

# TABLE OF CONTENTS

---

---

<b>Certificate .....</b>	<b>iii</b>
<b>Declaration by the Candidate .....</b>	<b>v</b>
<b>Copyright Transfer Certificate.....</b>	<b>vii</b>
<b>Acknowledgements .....</b>	<b>ix</b>
<b>List of Figures.....</b>	<b>xvii</b>
<b>List of Tables .....</b>	<b>xxi</b>
<b>List of Abbreviations .....</b>	<b>xxiii</b>
<b>List of Symbols .....</b>	<b>xxv</b>
<b>Preface.....</b>	<b>xxvii</b>
<b>Chapter 1: Introduction .....</b>	<b>1</b>
1.1 Background.....	1
1.2 Motivation.....	5
1.3 Problem Statement and Thesis Objectives .....	6
1.4 Outline of the Thesis .....	8
<b>Chapter 2: Theoretical Background and Literature Review.....</b>	<b>12</b>
2.1 Features Extraction for CBIR system .....	13
2.1.1 Colour Features.....	13
2.1.2 Texture Feature and Key Point's Detector .....	16
2.1.3 Shape Features .....	19
2.2 Similarity Measures .....	20
2.3 Literature Review of CBIR System for General Images .....	21
2.4 Literature Review for Mammogram Classification and Retrieval.....	35
2.5 Benchmark Databases.....	43
2.6 Performance Metrics.....	45
2.7 Conclusions.....	48
<b>Chapter 3: Design and Implementation of Effective CBIR System Using Fusion of Features and Machine Learning Approaches .....</b>	<b>49</b>
3.1 Introduction.....	50
3.2 Improved CBIR System Using Fusion of Fast Features with Varying Weighted Similarity Measure and Random Forests.....	54

3.2.1 Methods and Models .....	54
3.2.1.1 Feature Extraction .....	55
3.2.1.1.1 Chromaticity Moments.....	55
3.2.1.1.2 Colour Percentiles .....	57
3.2.1.1.3 Local Binary Patterns .....	58
3.2.1.2 Image Retrieval Using Fusion of Features and Weighted Similarity Measure .....	60
3.2.1.2 Image Retrieval Using Random Forests.....	62
3.2.2 Results Analysis and Discussions .....	65
3.2.2.1 Result Analysis for Fusion of Features and Weighted Similarity Measure .....	66
3.2.2.2 Result Analysis of Image Retrieval for Random Forests Framework ....	73
3.3 CBIR System Based on Supervised Learning with Combination of Orthogonal-LBP and Statistical Moments .....	79
3.3.1 Methods and Models .....	79
3.3.1.1 Feature Extraction .....	80
3.3.1.1.1 Statistical Colour Moments .....	80
3.3.1.1.2 Orthogonal Combination of Local Binary Patterns (OCLBP) .....	81
3.3.1.2 Proposed Models .....	82
3.3.2 Result Analysis and Discussions.....	90
3.3.2.1 Performance on Wang (COREL) Database .....	91
3.3.2.2 Performance on Oliva and Torralba (OT) Database .....	98
3.4 Conclusions .....	103
<b>Chapter 4: Effective Mammogram Classification-cum-Retrieval Based on Center Symmetric-LBP Features in Wavelet Domain Using Random Forests .....</b>	<b>106</b>
4.1 Introduction .....	107
4.2 Methods and Models .....	109
4.2.1 Proposed Models for Mammogram Classification.....	109
4.2.1.1 Image Cropping & Enhancement.....	110
4.2.1.2 Wavelet Transform.....	111
4.2.1.3 Feature Extraction .....	114
4.2.1.4 Feature Selection .....	120
4.2.1.5 Mammogram Classification Using Random Forests .....	121
4.2.2 Mammogram Classification-cum-Retrieval.....	121

4.3 Result Analysis and Discussion .....	123
4.3.1 Result Analysis for Mammogram Classification.....	123
4.3.2 Result Analysis for Mammogram Classification-cum-Retrieval.....	129
4.4 Conclusions.....	134
<b>Chapter 5: Automated and Effective Content-Based Mammogram Retrieval Using Wavelet Based CS-LBP Feature and Self-Organizing Map .....</b>	<b>135</b>
5.1 Introduction.....	135
5.2 Methods and Models.....	138
5.2.1 Pre-processing.....	140
5.2.1.1 Label and Artefacts Suppression .....	140
5.2.2.2 Pectoral Muscle Removal & Filtering of Mammograms.....	142
5.2.2.3 Mammogram Segmentation Using New Termintaion Criteria for Region-Growing .....	143
5.2.2 Feature Extraction.....	147
5.2.3 SOM Clustering and Mammogram Retrieval.....	150
5.3 Result Analysis and Discussion .....	152
5.3.1 Searching Time Analysis .....	152
5.3.2 Retrieval Analysis.....	155
5.4. Conclusions.....	162
<b>Chapter 6: Conclusion and Future Work.....</b>	<b>164</b>
6.1 Conclusions.....	164
6.2 Future Work .....	167
<b>References.....</b>	<b>169</b>
<b>List of Papers Published /Presented /Communicated .....</b>	<b>183</b>