

**REINFORCEMENT OF BUSINESS INTELLIGENCE  
APPLICATIONS IN SRI LANKAN LIFE INSURANCE  
INDUSTRY**

Nayomi Kanchana Wickramasekara

(169141J)

Degree of Master of Business Administration in Information Technology

Department of Computer Science and Engineering

University of Moratuwa

Sri Lanka

December 2017

**REINFORCEMENT OF BUSINESS INTELLIGENCE  
APPLICATIONS IN SRI LANKAN LIFE INSURANCE  
INDUSTRY**

Nayomi Kanchana Wickramasekara

(169141J)

The dissertation was submitted to the Department of Computer Science and Engineering of the University of Moratuwa in partial fulfilment of the requirement for the Degree of Master of Business Administration in Information Technology.

Department of Computer Science and Engineering

University of Moratuwa

Sri Lanka

December 2017

## DECLARATION

I declare that this is my own work and this thesis does not incorporate without acknowledgement of any material previously submitted for a Degree or Diploma in any other University or institute of higher studies and does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

Also, I hereby grant the University of Moratuwa the non-exclusive right to reproduce and distribute my thesis/dissertation, in whole or in part in print, electronic or other medium. I retain the right to use this content in whole or part in future works (such as articles or books).

.....

N K Wickramasekara

.....

Date

The above candidate has carried out research for the Masters' thesis under my supervision.

.....

Dr A S Perera

.....

Date

## **COPYRIGHT STATEMENT**

I hereby grant the University of Moratuwa the right to archive and to make available my thesis or dissertation in whole or part in the University Libraries in all forms of media, subject to the provisions of the current copyright act of Sri Lanka. I retain all proprietary rights, such as patent rights. I also retain the right to use this thesis or dissertation in future works (articles or books etc) in whole or part.

-----  
Date

## ABSTRACT

Business Intelligence is not a newer technology. Instead, it's an integrated solution for businesses, where business requirements are the key factors that drive technology innovation.

Nowadays Business Intelligence in financial organizations has been implemented and operated mainly to support decision making using knowledge as a strategic factor. Business Intelligence takes a vital role in insurance domain especially in life insurance sector where BI help firms in gaining business advantage mainly in decision making.

In the life insurance industry, using classification techniques on customer and product databases seems to be very effective. One of the best applications where classification can be used in the life insurance industry is for the regularity of life insurance policyholders for instalment payment depending on their behavioural attributes. That is deciding whether a life insurance policyholder is regular or irregular in premium payments by considering his or her behavioural attributes such as their demographic, social, cultural and economic data.

So in order to achieve the objective of this research, which is reinforcing business intelligence applications in Sri Lankan life insurance industry, primary data of 400 life insurance policyholders have been collected from different life insurance companies in Sri Lanka, considering the regularity of policyholders' premium payments. Five different classification techniques such as Naïve Bayes, Multi-Layer Perceptron, IBK, PART and SMO, which have been identified as most significant in classifying regularity of policyholders' premium payments, have been applied on primary data, in order to decide whether life insurance policyholder is regular or irregular in premium payments. Finally, those five classification techniques have been evaluated using evaluation techniques in order to come up with the best BI model in classifying regularity of policyholders' premium payments for Sri Lankan life insurance industry.

**Key words:** Business Intelligence, Naïve Bayes, Multi-Layer Perceptron, IBk, PART, SMO

## **ACKNOWLEDGEMENT**

First of all, my deepest gratitude expressed to Dr A.S. Perera, my supervisor for this research, for letting me to take this research project and guiding me from the beginning. Sir, your valuable comments and encouragements drive me to a successful endpoint of this research.

I appreciate the guidance provided by Dr Chandana Gamage, Ms Jeeva Padmini, who gave their valuable advice, criticisms to see the best from this research.

Finally, it is a pleasure to thank my parents, my sister, colleagues and all supporters who helped me to succeed in this research with their valuable support and advice.

# TABLE OF CONTENTS

|   |             |
|---|-------------|
| <b>DECLARATION .....</b>  | <b>I</b>    |
| <b>COPYRIGHT STATEMENT.....</b>                                       | <b>II</b>   |
| <b>ABSTRACT .....</b>   | <b>III</b>  |
| <b>ACKNOWLEDGEMENT.....</b>   | <b>III</b>  |
| <b>TABLE OF CONTENTS .....</b>  | <b>V</b>    |
| <b>LIST OF FIGURES .....</b>  | <b>VII</b>  |
| <b>LIST OF TABLES.....</b>  | <b>VIII</b> |
| <b>LIST OF ABBREVIATIONS.....</b>                                     | <b>IX</b>   |
| <b>1. INTRODUCTION.....</b>   | <b>1</b>    |
| 1.1. Background.....  | 1           |
| 1.2. Motivation .....   | 3           |
| 1.3. Research Scope.....  | 4           |
| 1.4. Problem Statement .....  | 5           |
| 1.5. Research Objectives .....  | 6           |
| <b>2. LITERATURE REVIEW .....</b>                                     | <b>7</b>    |
| 2.1 Global Life Insurance Industry.....                               | 7           |
| 2.2 Sri Lankan Life Insurance Industry.....                           | 9           |
| 2.3 Determinants of Life Insurance Demand .....                       | 10          |
| 2.4 Business Intelligence .....                                       | 11          |
| 2.5 Business Intelligence and Global Life Insurance Industry.....     | 14          |
| 2.6 Business Intelligence and Sri Lankan Life Insurance Industry..... | 22          |

