustness and high scalability. Its design does not involve any global information, and its efficiency has been proved. For the event-triggered case, two effective dynamical event conditions have been designed and implemented in a fully distributed way, and both of them have excluded Zeno behaviour. Finally, a simulation example has been provided to verify the effectiveness of theoretical analysis. Our future research topics focus on fully distributed event/self-triggered control for linear/nonlinear multiagent systems to gain a better understanding of fully distributed control.

Title: Cyber Attacks Prediction Model Based on Bayesian Network

Author: Jinyu W1, Lihua Yin and Yunchuan Guo

Year: 2012

The prediction results reflect the security situation of the target network in the future, and security administrators can take corresponding measures to enhance network security according to the results. To quantitatively predict the possible attack of the network within the future, attack probability plays a big role. It is often wont to indicate the likelihood of invasion by intruders. As a crucial quite network security quantitative evaluation measure, attack probability and its computing methods has been studied for an extended time. Many models are proposed for performing evaluation of network security. Graphical models like attack graphs become the main-stream approach. Attack graphs which capture the relationships among vulnerabilities and exploits show us all the possible attack paths that an attacker can take to intrude all the targets in the network. The traffics to different hosts or servers may differ from one another. The hosts or servers with big traffic may be more risky since they are often important hosts or servers, and intruders may have more contacts and understanding with them. In our cyber-attacks prediction model, they used attack graph to capture the vulnerabilities in the network. In addition we consider 3 environment factors that are the major impact factors of the cyber-attacks in the future. They are the value of assets in the network, the usage condition of the network and the attack history of the network. Cyber-attacks prediction is an important part of risk management. Existing cyber-attacks prediction methods didn't fully consider the precise environment factors of the target network, which can make the results deviate from truth situation. In this paper, we propose a cyber-attacks prediction model supported Bayesian network. We use attack graphs to represent all the vulnerabilities and possible attack paths. Then we capture the using environment factors using Bayesian network model. Cyber-attacks predictions are performed on the constructed Bayesian network.

Title: New Attack Scenario Prediction Methodology

Author: Seraj Fayyad, Cristoph Meinel

Year: 2013

Intrusion detection systems (IDS) are used to detect the occurrence of malicious activities against IT system. Through monitoring and analyzing of IT system activities the malicious activities will be detected. In ideal case IDS generate alert(s) for each detected malicious activity and store it in IDS database. Some of stored alerts in IDS database are related. Alerts relations are differentiated from duplication relation to same attack scenario relation. Duplication relation means that the two alerts generated as a result of same malicious activity. Where same attack scenario relation means that the two related alert are generated as a result of related malicious activities. Attack scenario or multi-step attack may be a set of related malicious activities travel by same attacker to succeed in specific goal. Normal relation between malicious activities belong to same attack scenario is causal relation. Causal relation means that current malicious activity output is pre-condition to run the next malicious activity. Possible multi-step attack against a network start with information gathering about network and the information gathering is done through network Reconnaissance and fingerprinting process. Through reconnaissance network configuration and running services are identified. Through fingerprint process Operating system type and version are identified. propose a true time prediction methodology for predicting most possible attack steps and attack scenarios.

Proposed methodology benefits from attacks history against network and from attack graph source data. it comes without considerable computation overload like checking of attack plans library. It provides parallel prediction for parallel attack scenarios. Possible third attack step is to identify attack plan based on the modeled attack graph in the past step. The attack plan usually will include the exploiting of a sequence of founded vulnerabilities. Mostly this sequence is distributed over a set of network nodes. This sequence of nodes vulnerabilities is related through causal relation and connectivity. Lastly Attacker start orderly exploits the attack scenario sequences till reaching his/her goal. Attack plan consist of many correlated malicious activities end up with attacking goal.

4. EXISTING SYSTEM

The goal of link prediction was to estimate the link likelihood of two unconnected nodes based on available network data and analysis tools, such as machine learning and network theory. Various link prediction methods has used and they are divided into four categories i.e. structural similarity based methods, maximum likelihood based methods ,stochastic probabilistic models and information theory based methods. The established link prediction methods are widely used in online product recommendation, bionetwork reconstruction and evolution process prediction of infrastructure networks. Real-world networks suffer from random failures and targeted attacks. Many scale-free networks, such as the Internet, are vulnerable to degree based targeted attacks. A small initial attack can trigger a large-scale cascading failure which is one of the main security issues in power networks. Novel attack strategies has been proposed, such as the edge attacks and path attacks these random or intentional attacks significantly affect the structure and dynamics of real-world networks. The predictability of real-world networks keeps changing as the network attack continues.

