

AGILE MINING
- A NOVEL DATA MINING PROCESS FOR
INDUSTRY PRACTICE BASED ON AGILE
METHODS AND VISUALIZATION



Xiao Zhu

Advanced Analytics Institute

School of Software

Faculty of Engineering and Information Technology

University of Technology Sydney

This dissertation is submitted for the degree of Master by Research

November 2017

Publication List during Master Degree Study:

X. Zhu, G. Xu. Applying Visual Analytics on Traditional Data Mining Process: Quick Prototype, Simple Expertise Transformation, and Better Interpretation. *International Conference on Enterprise Systems: Advances in Enterprise Systems (ES)*, 2016.

S. Liu, G. Xu, X. Zhu. Towards Simplified Insurance Application via Sparse Questionnaire Optimization. *International Conference on Behavioral, Economic, and Socio-Cultural Computing (BESC)*, 2017.

DECLARATION

This dissertation is the result of my work and includes nothing, which is the outcome of work done in collaboration except where specifically indicated in the text. It has not been previously submitted, in part or whole, to any university or institution for any degree, diploma, or other qualification.

Signed: Production Note:
Signature removed prior to publication. _____

Date: 15/11/2017

Xiao Zhu

ABSTRACT

Current standard data mining processes like Cross-Industry Standard Process for Data mining (CRISP-DM) are vulnerable to frequent change of customer requirement. Meanwhile, Stakeholders might not acquire sufficient understanding to generate business value from analytic results due to a lack of intelligible explanatory stage. These two cases repeatedly happen on those companies which are inexperienced in data mining practice. Towards this issue, Agile Mining, a refined CRISP-DM based data mining (DM) process, is proposed to address these two friction points between current data mining processes and inexperienced industry practitioners. By merging agile methods into CRISP-DM, Agile Mining process achieves a requirement changing friendly data mining environment for inexperienced companies. Moreover, this Agile Mining transforms traditional analytic-oriented evaluation to business-oriented visualization-based evaluation. In the case study, two industrial data mining projects are used to illustrate the application of this new data mining process and its advantages.

Keyword: Data Mining, Data Mining Standard Process, CRISP-DM, Visualization.

CONTENTS

1 INTRODUCTION.....	4
1.1 RESEARCH BACKGROUND	4
1.2 RELATED WORK.....	5
1.2.1 Data Mining Process	5
1.2.2 Agile Methods	6
1.2.3 Visualization in Data Mining.....	6
1.3 RESEARCH ISSUE	7
1.4 RESEARCH NOVELTY.....	8
1.5 STRUCTURE OF THIS PAPER.....	8
2 LITERATURE REVIEW.....	10
2.1 DATA MINING PROCESS	10
2.1.1 CRISP-DM	11
2.1.2 SEMMA	14
2.1.3 KDD	15
2.1.4 Comparison of KDD, SEMMA and CRISP-DM	16
2.2 AGILE METHOD FOR SOFTWARE DEVELOPMENT.....	18
2.2.1 Character of Agile Method	19
2.2.2 Extreme Programming.....	21
2.2.3 Scrum Method	23
2.2.4 Comparison of Scrum and XP.....	28
2.3 VISUALIZATION IN DATA MINING	29
2.3.1 Definition of Data Mining Visualization.....	30
2.3.2 Objective of Data Mining Visualization.....	31
2.4 SUMMARY OF LITERATURE REVIEW	33
3 A NOVEL DATA MINING PROCESS BASED ON AGILE METHODS AND VISUALIZATION	34
3.1 INTRODUCTION TO AGILE MINING PROCESS.....	34
3.2 REQUIREMENT RECONFIRMING	36

3.3 PERFORMANCE REFINING	38
3.4 CHAPTER SUMMARY	40
4 AM REFINED REQUIREMENT CONFIRMATION AND ACCURACY-COST BALANCE	41
4.1 GAP RESEARCH	41
4.1.1 <i>Data Insufficiency</i>	42
4.1.2 <i>Evolving Analytic Objectives</i>	42
4.1.3 <i>Unmanageable Accuracy-Cost Tradeoff</i>	43
4.2 AGILE BASED DATA PREPROCESSING AND MODELING	43
4.2.1 <i>Data Sufficiency Test</i>	44
4.2.2 <i>Deliverable Reconfirmation</i>	45
4.2.3 <i>Business-Oriented Accuracy-Cost balancing</i>	45
4.3 CASE STUDY OF AM APPLICATION.....	45
4.3.1 <i>Requirement Reconfirming in Workforce Modeling</i>	46
4.3.2 <i>Performance Refining in Customer Churn Prediction</i>	49
4.4 CHAPTER SUMMARY	53
5 AM ENHANCED INTERPRETATION AND INTERACTION	54
5.1 GAP DESCRIPTION: BIAS ON UNDERSTANDING PROJECT’S SUCCESS.....	54
5.2 VISUAL-DRIVEN INTERPRETATION AND INTERACTION.....	55
5.3 CASE STUDY	56
5.3.1 <i>Information Gain Based Heatmap</i>	56
5.3.2 <i>Association Rule-Based Directed Graph</i>	59
5.3.3 <i>Customer Segmentation Based Parallel Coordinate</i>	61
5.4 CHAPTER SUMMARY	65
6 CONCLUSION.....	66
7 REFERENCE	67

LIST OF ABBREVIATIONS AND ACRONYMS

CRISP-DM: Cross Industry Standard Process for Data Mining

AM: Agile Mining

RR: Requirement Reconfirming

PR: Performance Refining

RF: Random Forest

LR: Logistic Regression

SVM: Support Vector Machine

NB: Naïve Bayes