

# CONTENTS

<i>Abstract</i>	<i>i</i>
<i>Acknowledgment</i>	<i>ii</i>
<i>Contents</i>	<i>iii</i>
<i>List of Figures</i>	<i>vi</i>
<i>List of Tables</i>	<i>vii</i>

<u>Chapters</u>	<u>Page No.</u>
<b>Chapter 1: Introduction</b>	<b>01</b>
1.1 Overview	01
1.2 Network Security	01
1.2.1 Anomaly in Network Security	01
1.2.2 Intrusion Detection System	01
1.2.3 Attack Classification	02
1.3 Machine Learning and its Applications	03
1.4 Types of Intrusion Detection Systems	04
1.4.1 Signature Based Detection	04
1.4.2 Statistical Anomaly Based Detection	04
1.5 Machine Learning	04
1.5.1 Supervised Learning	05
1.5.2 Unsupervised Learning	06
1.5.3 Reinforcement Learning	06
1.6 Types of Anomaly Based Detection	07
1.6.1 Statistical Anomaly Detection	07
1.6.2 Data Mining Based Approach	09
1.6.3 Knowledge Based Detection Techniques	10
<b>Chapter 2: Literature Survey</b>	<b>12</b>
2.1 Statistical Modeling	12
2.1.1 Markov Models	12
2.1.2 Markov Chains	13

2.1.3 Hidden Markov Models	13
2.1.4 HMM Based Related Work	15
2.2 Naive Bayes Classifier	16
2.2.1 Bayes Theorem	16
2.2.2 Formal Definition and Background	17
2.2.3 Properties of Naive Bayes	18
2.2.4 Advantages and Limitations	18
2.2.5 Recent Research in Network Anomaly Detection using NBC	19
2.3 Proposed System	22
<b>Chapter 3: System Analysis</b>	<b>23</b>
3.1 Requirements	23
3.1.1 Hardware Requirements	23
3.1.2 Software Requirements	23
3.1.3 Functional Requirements	23
3.2 Datasets	24
<b>Chapter 4: System Design</b>	<b>27</b>
4.1 Design Considerations	27
4.1.1 Modules	27
4.1.2 Use Case Diagram	29
4.1.3 Data Flow Diagram	30
4.1.4 State Diagram	30
<b>Chapter 5: Implementation</b>	<b>32</b>
5.1 Language Used for Implementation	32
5.1.1 Python	32
5.2 Libraries Used for Implementation	33
5.2.1 NumPy	33
5.2.2 Flask	34
5.2.3 Matplotlib	34
5.3 Pseudo Code	35
5.3.1 Determine Optimal Bands Procedure	35
5.3.2 Update Probabilities Procedure	36
5.3.3 Train Procedure	37

5.3.4 Train Phase Procedure	38
5.3.5 Determine Probability Procedure	39
5.3.6 Determine Threshold Probability Procedure	39
5.3.7 Deploy Procedure	40
<b>Chapter 6: Testing</b>	<b>41</b>
6.1 Testing Methods	41
6.1.1 Static Tetsing	41
6.1.1 Dynamic Tetsing	41
6.1.1 White Box Tetsing	41
6.1.1 Black Box Tetsing	41
6.2 Testing Levels	42
6.2.1 Unit Testing	42
<b>Chapter 7: Results</b>	<b>44</b>
7.1 Screenshots	44
7.2 Results Obtained	48
<b>Chapter 8: Conclusion</b>	<b>50</b>
<b>Chapter 9: Challenges and Future Work</b>	<b>51</b>
<b>Appendix</b>	<b>52</b>
<b>Bibliography</b>	<b>57</b>