Drawbacks:

The proposed method did not predict the specific or particular attack. Algorithm prediction results by best accuracy of algorithms with classification report of precision, recall and f1-score and additionally, to categorized other attacks of network

5. PROPOSED SYSTEM

Exploratory Data Analysis

This analysis is not meant to be providing a final conclusion on the reasons leading to network sector as it doesn't involve using any inferential statistics techniques/machine learning algorithms. Machine learning supervised classification algorithms will be used to give the network connection dataset and extract patterns, which would help in predicting the likely patient affected or not, thereby helping the attack of avoids for creating better decisions within the future. Multiple datasets from different sources would be combined to make a generalized dataset, then different machine learning algorithms would be applied to extract patterns and to get results with maximum accuracy.

Data Wrangling

In this section of the report will load in the data, check for cleanliness, and then trim and clean given dataset for analysis. Make sure that the document steps carefully and justify for cleaning decisions.

Data collection

The data set collected for predicting the network attacks is split into Training set and Test set. Generally, 7:3 ratios are applied to separate the Training set and Test set. The Data Model which was created using Random Forest, logistic, Decision tree algorithms, K-Nearest Neighbor (KNN) and Support vector classifier (SVC) are applied on the Training set and based on the test result accuracy, Test set prediction is completed .

Preprocessing

The data which was collected might contain missing values which will cause inconsistency. To gain better results data got to be preprocessed so on improve the efficiency of the algorithm. The outliers got to be removed and also variable conversion need to be done. The correlation among attributes can be identified using plot diagram in data visualization process. Data preprocessing is that the most time consuming phase of a knowledge mining process. Data cleaning of connections, data removed several attributes that has no significance about the behavior of a packet transfers. Data integration, data reduction and data transformation are also to be applicable for network connections dataset. For easy analysis, the info is reduced to some minimum amount of records. Initially the Attributes which are critical to make a loan credibility prediction is identified with information gain because the attribute-evaluator and Ranker because the search-method.

6. MODULE DESCRIPTION

- Data validation and pre-process by each attack
- Performance measurements of DoS attack

- Performance measurements of R2L attack
- Performance measurements of U2R attack
- Performance measurements of Probe attack
- Performance measurements of overall network attack
- GUI based prediction of network attack

Data validation and pre-process by Each attack:

Validation techniques in machine learning are wont to get the error rate of the Machine Learning (ML) model, which may be considered as on the brink of truth error rate of the dataset. Importing the library packages with loading given dataset. To analyzing the variable identification by data shape, data type and evaluating the missing values, duplicate values. The primary goal of data cleaning is to detect and remove errors and anomalies to increase the price of data in analytics and deciding . Data visualization can be helpful when exploring and getting to know a dataset and can help with identifying patterns, corrupt data, outliers, and much more.

Performance Measurements of DoS attack:

In computing, a denial-of-service attack (DoS attack) could also be a cyber-attack during which the perpetrator seeks to make a machine or network resource unavailable to its intended users by temporarily or indefinitely disrupting services of a number connected to the web . Denial of service is usually accomplished by flooding the targeted machine or resource with superfluous requests in an effort to overload systems and stop some or all legitimate requests from being fulfilled. An application layer DoS attack is a form of DoS attack where attackers target application-layer processes. The attack over-exercises specific functions or features of an internet site with the intention to disable those functions or features. This application-layer attack is different from a whole network attack, and is usually used against financial institutions to distract IT and security personnel from security breaches.

Performance Measurements of R2L Attack

Now-a-days, it's vital to take care of a high - level security to make sure safe and trusted communication of data between various organizations. But secured digital communication over internet and the other network is usually under threat of intrusions and misuses. To control these threats, recognition of attacks is critical matter. Probing, Denial of Service (DoS), Remote To User (R2L) attacks is a few of the attacks which affect sizable amount of computers within the world daily. Detection of those attacks and prevention of computers from it's a serious research topic for researchers throughout the planet .

Performance Measurements of U2R Attack

These attacks are exploitations during which the hacker starts off on the system with a traditional user account and attempts to abuse vulnerabilities within the system so as to realize super user privileges e.g. perl, xterm.

Performance Measurements of Probing Attack

Probing is an attack during which the hacker scans a machine or a networking device so as to work out weaknesses or vulnerabilities which will later be exploited so on compromise the system. This technique is usually utilized in data processing e.g. saint, portsweep, mscan, nmap etc.

Performance measurements of overall network attacks

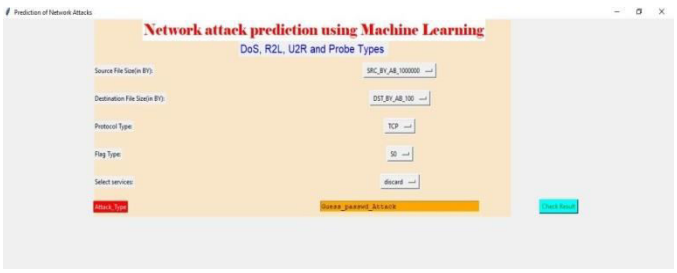
Comparing Algorithm with prediction in the form of best accuracy from the below algorithms,

- Logistic Regression
- Decision Tree
- Navies Bayes
- K- Nearest Neighbor
- Random Tree

