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ON-LINE RECOGNITION OF DEVELOPING CONTROL CHART PATTERNS

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DEDICATION

This thesis is dedicated to my father, who taught me that the best kind of knowledge to have is that which is learned for its own sake. It is also dedicated to my mother, who taught me that even the largest task can be accomplished if it is done one step at a time.

ACKNOWLEDGEMENT

In preparing this thesis, I was in contact with many people, researchers, academicians, and practitioners. They have contributed towards my understanding and thoughts. In particular, I wish to express my sincere appreciation to my main thesis supervisor, Professor Dr. Mohd Shariff Nabi Baksh, for encouragement, guidance, critics and friendship. I am also very thankful to my co-supervisor Professor Dr Awaluddin Mohd Shaharoun and Associate Professor Dr. Hishamuddin Jamaluddin for their guidance, advices and motivation. Without their continued support and interest, this thesis would not have been the same as presented here.

I am also indebted to Universiti Teknologi Malaysia (UTM) for funding my Ph.D study. Librarians at UTM, Cardiff University of Wales and the National University of Singapore also deserve special thanks for their assistance in supplying the relevant literatures.

My fellow postgraduate student should also be recognised for their support. My sincere appreciation also extends to all my colleagues and others who have provided assistance at various occasions. Their views and tips are useful indeed. Unfortunately, it is not possible to list all of them in this limited space. I am grateful to all my family member.

ABSTRACT

The purpose of this study is to investigate the application of genetic algorithm (GA) in modelling linear and non-linear dynamic systems and develop an alternative model structure selection algorithm based on GA. Orthogonal least square (OLS), a gradient descent method was used as the benchmark for the proposed algorithm. A model structure selection based on modified genetic algorithm (MGA) has been proposed in this study to reduce problems of premature convergence in simple GA (SGA). The effect of different combinations of MGA operators on the performance of the developed model was studied and the effectiveness and shortcomings of MGA were highlighted. Results were compared between SGA, MGA and benchmark OLS method. It was discovered that with similar number of dynamic terms, in most cases, MGA performs better than SGA in terms of exploring potential solution and outperformed the OLS algorithm in terms of selected number of terms and predictive accuracy. In addition, the use of local search with MGA for fine-tuning the algorithm was also proposed and investigated, named as memetic algorithm (MA). Simulation results demonstrated that in most cases, MA is able to produce an adequate and parsimonious model that can satisfy the model validation tests with significant advantages over OLS, SGA and MGA methods. Furthermore, the case studies on identification of multivariable systems based on real experiment t al data from two systems namely a turbo alternator and a continuous stirred tank reactor showed that the proposed algorithm could be used as an alternative to adequately identify adequate and parsimonious models for those systems. Abstract must be bilingual. For a thesis written in Bahasa Melayu, the abstract must first be written in Bahasa Melayu and followed by the English translation. If the thesis is written in English, the abstract must be written in English and followed by the translation in Bahasa Melayu. The abstract should be brief, written in one paragraph and not exceed one (1) page. An abstract is different from synopsis or summary of a thesis. It should states the field of study, problem definition, methodology adopted, research process, results obtained and conclusion of the research. The abstract can be written using single or one and a half spacing. Example can be seen in Appendix 1 (Bahasa Melayu) and Appendix J (English).

ABSTRAK

Kajian ini dilakukan bertujuan mengkaji penggunaan algoritma genetik (GA)

dalam pemodelan sistem dinamik linear dan tak linear dan membangunkan kaedah alternatif bagi pcmilihan struktur model menggunakan GA. Algorithma kuasa dua terkecil ortogon (OLS), satu kaedah penurunan kecerunan digunakan sebagai bandingan bagi kaedah yang dicadangkan. Pcmilihan struktur model mengunakan kaedah algoritma genetik yang diubahsuai (MGA) dicadangkan dalam kajian ini bagi

