

RELIABILITY IMPROVEMENT IN AUTOMATED INCIDENT DETECTION
(AID)

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This project is dedicated to my parents and my beautiful wife
for their endless love, support and encouragement

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ABSTRACT

This study uses the simulated data collected from the probe vehicles and loop detectors to explain how the Adaptive Neuro-Fuzzy Inference System has been developed to be applicable in the Automatic Incident Detection on the arterial roads. This research is conducted to extend what previously have been done in this area of study, and it is theoretically built on those findings that support the effectiveness of the Adaptive Neuro-Fuzzy Inference System in the data fusion. Because it is difficult to collect real data from the road networks, in this study, we use a data set formed by a validated and calibrated traffic simulation model of a commuter corridor located in Brisbane, Australia. Simulated accidents were provided and the required data were gathered from the probe vehicles and loop detectors that have been deployed at two different places of the network. A detector configuration was examined, and a total number of 108 incidents were modelled for that. To ensure the generality, the models were differed in factors such as the incident location, incident duration, road and detector configuration, severity level of the incident and the traffic flow conditions. The best result that was obtained for the Adaptive Neuro-Fuzzy Inference System was a 95% detection rate for a false alarm rate of 0.5%. The data collected for this study were consisted of features like speed, occupancy, and flow.

ABSTRAK

Kajian ini menggunakan data simulasi dikutip dari probe vehicles and loop detectors untuk menjelaskan bagaimana Adaptive Neuro-Fuzzy Interference System telah diwujudkan untuk diguna pakai dalam Automated Incident Detection di jalan raya arteri. Penyelidikan ini dijalankan untuk melanjutkan apa yang telah dikaji sebelum ini, dan ia secara teorinya dibina di atas penemuan yang menyokong keberkesanan Adaptive Neuro-Fuzzy Interference System dalam gabungan data. Disebabkan kesukaran dalam mengumpul data sebenar dari rangkaian jalan raya dalam kajian ini, kita menggunakan set data yang dibentuk dari trafik yang disahkan dan ditentukan iaitu simulasi model koridor komuter yang terletak di Brisbane, Australia. Simulasi kemalangan telah disediakan dan data yang diperlukan dikumpulkan daripada probe vehicles and loop detectors telah ditempatkan di dua tempat yang berbeza rangkaian. Satu konfigurasi Pengesanan telah diperiksa, dan jumlah sebanyak 108 insiden telah diambil untuk dijadikan model. Untuk memastikan keluasan, model dibezakan dari faktor-faktor seperti the incident location, incident duration, road and detector configuration, severity level of the incident dan keadaan traffic flow. Hasil yang terbaik yang telah diperolehi bagi Adaptive Neuro-Fuzzy Interference System adalah 95% detection rate untuk false alarm rate daripada 0.5%. Data yang dikumpul untuk kajian ini terdiri daripada ciri-ciri seperti speed, occupancy, dan flow.

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	DECLARATION	ii
	DEDICATION	iii
	ACKNOWLEDGEMENT	iv
	ABSTRACT	v
	ABSTRAK	vi
	TABLE OF CONTENTS	vii
	LIST OF TABLES	xi
	LIST OF FIGURES	xii
1	INTORDUCTION	1
	1.1 Introduction	1
	1.2 Problem Background	2
	1.3 Problem Statement	2
	1.4 Project Goal	3
	1.5 Project Objective	3
	1.6 Project Scope	3
	1.7 Project Significance	4
	1.8 Organization of Report	4
2	LITERATURE REVIEW	6
	2.1 Introduction	6
	2.3 Incident Management System	7
	2.4 Detection and Investigation Incident	9
	2.5 Traffic Information Collection System	10
	2.6 Automated Incident Detection Algorithm	10
	2.7 Performance Criteria of Automated Incident Detection	11
	2.7.1 Detection Rate (DR)	11