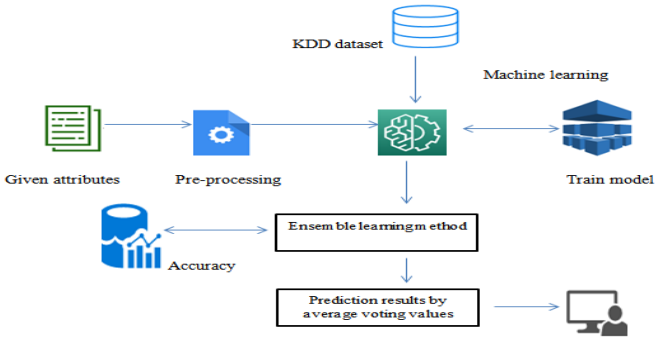
It is important to match the performance of multiple different machine learning algorithms consistently and it'll discover to make a test harness to match multiple different machine learning algorithms in Python with scikit-learn. It can use this test harness as a template on your own machine learning problems and add more and different algorithms to match .

GUI based prediction results of Network attack

Tkinter may be a python library for developing GUI (Graphical User Interfaces). We use the tkinter library for creating an application of UI (User Interface), to make windows and every one other graphical interface and Tkinter will accompany Python as a standard package, it are often used for security purpose of every users or accountants.



7.SYSTEM ARCHITECTURE



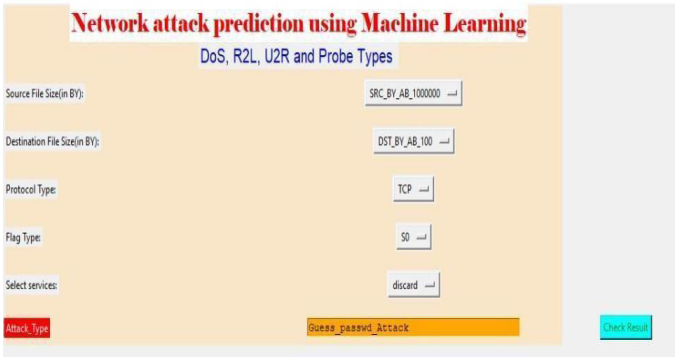
8.FUTURE ENHANCEMENT

Network sector want to automate the detecting the attacks of packet transfers from eligibility process (real time) supported the connection detail. To automate this process by show the prediction end in web application or desktop application. To optimize the work to implement in AI environment.

9. CONCLUSION

This brings some of the following insights about diagnose the network attack of each new connection. To presented a prediction model with the aid of artificial intelligence to improve over human accuracy and provide with the scope of early detection. It can be inferred from this model that, area analysis and use of machine learning technique is useful in developing prediction models that can helps to network sectors reduce the long process of diagnosis and eradicate any human error.

10. RESULT



Hence this is the output we derive from our project. The GUI shows the type of attack that took place using the symptoms. The symptoms are source file size, destination file size, protocol type, flag type and selected services. These were found using the Random Forest Algorithm among all the other algorithms because the Random Forest Algorithm showed the highest accuracy in comparison with the other algorithms. This could be improvised in the future by takinsg into account the use of applications for finding the attacks and this work could be developed in the AI environment. Hence this could help us prevent human errors and long diagnosis process.

REFERENCES

[1] R. Olfati-Saber, J. A. Fax, and R. M. Murray, “Consensus and cooperation in networked multi-agent systems,” Proc. IEEE, vol. 95, no. 1,pp. 215–233, Jan. 2007.

[2] Y. Su and J. Huang, “Cooperative output regulation of linear multi-agent systems,” IEEE Trans. Autom. Control, vol. 57, no. 4, pp. 1062–1066, Apr. 2012.

[3] Z. Feng, G. Hu, W. Ren, W. E. Dixon, and J. Mei, “Distributed coordination of multiple unknown Euler-Lagrange systems,” IEEE Trans. Control Netw. Syst., vol. 5, no. 1, pp. 55–66, Mar. 2018.

[4] Z. Feng, C. Sun, and G. Hu, “Robust connectivity preserving rendezvous of multirobot systems under unknown dynamics and disturbances,” IEEE Trans. Control Netw. Syst., vol. 4, no. 1, pp. 725–735, Dec. 2017.

[5] X. Dong and G. Hu, “Time-varying formation control for general linear multi-agent systems with switching directed topologies,” Automatica,vol. 73, pp. 47–55,Nov.2016.

[6] Z. Li, G. Wen, Z. Duan, and W. Ren, “Designing fully distributed consensus protocols for linear multi-agent systems with directed graphs,” IEEE Trans. Autom. Control, vol. 60, no. 4, pp. 1152–1157, Apr. 2015

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[7] I. Shames, A. M. H. Teixeira, H. Sandberg, and K. H. Johansson, "Distributed fault detection for interconnected second-order systems,"Automatica, vol. 47, no. 12, pp. 2757–2764, 2011.

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