mengurangkan masalah konvergens pramatang dalam algoritma genetik mudah (SGA). Kesan penggunaan gabungan operator MGA yang berbeza ke atas prestasi model yang terbentuk dikaji dan keberkesanan serta kekurangan MGA diu t arakan. Kajian simulasi dilakukan untuk membanding SGA, MGA dan OLS. Dengan meggunakan bilangan parametcr dinamik yang setara kajian ini mendapati, dalam kebanyakan kes, prestasi MGA adalah lebih baik daripada SGA dalam mencari penyelesaian yang berpotensi dan lebih berkebolehan daripada OLS dalam menentukan bilangan sebutan yang dipilih dan ketcpatan ramalan. Di samping itu, penggunaan carian tcmpatan dalam MGA untuk menambah baik algorithma tersebut dicadang dan dikaji, dinamai sebagai algoritma mcmetic (MA). Hasil simulasi menunjukkan, dalam kebanyakan kes, MA berkeupayaan menghasilkan model yang bersesuaian dan parsimoni dan mcmenuhi ujian pengsahihan model di samping mcmperolehi beberapa kelebihan dibandingkan dengan kaedah OLS, SGA dan MGA. Tambahan pula, kajian kes untuk sistcm berbilang pcmbolehubah menggunakan data eksperimental sebenar daripada dua sistem iaitu sistem pengulang-alik turbo dan reaktor teraduk berterusan menunjukkan algoritma ini boleh digunakan sebagai alternatif untuk mcmperolehi model termudah yang memadai bagi sistcm tersebut.

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LIST OF ABBREVIATIONS

|  |  |  |
| --- | --- | --- |
| ANN | - | Artificial Neural Network |
| GA | - | Genetic Algorithm |
| MD | - | Mahalanobis Distance |
| MTS | - | Mahalanobis Taguchi System |
| PSO | - | Particle Swarm Optimization |
| TM | - | Taguchi Method |
| UTM | - | Universiti Teknologi Malaysia |
| XML | - | Extensible Markup Language |
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LIST OF SYMBOLS

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| --- | --- | --- |
| δ | - | Minimal error |
|  | - | Diameter |
|  | - | Force |
|  | - | Velocity |
|  | - | Pressure |
|  | - | Moment of Inersia |
|  | - | Radius |
|  | - | Reynold Number |
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# INTRODUCTION

## Problem Background

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## Problem Background

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## Problem Statement

## Research Goal

### Research Objectives

The objectives of the research are :

