MSc in Information Technology

Analyze Quality of Products in E-commerce Systems with Sentimental Analysis

Prepared by

P. M. A. U. Bandara

Index No: 158751L

Supervised by

Mr. SamindaPremaratne

Faculty of Information Technology

University of Moratuwa

March 2019

MSc in Information Technology

Analyze Quality of Products in E-commerce Systems with Sentimental Analysis

Prepared by

P. M. A. U. Bandara

Index No: 158751L

Dissertation submitted to the Faculty of Information Technology, University of Moratuwa, Sri Lanka for the partial fulfillment of the requirements of the Degree of Master of Science in Information Technology.

March 2019

Declaration

I declare that this research is my own work and has not been submitted in any form for another degree or diploma at any university or other institution of tertiary education. Information derived from the published or unpublished work of others has been acknowledged in the text and the list of references is given.

| P. M. A. U. Bandara |
|--|
| (158751L) |
| 2019/04/ |
| I have supervised and accepted this thesis for the submission of the degree. |
| Mr. Saminda Premaratne |
| (Main Supervisor) |
| 2019/04/ |

Acknowledgements

I would like to express my genuine gratitude to my advisor Mr. S.C Premaratne for the continuous support of my research, for his patience, motivation, and immense knowledge. His direction helped me in all the period of research and writing of this thesis. I could not have imagined having a better advisor and mentor for my research. Also I thank my associates and staff in the University of Moratuwa who helped me carry out this research. Last but not the least, I would like to thank my family, my parents for supporting me spiritually throughout writing this thesis.

Abstract

E-commerce websites getting extra significant and popular today since the vast differentiated and diversified information that is presented. Studies says that more than 80% of the world population is using these websites to purchase goods and services online. For these online customers, comments / feedbacks play a major role in decision making when buying the products from the market space. Hence the diversity and the popularity of the Online space, sales of these online products get increased with time. Therefore, it is not practical to review all the given product feedback and come to conclusion on purchasing the product for a consumer. Focusing on this, this study is urges to observe the success factors of online websites and how those aspects influence on online marketing to sales growth in any organization. Therefore, in this research a Analyze Quality of Products in E-commerce System is focused on analyzing the online consumers feedbacks or comments on various products using data mining techniques such as Sentimental and filtering analysis. The outcome from the study will show feature wise relativeness in the mobile phone domain. All procedures were based on the features extracted through a thorough literature review and existing apparatuses. This will aid to calculate a "Trust Score" for the online products and a general overview to achieve a higher trust score for e-commerce organization.

Table of Contents

| Declara | ition | I |
|---------|--|------|
| Acknow | vledgements | II |
| Abstrac | t | III |
| Table o | f Contents | IV |
| List of | Figures | VII |
| List of | Tables | VII |
| Chapter | r 1 – Introduction | 1 |
| 1.1 | Prolegomena | 1 |
| 1.2 | Identifying the Research Problem | 2 |
| 1.2 | Symptoms of the Problem | 2 |
| 1.2 | Justification of the problem | 3 |
| 1.2 | Defining Research Problem | 3 |
| 1.3 | Research Question | 5 |
| 1.4 | Aim | 5 |
| 1.5 | Objectives of the Study | 5 |
| 1.6 | Study Limitations | 5 |
| 1.7 | Chapter Outline | 5 |
| 1.8 | Chapter Summary | 6 |
| Chapter | r 2 – Literature Review on Developments and Challenges in Product Qual | lity |
| Analysi | S | 7 |
| 2.1 | Introduction | 7 |
| 2.2 | Early development and Modern Trends | 7 |
| 2.3 | Existing Models | 8 |
| 2.4 | Lexicon-Based Approach | 8 |
| 2.5 | Confusion Matrix | 9 |
| 2.6 | Summary | 12 |
| Chapter | r 3 – Adopted Technology in Data Mining Tools and Techniques | 13 |
| 3.1 | Introduction | 13 |
| 3.2 | Comparison of Machine Learning and Lexicon Based Method | 13 |

