Intrusion Detection System Using Neural Networks

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Overview

- Introduction
- Several Methods to detect intrusion
- A model of Intrusion detection System(IDS) using artificial neural networks(ANN)
- Analysis of IDS using ANN.
- Conclusion

Introduction

- What is Intrusion ?

  Intrusion refers to any unauthorized access, unauthorized attempt to access or damage, or malicious use of information resources.
- Necessity Intrusion Detect Systems.

1. With the growing rate of interconnections among computer systems, network security is becoming a real challenge.
2. IDSs are designed to protect availability, confidentiality and integrity of critical networked information systems.

Type of IDS

Early research into IDS suggested two major detection principles:

- Anomaly Detection

  Attempts to quantify the usual or acceptable behavior and flags other irregular behavior as potentially intrusive.
- Misuse Detection

  Attempts to flag behavior that is close to some previously defined pattern signature of a known intrusion.

Methods to detect intrusion

1. Expert System
   - Most common form of rule-based intrusion detection approache.
   - Rule-bases analysis relies on sets of predefined rules that are provided by an administrator, automatically created by the system, or both.
   - Requires frequent updates to remain current.
   - Less flexibility in the rule-to-audit record representation.
2. Statistical Method
   - Often used to measure how anomalous the behavior is.
   - Requires that the distribution of subject's behavior is known.
   - Pattern matching techniques are used to determine whether the sequence of events is part of normal behavior.

Methods to detect intrusion

3. Artificial Neural Networks
   - ANNs have recently been proposed as alternatives to the statistical analysis components of anomaly detection system.
   - Intrusion detection using neural networks is more flexible.
   - The inherent ability of neural networks can learn the characteristic of attacks.

Example: Real Time detection(NSOM)

Model:

A Real-Time Network-based Intrusion Detection System Using Self-Organizing Maps.

Hypothesis:

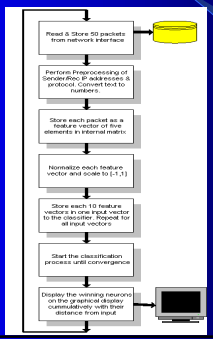
- The routine traffic that represents normal behavior would be clustered around one or more cluster centers ;
- Any irregular traffic representing abnormal and possibly suspicious behavior would be clustered outside of the normal clustering.

Data collection:

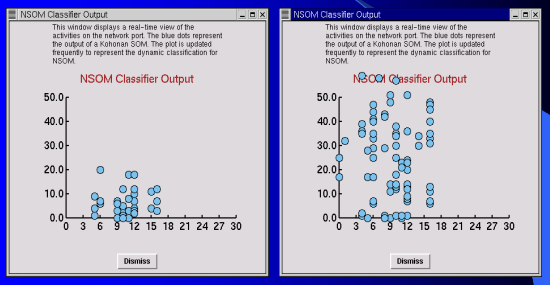
Use a host PC running Linux as the primary test bed. The system is connected to a network using Ethernet controller.

NSOM

- Data processing:



NSOM(result)



NSOM(result)

- Compare Y value on the graphs:

1. The attack neurons were much higher than normal ones.
2 Since Y values represent the distance of the winning neurons with respect to the input vector, we can conclude high Y value neurons represent uncommon and irregular behavior and therefore a possible attack.

Analysis

- This model shows that we were able to classify simulated DoS(Denial of service) attacks graphically as opposed to normal traffic, by showing different clustering of output neurons.
- Training requires more data, which may need more disk space and CPU resource.
- In order to analyze system log, the operating system must keep all performed action information.

Conclusion

- Introduced the background of intrusion detection systems.
- Analized existing methods of IDS
- Intrusion detection using neural networks displayed substantial promise and it especially suited for multi-category classification.

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