1. To estimate the parameters
2. Item 1
3. Item 2
4. To define the best parameter estimate.

## Captions

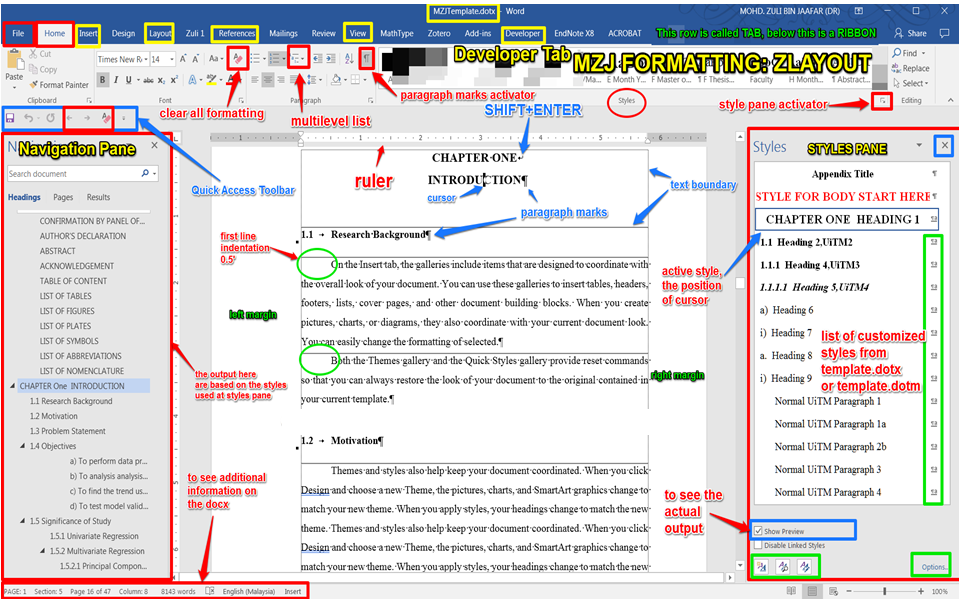


Figure ‎1.1 Trends leading to the problem using MZJ Formatting Method

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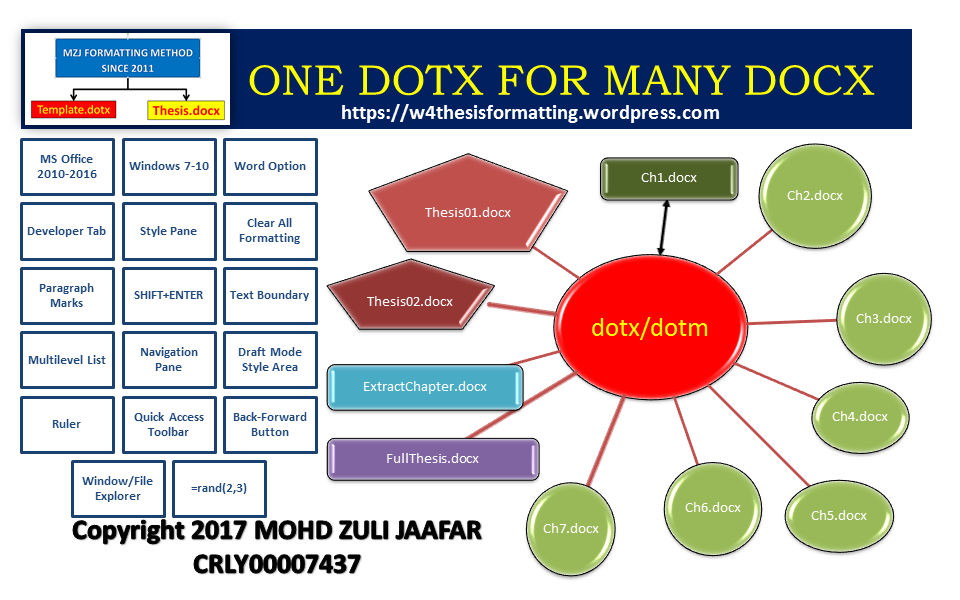


Figure ‎1.2 Design and development phases of the proposed scheme (Muhamad, 2018)

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Table ‎1.1 The role of statistical quality engineering tools and methodologies

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Table ‎1.2 Basic ANN models used for control chart pattern recognition

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## Quotation

After deliberating on doctoral education in Australia in the 1990s, one observer I Australia writes:

The lack of any significant formal course work within our Ph.D. and master degrees by research has continued for three decades. The focus of our Ph.D. research type degrees continues to be the research project, and this is almost the only medium by which education is accomplished.

(Stranks, 1984:171)

## Equation

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# LITERATURE REVIEW

## Introduction

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Figure ‎2.1 Continuous variability reduction using SPC chart (Revelle and Harrington, 1992)

Figure ‎2.2 Typical fully developed patterns on Shewhart control chart (Cheng, 1989)

Table ‎2.1 Regression analysis for the results of preliminary feature screening

Table ‎2.2 Estimated effects and regression coefficients for the recogniser's performance (reduced model)

