
Contents

INTRODUCTION	vii
CHAPTER 1. INTRODUCTION TO TRAFFIC ANOMALY DETECTION METHODS	1
1.1. Cumulative sum control charts (CUSUM)	1
1.2. Tests of goodness-of-fit	4
1.2.1. Pearson’s Chi-squared test (χ^2)	4
1.2.2. Kolmogorov–Smirnov test	6
1.3. Mutual information (MI)	8
CHAPTER 2. FINDING THE OPTIMAL AGGREGATION PERIOD	11
2.1. Introduction	12
2.2. State of the art	14
2.3. Macroscopic observation of traffic	17
2.3.1. Traffic overview	17
2.3.2. Observation of traffic	18
2.4. Average-day analysis	21
2.4.1. Pearson’s Chi-square test	22
2.4.2. Kolmogorov–Smirnov (K–S) test	23
2.4.3. Detection of the optimal aggregation period	25
2.5. Conclusion	26

CHAPTER 3. COMPARATIVE ANALYSIS OF TRAFFIC ANOMALY DETECTION METHODS	29
3.1. Introduction	29
3.2. State of the art	30
3.3. Average-day preliminary analysis	34
3.3.1. Baseline scenario	34
3.3.2. Anomalous scenario	35
3.4. Proposed change point detection algorithms	36
3.4.1. Statistical control charts	37
3.4.2. Tests of goodness-of-fit	38
3.4.3. Mutual information	39
3.5. Behavior of the analyzed algorithms	40
3.5.1. Methodology	40
3.6. Conclusion	45
CHAPTER 4. PROPOSAL OF A NEW INFORMATION-THEORY TECHNIQUE	47
4.1. Introduction	48
4.2. Related work	48
4.3. Analysis of traffic anomaly detection methods applied to typical day profile	49
4.3.1. Choice of algorithms	51
4.4. Conclusions	52
4.5. Acknowledgments	53
BIBLIOGRAPHY	55
INDEX	61