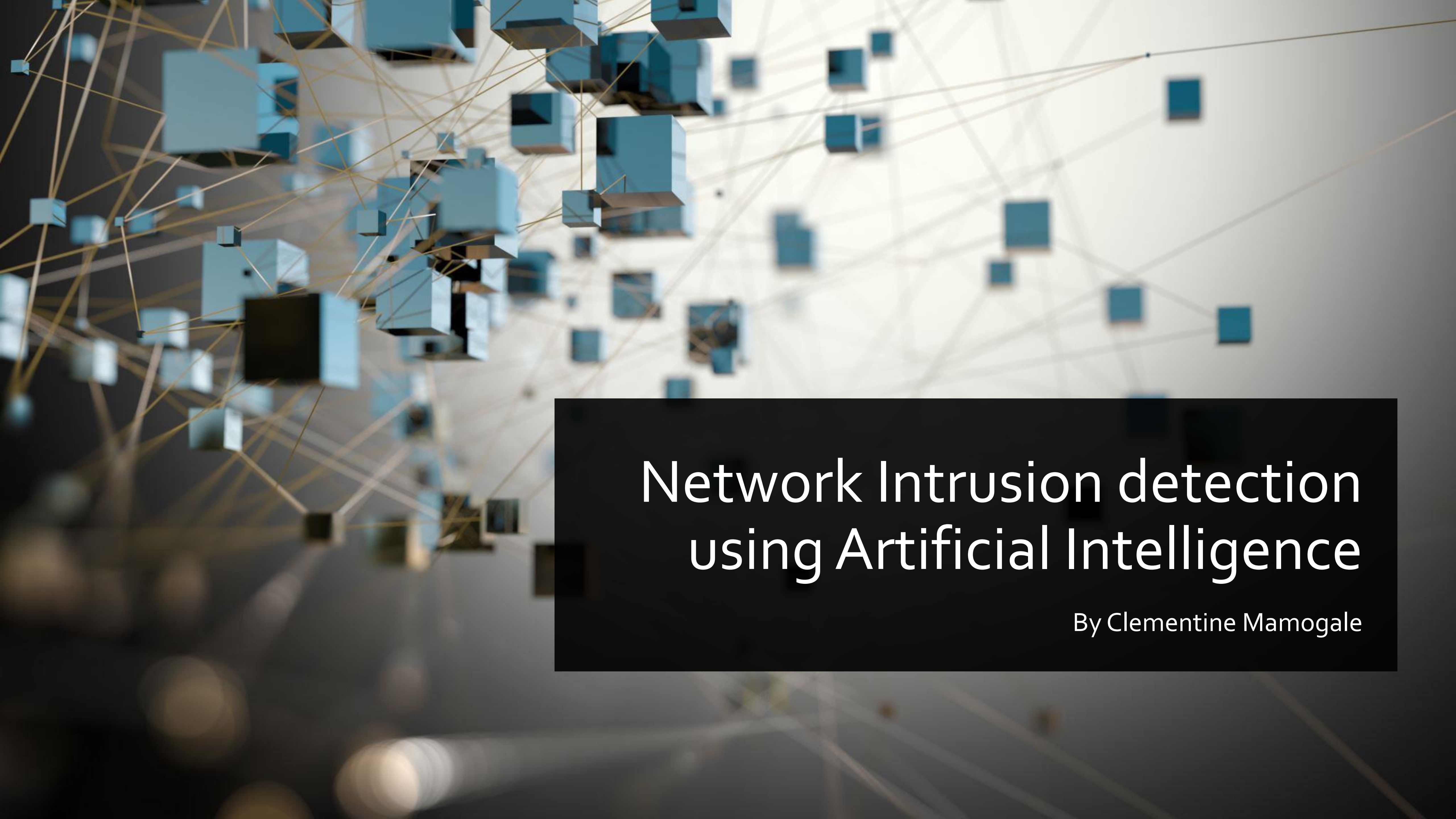


Network Intrusion detection using Artificial Intelligence

By Clementine Mamogale

Outline

Introduction

Research problem

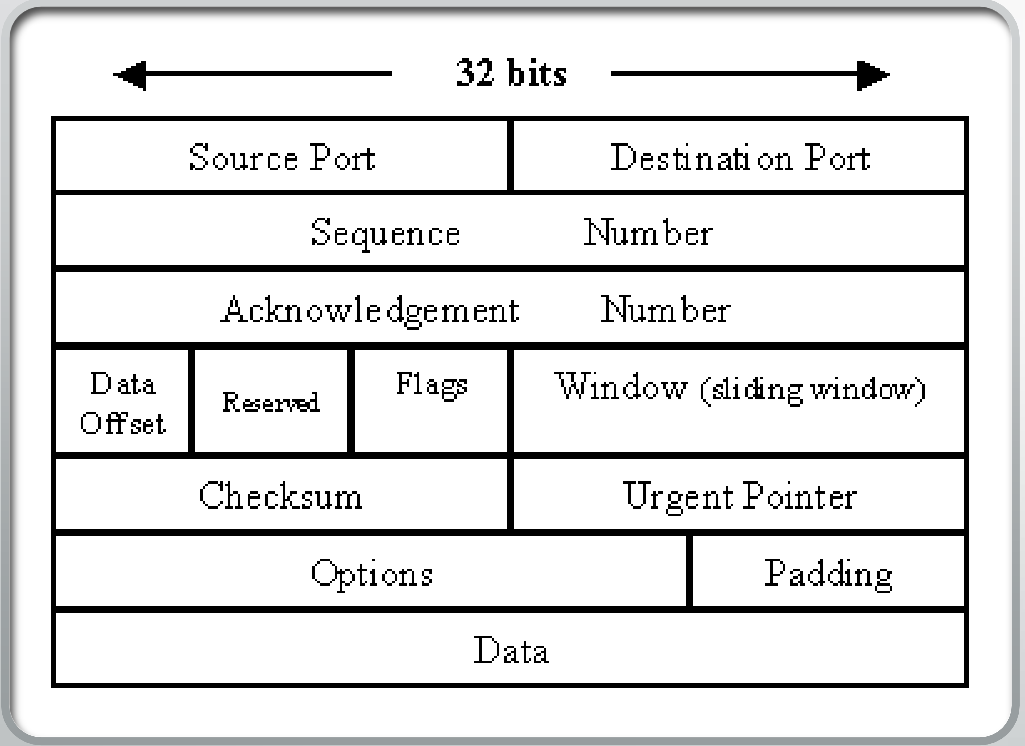
System overview

Models

Results

Conclusion

Network intrusion detection system



32 bits

<table>
<tr><td colspan="3">Source Port</td><td colspan="2">Destination Port</td></tr>
<tr><td colspan="5">Sequence Number</td></tr>
<tr><td colspan="5">Acknowledgement Number</td></tr>
<tr><td>Data Offset</td><td>Reserved</td><td>Flags</td><td colspan="2">Window (sliding window)</td></tr>
<tr><td colspan="3">Checksum</td><td colspan="2">Urgent Pointer</td></tr>
<tr><td colspan="4">Options</td><td>Padding</td></tr>
<tr><td colspan="5">Data</td></tr>
</table>

https://www.techrepublic.com/article/exploring-the-anatomy-of-a-data-packet/

- A security technology
- monitor and protect network
- Analyze packets - normal or malicious

Research Problem

- Network intrusion detection system (NIDS) is expensive
- A NIDS that uses AI is cheaper,
- Works better than the traditional NIDS
- Can be deployed in critical infrastructure

System overview

- Datasets
- Pre-processing
- Model selection
- Training
- Testing
- Classification

Datasets

- **KDD+**
- It is used in many NIDS research papers since it is old, 1999
- Can be used for good baseline of the system

- **CICIDS 2017**
- It is new, it uses modern technologies
- It has datasets that occurred recently