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### State-of-the-Arts

## Limitation

## Research Gap

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# RESEARCH METHODOLOGY

## Introduction

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### Proposed Method

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#### Research Activities

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## Tools and Platforms

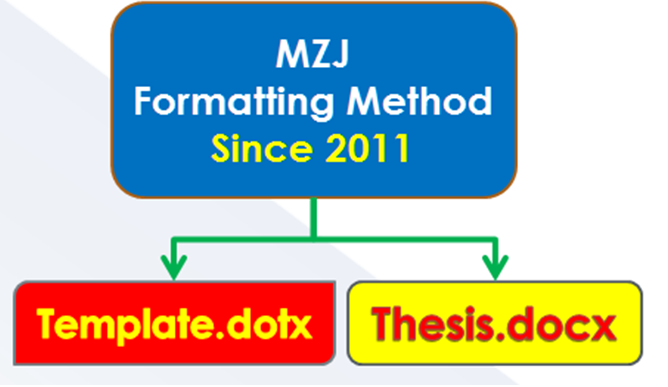


Figure ‎3.1 Example of Formatting Method

## Chapter Summary

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# PROPOSED WORK

## The Big Picture

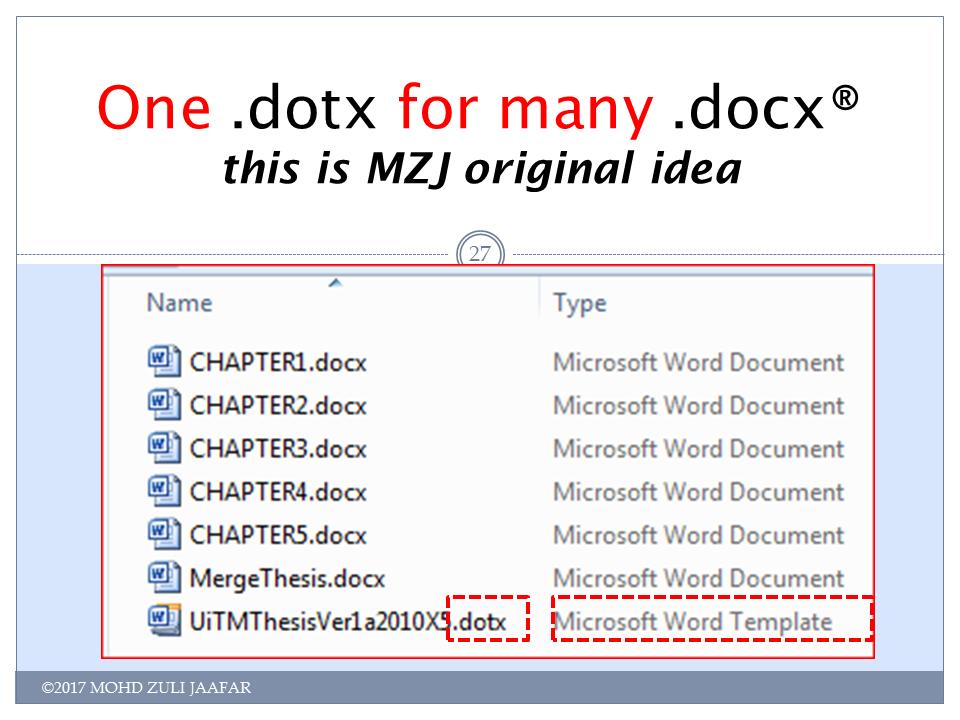


Figure ‎4.1 This is MZJ original idea

## Analytical Proofs

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## Result and Discussion



Figure ‎4.2 The method for hig performance formatting

## Chapter Summary

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# CONCLUSION AND RECOMMENDATIONS

## Research Outcomes

## Contributions to Knowledge

## Future Works

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REFERENCES

Chen, M.-C. and Huang, S.-H. (2003) ‘Credit scoring and rejected instances reassigning through evolutionary computation techniques’, *Expert Systems with Applications*, 24(4), pp. 433–441.

Clerc, M. and Kennedy, J. (2002) ‘The particle swarm - explosion, stability, and convergence in a multidimensional complex space’, *IEEE Transactions on Evolutionary Computation*, 6(1), pp. 58–73.

Gosnell, M., Woodley, R., Hicks, J. and Cudney, E. (2014) ‘Exploring the Mahalanobis-Taguchi Approach to Extract Vehicle Prognostics and Diagnostics’, in *Computational Intelligence in Vehicles and Transportation Systems (CIVTS), 2014 IEEE Symposium on*, pp. 84–91.