| 3.3 | W | hat is Data Mining? | 14 |
|---------|-------|---|----|
| 3.4 | R l | Data Mining Tool | 15 |
| 3.5 | Su | mmary | 15 |
| Chapter | r 4 - | Approach to Analyze Quality of Products in a System | 16 |
| 4.1 | Int | roduction | 16 |
| 4.2 | Us | ers | 16 |
| 4.3 | Inp | out | 16 |
| 4.4 | Ou | tput | 16 |
| 4.5 | Pro | ocess | 16 |
| 4.6 | Te | chnology | 17 |
| 4.7 | Su | mmary | 17 |
| Chapter | r 5 – | Design to Analyze Quality of Products in System | 18 |
| 5.1 | Int | roduction | 18 |
| 5.2 | То | p level Architecture of the System | 18 |
| 5.3 | Da | ta Collection | 19 |
| 5.4 | Pre | e-Processing | 19 |
| 5.4 | .1 | Removal of duplicate | 20 |
| 5.4 | .2 | Removal of HTML tags , hyperlinks | 20 |
| 5.4 | .3 | Stop words removal | 20 |
| 5.4.4 | | Tagging Speech | 20 |
| 5.5 | То | kenization | 21 |
| 5.6 | | tegorization | |
| 5.7 | | xicon Module | |
| 5.7 | | Lexicon Dictionary | |
| 5.8 | Ge | nerating Product Rating | |
| 5.9 | | ting Module | |
| 5.10 | | lidate Model | |
| | 0.1 | Confusion matrix for positive reviews | |
| | | | |
| 5.1 | 0.2 | Confusion matrix for negative reviews | 23 |
| 5.1 | 0.3 | Confusion matrix for neutral reviews | 23 |
| 5 11 | Su | mmarv | 24 |

| Chapter | 6 – Implementation of Analyzing the Quality of the Product in a System | 25 | | |
|---|--|----|--|--|
| 6.1 | Introduction | 25 | | |
| 6.2 | R Language | 25 | | |
| 6.3 | Data Collection | 26 | | |
| 6.4 | Data set Preprocessing | 26 | | |
| 6.5 | Categorization of the Dataset | 26 | | |
| 6.6 | Implementation of the Application | 26 | | |
| 6.6 | .1 Lexicon Module | 26 | | |
| 6.6 | .2 Lexicon Dictionary | 27 | | |
| 6.6 | .3 Scoring Algorithm | 27 | | |
| 6.7 | Summary | 27 | | |
| Chapter | 7 - Evaluation | 28 | | |
| 7.1 | Introduction | 28 | | |
| 7.2 | Analysis | 28 | | |
| 7.3 | Model Validation with Existing Products | 31 | | |
| 7.3 | .1 TheySay API | 31 | | |
| 7.3 | .2 Google Cloud Natural Language | 32 | | |
| 7.3 | .3 Paralleldots API | 33 | | |
| 7.4 | Overview of the Research | 34 | | |
| Chapter | 8 – Conclusion and Recommendations | 35 | | |
| 8.1 | Introduction | 35 | | |
| 8.2 | Summary of the research | 35 | | |
| 8.3 | Conclusions | 35 | | |
| 8.4 | Limitations of the Study | 35 | | |
| 8.5 | Future Work | 36 | | |
| Append | lixes | 41 | | |
| Appe | endix A – R code for Web Scrape from Amazon | 41 | | |
| Appendix B – R code for Web Scrape Parse Amazon html pages for data42 | | | | |
| Appe | endix C – R code for Review categorized by features | 46 | | |
| Appe | endix D - R code for Sentimental Analysis using Lexicon Dictionary | 48 | | |

List of Figures

| Figure 1.1.1: Retail e-commerce sales worldwide from 2014 to 2021 | 1 |
|---|----|
| Figure 2.4.1: Example of Native words | 9 |
| Figure 3.3.1: Steps of data mining Process | 14 |
| Figure 5.2.1: Top level architecture of the system | 19 |
| Figure 7.2.1: Positive Accuracy Comparison for Lexicon | 30 |
| Figure 7.2.2: Negative Accuracy Comparison for Lexicon | 30 |
| Figure 7.3.1: Result of theysay API | 31 |
| Figure 7.3.2: Google Cloud Natural Language Results | 32 |
| Figure 7.3.3: Google Cloud Natural Language Results | 33 |
| Figure 7.3.4: Paralleldots Results | 33 |
| | |
| | |
| List of Tables | |
| Table 5.11.1: Confusion Matrix for Positive Reviews | 23 |
| Table 5.11.2: Confusion Matrix for Negative Reviews | 23 |
| Table 5.11.3: Confusion Matrix for Neutral Reviews | 23 |
| Table 7.2.1: Lexicon Performance | 28 |
| Table 7.2.2: Tweaked for Mobile Phone Domain | 29 |
| Table 7.2.3: Lexicon VS Tweaked Lexicon | 29 |
| Table 7.3.1: Comparison with TheySay API | 31 |
| Table 7.3.2: Comparison with Google Cloud Natural Language | 33 |
| Table 7.3.3: Comparison with Paralleldots API | 34 |