2.7.2	False Alarm Rate (FAR)	12
2.7.3	Mean Time to Detect (MTTD)	12
2.8	Classified of Automated Incident Detection Algorithms	13
2.8.1	Pattern Recognition Algorithms (Pattern Comparison)	14
2.8.2	Statistical Algorithms	14
2.8.3	Time Series and Smoothing Methods	15
2.8.4	Algorithm Based on Traffic Flow Theory	15
2.8.5	Image Processing Algorithms	16
2.8.6	Algorithm Based on Probe Vehicle	16
2.8.7	Artificial Neural Network (ANN)	18
2.9	Definitions of Artificial Neural Network	18
2.9.1	Network Topology	19
2.9.2	The Main Idea of Performing Artificial Neural Network	19
2.9.3	Disadvantages of ANN	20
2.9.4	The Application of Artificial Neural Network	20
2.9.5	Jordan/Elman Neural Network	21
2.10	Adaptive Nero Fuzzy Interface System (ANFIS)	21
2.10.1	Advantage of ANFIS	25
2.10.2	Drawbacks of ANFIS	26
2.11	Paramics	26
2.11.1	Collection of Incident Data by Paramics	27
2.11.2	Paramics Network Structure	27
2.11.3	Simulating Incidents	28
2.12	Summary	30
3	RESEARCH METHODOLOGY	31
3.1	Introduction	31
3.2	Research Framework	31
3.3	Model Development	33
3.4	Simulation Model Variable	33
3.4.3	Incident Duration	35
3.4.4	Incident Severity	35
3.4.5	Traffic Flow	36
3.5	Data	36

3.6	Initial Planning	38
3.7	DR & FAR	39
3.8	Summary	40
4	DATA PREPROCESSING	41
4.1	Introduction	41
4.2	Data Aggregation: Time Interval	41
4.3	Data Type	42
4.4	Raw Data	44
4.5	Data Set	46
4.6	Summary	48
5	IMPLEMENTATION	49
5.1	Introduction	49
5.2	ANFIS Structure	49
5.3	Project Scenario	53
5.3.1	Least Square	53
5.3.2	Back Propagation	54
5.3.3	Subtractive Clustering	54
5.3.4	Sugeno	55
5.3.5	Threshold	56
5.4	Result of ANFIS	56
5.4.1	Overall Performance	58
5.4.2	Link Length	58
5.4.3	Incident Location on Link	58
5.4.4	Incident Duration	59
5.4.5	Incident Severity	59
5.4.6	Traffic Flow	59
5.5	Summary	60
6	DISCUSSION AND CONCLUSION	61
6.1	Introduction	61
6.2	Finding	61
6.3	Simulation Model Variables	62

6.4	Data Collection: Simulated VS Field Data	62
6.5	Future Research	64
6.6	Conclusion	65

REFERENCES	66
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LIST OF TABLES

TABLE NO.	TITLE	PAGE
3.1	Distance Between Detectors For Each Modeled Road	34
3.2	Sample Of Simulation Data	37
4.1	Input Data: Loop Detector	42
4.2	Input Data: Probe Vehicle	44
4.3	Sample Of Input Data	48
5.1	Default Inference Method	51
5.2	ANFIS And JE Performance For Model Variables	57
6.1	Overall Result	62

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE
2.1	Incident management process	8
2.2	Schematic picture of AID component	11
2.3	An ANFIS architecture	22
2.4	Learning in ANFIS	23
2.5	Modeling network	27
2.6	Milton road segment	28
2.7	Coronation drive segment	29
3.1	Project task	32
3.2	Model detector configuration	36
3.3	Framework of proposed model	38
4.1	Sample of Incfile.txt	45
4.2	Sample of loopdata.txt	45
4.3	Sample of travtime.txt	46
5.1	FIS editor	50
5.2	Rule editor	50
5.3	Membership function editor	51
5.4	Rule viewer	52
5.5	ANFIS model structure	52