Gupta, A. (2015) ‘Classification of Complex UCI Datasets Using Machine Learning Algorithms Using Hadoop’, *International Journal of Scetific & Techology Research*, 4(5), pp. 85–94.

Hu, J., Zhang, L., Liang, W. and Wang, Z. (2009) ‘Incipient mechanical fault detection based on multifractal and MTS methods’, *Petroleum Science*, 6(2), pp. 208–216.

Huang, C.-L., Chen, Y. H. and Wan, T.-L. J. (2012) ‘The mahalanobis taguchi system—adaptive resonance theory neural network algorithm for dynamic product designs’, *Journal of Information and Optimization Sciences*, 33(6), pp. 623–635.

Jain, A. K. A. K., Duin, R. P. W. and Mao, J. (2000) ‘Statistical pattern recognition: a review’, *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 22(1), pp. 4–37.

Khalid, S., Khalil, T. and Nasreen, S. (2014) ‘A survey of feature selection and feature extraction techniques in machine learning’, *2014 Science and Information Conference*, pp. 372–378.

Li, C., Yuan, J. and Qi, Z. (2015) ‘Risky group decision-making method for distribution grid planning’, *International Journal of Emerging Electric Power Systems*, 16(6), pp. 591–602.

Lv, Y. and Gao, J. (2011) ‘Condition prediction of chemical complex systems based on Multifractal and Mahalanobis-Taguchi system’, in *ICQR2MSE 2011 - Proceedings of 2011 International Conference on Quality, Reliability, Risk, Maintenance, and Safety Engineering*, pp. 536–539.

der Maaten, L. J. P., Postma, E. O., den Herik, H. J., van der Maaten, L., Postma, E. O., van den Herik, J., der Maaten, L. J. P., Postma, E. O. and den Herik, H. J. (2009) ‘Dimensionality Reduction: A Comparative Review’, *Technical Report TiCC TR 2009-005*, 10(January), pp. 1–41.

Motwani, R. and Raghavan, P. (1996) ‘Randomized algorithms’, *ACM Computing Surveys*, 28(1), pp. 33–37.

Qinbao Song, Jingjie Ni and Guangtao Wang (2013) ‘A Fast Clustering-Based Feature Subset Selection Algorithm for High-Dimensional Data’, *IEEE Transactions on Knowledge and Data Engineering*, 25(1), pp. 1–14.

Rao, V. M. and Singh, Y. P. (2013) ‘Decision Tree Induction for Financial Fraud Detection’, in *Proceeding of the International Conference on Artificial Intelligence in Computer Science and ICT (AICS 2013)*, pp. 321–328.

Shi, Y. and Eberhart, R. (1998) ‘A modified particle swarm optimizer’, 1998 IEEE International Conference on Evolutionary Computation Proceedings. IEEE World Congress on Computational Intelligence (Cat. No.98TH8360), pp. 69–73.

Soylemezoglu, A., Jagannathan, S. and Saygin, C. (2011) ‘Mahalanobis-Taguchi system as a multi-sensor based decision making prognostics tool for centrifugal pump failures’, *IEEE Transactions on Reliability*, 60(4), pp. 864–878.

Theodoridis, S., Koutroumbas, K., Holmstrom, L. and Koistinen, P. (2009) *Pattern Recognition*, *Wiley Interdisciplinary Reviews Computational Statistics*.

Zaki, M. J., Wong, L., Berry, M. J. A., Linoff, G. S., Hegland, M., Zaki, M. J. and Wong, L. (2003) ‘Data Mining Techniques’, *WSPC/Lecture Notes Series: 9in x 6in*, 10(1–2), p. 545.

APPENDICES

Appendix A Mathematical Proofs

Appendix B Psuedo Code

Appendix C Time-series Results Long Long Long Long Long Long Long Long Long Long

1. Mary Duncan Carterand Rose Mary Magrill, “Building Library Collections" Fourth edition. (Metuchen, N. J.: Scarecrow Press, 1974), pp.61 - 66. [↑](#footnote-ref-1)