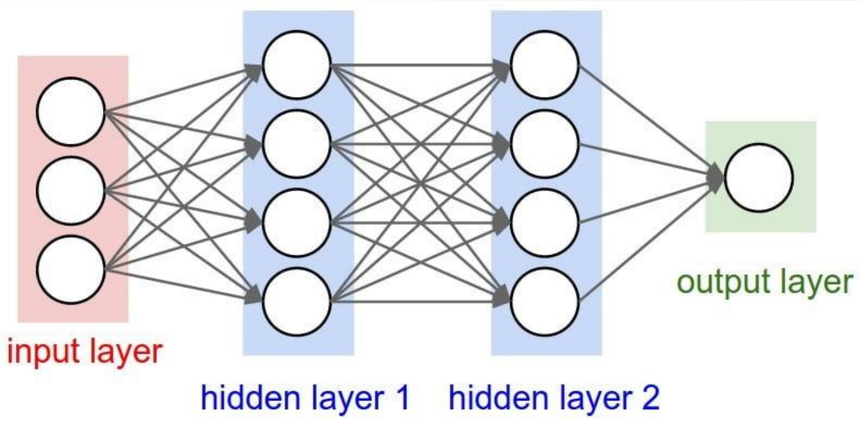
Pre-Processing

- **KDD+ Pipeline**
- Duration
- Protocol type
- Src_bytes
- Dst_bytes
- Labels

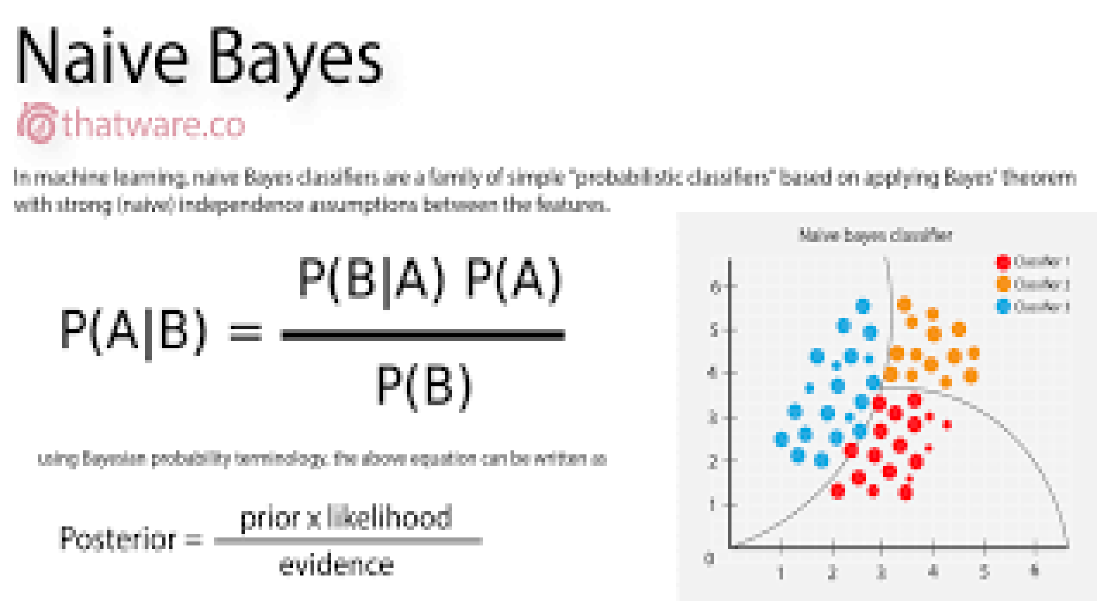
- **CICIDS 2017 Pipeline**
- Flow Duration
- Total Forward
- Total backward
- Forward Packet Length
- Backward Packet Length
- Labels

Model Selection

- Deep Neural Network (DNN)
- Naïve bayes
- Support Vector Machine (SVM)



https://www.bmc.com/blogs/deep-neural-network/



Naive Bayes

thatware.co

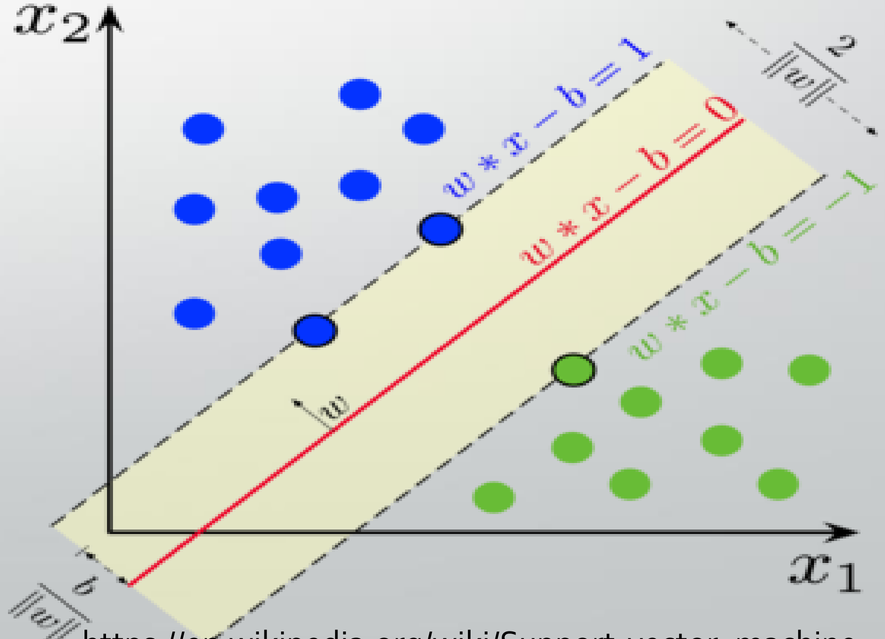
In machine learning, naive Bayes classifiers are a family of simple "probabilistic classifiers" based on applying Bayes' theorem with strong (naive) independence assumptions between the features.

$$P(A|B) = \frac{P(B|A)\,P(A)}{P(B)}$$

using Bayesian probability terminology, the above equation can be written as

$$\text{Posterior} = \frac{\text{prior x likelihood}}{\text{evidence}}$$

https://towardsdatascience.com/introduction-to-na%C3%AFve-bayes-classifier-fa59e3e24aaf



https://en.wikipedia.org/wiki/Support-vector_machine

Results

Model	Dataset	Accuracy
Deep Neural Network (DNN)	KDD+	~90.92%
Deep Neural Network (DNN)	CICIDS 2017	N/A
Naïve Bayes	KDD+	~55.6%
Naïve Bayes	CICIDS 2017	~93.09
Support Vector Machine (SVM)	KDD+	~46.38%
Support Vector Machine (SVM)	CICIDS 2017	~97.48%

Technologies used

Flask
web development,
one drop at a time

JS
JavaScript

Numpy, SKLearn, and Matplotlib

Conclusion

- NIDS can be done using AI
- Takes time to train the model, but…
- Beneficial to many organizations and businesses