

**A PERFORMANCE COMPARISON STUDY OF PATTERN  
RECOGNITION SYSTEMS FOR VOLATILE ORGANIC  
COMPOUNDS DETECTION**



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## TABLE OF CONTENTS

**FRONT COVER**

**TITLE PAGE**

**LETTER OF CHANGE RESEARCH TITLE**

**LETTER OF RESEARCH OFFER**

**LETTER OF REPORT SUBMISSION**

**PROJECT TEAM MEMBERS**

**ACKNOWLEDGEMENTS** i

**TABLE OF CONTENTS** ii

**LIST OF TABLES** v

**LIST OF FIGURES** vii

**LIST OF ABBREVIATIONS** viii

**ABSTRACT** ix

### **CHAPTER 1: INTRODUCTION**

1.1 Atmospheric Pollution 1

1.2 Indoor Air Pollution 2

1.3 Volatile Organic Compounds 3

1.4 Environmental Monitoring Technology 5

1.5 Research Objectives 7

1.6 Thesis Organisation 7

### **CHAPTER 2: LITERATURE REVIEW**

2.1 Introduction 9

2.2 Electronic Nose 9

2.3 Pattern Recognition 10

2.4 Introduction to ANN 13

2.4.1 Biological Neural Network 14

2.4.2 Artificial Neuron Model 16

2.4.3	Comparison between Biology Neural and Artificial Neural	18
2.4.4	Neural Network Architecture	19
2.4.5	Neural Network Learning Algorithm	20
2.5	Multilayer Perceptron (MLP)	21
2.5.1	History of MLP Network	22
2.5.2	Architecture of MLP Network	22
2.5.3	Learning Algorithm of MLP Network	24
2.5.4	Application of MLP Network	26
2.5.5	Advantages and Disadvantages of MLP Network	27
2.6	Learning Vector Quantization (LVQ)	27
2.6.1	History of LVQ Network	28
2.6.2	Architecture of LVQ Network	28
2.6.3	Learning Algorithm of LVQ Network	30
2.6.4	Application of LVQ Network	32
2.6.5	Advantages and Disadvantages of LVQ Network	32
2.7	Adaptive Network Based Fuzzy Inference System (ANFIS)	33
2.7.1	History of ANFIS Network	34
2.7.2	Architecture of ANFIS Network	34
2.7.3	Learning Algorithm of ANFIS Network	36
2.7.4	Application of ANFIS Network	37
2.7.5	Advantages and Disadvantages of ANFIS Network	38
<b>CHAPTER 3: METHODOLOGY</b>		
3.1	Introduction	40
3.2	Data Storage	41
3.3	Data Processing and Data Representation	42
3.4	Neural Network Development	45
3.4.1	MLP Network Development	45
3.4.2	LVQ Network Development	46
3.4.3	ANFIS Network Development	47
3.5	Neural Network Training Process	48
3.5.1	MLP Training Process	48
3.5.2	LVQ Training Process	50

3.5.3	ANFIS Training Process	51
3.6	The Accuracy and Score Percentage Calculation	51
3.7	The Network Performance	53

## **CHAPTER 4: RESULTS AND DISCUSSIONS**

4.1	Introduction	54
4.2	Multilayer Perceptron (MLP)	54
4.2.1	MLP Network Trained with Raw Data	54
4.2.2	MLP Network Trained with Normalized Data	58
4.2.3	Performance of the Optimised MLP Networks	61
4.3	Learning Vector Quantization (LVQ)	62
4.3.1	LVQ Network Trained with Raw Data	62
4.3.2	LVQ Network Trained with Normalized Data	65
4.3.3	Performance of the Optimised LVQ Networks	69
4.4	Adaptive Network Based Fuzzy Inference System (ANFIS)	70
4.4.1	ANFIS Network Trained with Raw Data	70
4.4.2	Performance of the Optimised ANFIS Network	73
4.5	Performance Comparison of the Overall Optimised Network	74

## **CHAPTER 5: CONCLUSION AND FUTURE DEVELOPMENT**

5.1	Conclusion	77
5.2	Future Development	78

<b>BIBLIOGRAPHY</b>		79
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## **APPENDICES**

Appendix A: Sample of Vapour Frequency-Shift Data	83
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## ABSTRACT

It is well known that the use of a gas sensor array and pattern recognition system offers an effective technique for the identification of volatile organic molecules because of the poor selectivity of a lot of other gas sensors. Among the chemometric techniques for signal processing, artificial neural networks (ANNs) are powerful tools, which have been employed in a diverse range of applications in recent years. This project focuses only on the development of an Artificial Neural Network (ANN) for the classification of Volatile Organic Compounds (VOCs). The ANNs that were used in this project were Multilayer Perceptron (MLP), Learning Vector Quantization (LVQ) and Adaptive Network Based Fuzzy Inference System (ANFIS). The types of VOCs used for the classification were Acetone, Benzene, Chloroform, Ethanol and Methanol. In this project, the networks were trained using certain types training algorithm depending on the types of networks; Levenberg Marquardt (LM) for the MLP, competitive network for the LVQ and hybrid learning for ANFIS. The input and output neurons used for the three networks were 5 neurons. The optimum structure of the neural network was determined by trial and error method to obtain the optimized hidden neuron and weight values. The performance of each neural network was analysed in terms of the classification accuracy, average score, total training time required during the training process and the test time of the optimised networks. From the results obtained, the classification accuracy and the average score percentages for the MLP network was the highest (above 90%). The ANFIS network was also observed to have good classification rate with classification accuracy and average

score percentage above 90%. The LVQ network was observed to have poor classification for the VOCs data with classification accuracy percentage below 80%. The training time for ANFIS network was the shortest (361.14 seconds) which was then followed by the MLP (536.27 seconds) and LVQ networks (5427.35 seconds). However, the test time for MLP network was the shortest (0.0108 second) which was then followed by the LVQ network (0.0133 second) and ANFIS network (0.078 second). Overall, the MLP was considered the best optimised network followed by ANFIS and LVQ networks.