|   |           |
|---|-----------|
| <b>3. RESEARCH METHODOLOGY .....</b>                      | <b>23</b> |
| 3.1. Overview of Chapter .....                            | 23        |
| 3.2. Introduction to Methodology.....                     | 23        |
| 3.3. Data Gathering .....                                 | 25        |
| 3.4. Population and Sample.....                           | 26        |
| 3.5. Designing the Questionnaire .....                    | 27        |
| 3.6. Methodology .....                                    | 27        |
| <b>4. DATA ANALYSIS .....</b>                             | <b>30</b> |
| 4.1. General Overview of the Data.....                    | 30        |
| 4.2. Statistical Analysis .....                           | 31        |
| 4.3. Statistical Tests.....                               | 37        |
| 4.4. Evaluation .....                                     | 38        |
| 4.5. Summary .....  | 41        |
| <b>5. RECOMMENDATIONS AND CONCLUSION.....</b>             | <b>42</b> |
| <b>REFERENCES .....</b>                                   | <b>45</b> |
| <b>APPENDIX A: QUESTIONNAIRE INSTRUMENT .....</b>         | <b>49</b> |
| <b>APPENDIX B: CHI-SQUARE TESTS OF INDEPENDENCE .....</b> | <b>52</b> |
| <b>APPENDIX C: EVALUATION OF CLASSIFIERS.....</b>         | <b>56</b> |



## LIST OF FIGURES

|   |    |
|---|----|
| Figure 2.1 A Consulting Engine for Life Insurance Market.....                                 | 19 |
| Figure 2.2 A Comprehensive BI Application Infrastructure for a Life Insurance<br>Company..... | 19 |
| Figure 3.1 Sample Size vs. Total Population.....  | 26 |
| Figure 4.1 Variations over Gender.....  | 31 |
| Figure 4.2 Variation over age groups.....   | 32 |
| Figure 4.3 Variations over Civil Status.....  | 32 |
| Figure 4.4 Variation over the number of children.....   | 33 |
| Figure 4.5 Variations over Occupation.....  | 33 |
| Figure 4.6 Variation over Educational qualifications.....                                     | 34 |
| Figure 4.7 Variation over Living environments.....  | 34 |
| Figure 4.8 Variations over Policy Term.....   | 35 |
| Figure 4.9 Variations over Sum Assured.....   | 35 |
| Figure 4.10 Variations over Premium Payment Methods.....                                      | 36 |
| Figure 4.11 Variations over Premium Payment Regularity.....                                   | 36 |
| Figure 4.12 Model comparisons in TP and FP rates.....   | 39 |
| Figure 4.13 Model comparisons in ROC Area.....  | 40 |

## LIST OF TABLES

|  |    |
|--|----|
| Table 2.1 Role of data mining in Insurance Industry .....  | 16 |
| Table 2.2 BI applications in the Life Insurance business process .....                           | 18 |
| Table 4.1 Data Source.....   | 30 |
| Table 4.2 Chi-Square test of independence (Association with Regularity of premium payments)..... | 38 |
| Table 4.3 Comparison of models using classification evaluations .....                            | 39 |
| Table 4.4 Model evaluation done by Rahman et al (2017) .....                                     | 41 |

## **LIST OF ABBREVIATIONS**

A/L - Advanced Level  
AUC - Area Under the Curve  
BI - Business Intelligence  
CRM - Customer Relationship Management  
FP - False Positive  
HNB - Hatton National Bank  
IBk - Instance Bases learning with parameter k  
ID3 - Iterative Dichotomiser 3  
IT - Information Technology  
KNN - K-nearest neighbours  
MLP - Multi-Layer Perceptron  
O/L - Ordinary Level  
PART - Projective Adaptive Resonance Theory  
QP- Quadratic Programming  
ROC - Receiver Operating Characteristics  
SMO- Sequential Minimal Optimization  
SVM- Support Vector Machine  
TP - True Positive  
WEKA - Waikato Environment for Knowledge Analysis