

TABLE OF CONTENT

COVER PAGE

ORIGINALITY STATEMENT OF THE THESIS

THESIS SUPERVISOR'S APPROVAL

THESIS EXAMINATION COMMITTEE

ABSTRACT.....	v
FOREWORD	vii
TABLE OF CONTENT	viii
LIST OF FIGURES	x
LIST OF TABLES	xi
LIST OF ATTACHMENTS	xii
1. CHAPTER I	13
1.1 Background	13
1.2 Problem Identification	18
1.3 Problem Limitation	19
1.4 Problem Definition	20
1.5 Research Purposes	21
1.6 Outline of the Thesis	21
2. CHAPTER II.....	24
2.1 Named Entity Recognition	24
2.2 Image Pre-processing	27
2.3 Optical Character Recognition	34
2.4 Rule-Based Text Matching	44
2.5 Evaluation Method	446
3. CHAPTER III.....	46
3.1 Overview	47
3.2 Text Data Extraction from Letter of Credit	48
3.3 Data Extraction from Invoice	52
3.4 Rule-based Matching	58
3. CHAPTER IV	61
4.1 Paper Summary 1: OPTICAL CHARACTER RECOGNITION (OCR) FOR TEXT RECOGNITION AND ITS POST-PROCESSING METHOD: A LITERATURE REVIEW	61

4.2	Paper Summary 2: AN AUTOMATION OF INVOICE EXAMINATION UNDER LETTER OF CREDIT BASED ON UCP 600 USING OCR AND RULE-BASED TEXT MATCHING	62
4.3	Research Connectivity	62
3.	CHAPTER V	65
5.1	Summary	65
5.2	Future Research	65
	BIOGRAPHY	Error! Bookmark not defined.
	REFERENCES	67
	ATTACHMENT	72



LIST OF FIGURES

Figure 2.1. Illustration of Image filtering	32
Figure 2.2. Illustration of Padding	32
Figure 2.3. Original Image (Left) and Sharpened Image (Right).....	33
Figure 2.4. Illustration of blurring on noisy image with their OCR result.....	34
Figure 2.5. Architecture of Tesseract OCR.....	37
Figure 2.6. Sample Image	38
Figure 2.7. Output from Tesseract v 3.0 (a), 4.0 (b) and 5.0 (c)	38
Figure 2.8. Neural Network Architecture	41
Figure 2.9. RNN Node Architecture	42
Figure 2.10. LSTM Node Architecture	44
Figure 3.1. Block Diagram of the whole process.....	47
Figure 3.2. L/C Example.....	49
Figure 3.3. Variation of Name and Address	49
Figure 3.4. Coding example to extract Beneficiary/Applicant Name	50
Figure 3.5. Coding to extract Applicant Country.....	51
Figure 3.6. Original Image.....	54
Figure 3.7. De-skewed Image	54
Figure 3.8. Cleaned border image.....	54
Figure 3.9. Image after box lines deleted.....	55
Figure 3.10. Blurred Image.....	55
Figure 3.11. OCR result of image without blurring (left) and with blurring (right)	55
Figure 3.12. (a) OCR output in string type, (b) Invoice illustration	56
Figure 3.13. Original image (left) and signature location extracted (right)	57
Figure 3.14. Beneficiary Name checking output	59
Figure 3.15. Result of City/Country search on Invoice	60
Figure 3.16. Currency Checking result	60

LIST OF TABLES

Table 4.1. Experiment Results 62



LIST OF ATTACHMENTS

Paper 1 (OPTICAL CHARACTER RECOGNITION (OCR) FOR TEXT RECOGNITION AND ITS POST-PROCESSING METHOD: A LITERATURE REVIEW)	A-1
Paper 2 (AN AUTOMATION OF INVOICE EXAMINATION UNDER LETTER OF CREDIT BASED ON UCP 600 USING OCR AND RULE-BASED TEXT MATCHING)	A-2