CHAPTER 1

INTORDUCTION

1.1 Introduction

Traffic is the phenomenon of mobility of human, Animal, Vehicles and other goods from point to point. Heavy traffic is the most major problem of cities in the world. The high price of overcrowding caused by incidents, mainly in conditions of air pollution, traffic delays and deteriorated safety situation has prompted an increasing global attention in extending effective and efficient automated incident detection (AID) models. The traffic problem is the introduction to the emergence of numerous problems of urban traffic that mostly can be called air pollution which causes death and disease of many residents in these cities. Agencies, organizations and several sets want to heal this problem and they are trying to solve it. However, over the years, we cannot see any sensible and encouraged changes in this situation. In this regard, the purpose of traffic management is using the methods and measures for the optimum use of existing facilities in order to improve roads and increase safety on streets.

In this chapter, we will try to identify the problem background and will define the limitation and the objective during the project.

1.2 Problem Background

Automated incident detection (AID) algorithms have a great importance for detection and prediction of incidents. Also this algorithm can help to control traffic center to be inform about the situation of road and streets in order to prevent of traffic jam in cities. An incident detection algorithm should be able to detect quickly and accurately. These algorithms detect the traffic event with using the data collection system and they are independent of human resources.

Automated incident detection (AID) algorithms are designed with different approaches and classified in different groups. Automated incident detection (AID) models based on time series analysis, pattern comparison, statistical algorithms, traffic flow theory, image processing algorithms and fuzzy logic are trying on every two streets and freeways environment and show the different levels of detection performance. Also, all of these models have some advantages and disadvantages according to operational performance, area coverage and cost. But, some of these models cannot overcome the operational needs of the traffic management and control center operator yet, that means these models cannot increase the detection rate and decrease of false alarm rate in order to minimize traffic overload.

Considering the problem mentioned, this project offers approaches in order to minimize these problems.

1.3 Problem Statement

As was said in the previous section, some of automated incident detection models cannot overcome the operational needs of the traffic management and control center operator yet, that means these models cannot increase the detection rate and decrease of false alarm rate in order to minimize traffic overload. traffic control center needs to reliable and quick data to detect the incident and control the traffic in

city. We will use Adaptive Neuro-Fuzzy Inference System data fusion techniques to combine travel time data collected from probe vehicles with traffic data of loop detectors and some roadside sensors data. After that we compare the result of ANFIS with Jordan/Elman techniques and choose the best algorithm that it has the greatest performance.

1.4 Project Goal

The goal of this project is to increase the detection rate and decrease false alarm rate. This study tries to improve the reliability of automated incident detection algorithm in order to solving the problem of traffic and improving the safety of the road in the city.

1.5 Project Objective

- To review and analyze the existing Automated Incident Detection (AID) techniques
- To improve the reliability of AID techniques by using Adaptive Neuro-Fuzzy Inference System

1.6 Project Scope

- Implementation of ANFIS will be done by Matlab.
- The data set was collected from Paramics micro simulation.
- The result of ANFIS will be measured in terms of detection rate and false alarm rate.

- Comparison will be done with ANFIS and JE networks

1.7 Project Significance

This project is important for traffic control center to prevent and manage the traffic by incident. Also, it has great importance for passengers that pass in the city. Moreover it can be useful for people, animal and environment that live in the world and need to breath in the clean air.

1.8 Organization of Report

This project is included in six chapters. These chapters according to the various tasks that are involved in the project have been organized. This section is describes about each of these chapters. More details of these chapters are given below:

Chapter 1 is a short report of the project that included problem background, problem statement, objectives, scope and significant of this project.

Chapter 2 is includes a review of other publications related to this field. It discusses about importance of automated incident detection and AID algorithms.

Chapter 3 is includes the research methodology that will be used. This chapter is also includes project operational framework.

Chapter 4 is includes dataset that we will used in this project.

Chapter 5 is including the ANFIS that we will using and provide the result of this project.

Chapter 6 is including the conclusion of this project and it suggests future work in order to further develop.

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