Contents

Abstract viii

page

Abstract *i*
Acknowledgements *iii*
Contents *v*
List of Figures *vii*
List of Tables *viii*
List of Symbols *xiii*
List of Abbreviations *xv*

Chapter 1: Introduction 1
1.1 Perceptual Hash Function 2
1.1.1 General framework for Perceptual Hash Function *3*
1.1.2 Characteristics of Perceptual Hash Function *4*
1.1.3 Classification of Image Hashing system *5*
1.1.4 Perceptual Hashing Application *6*
1.2 Image Encryption 7
1.2.1 Characteristics of cryptographic system *8*
1.2.2 Types of Image Encryption Systems *8*
1.3 Watermarking System 12
1.3.1 General Framework of Watermarking System *13*
1.3.2 Characteristic of Watermarking System *14*
1.3.3 Watermarking Application *15*
1.3.4 Attacks on Watermarking System: *16*
1.3.5 Classification of Watermarking Techniques *18*
1.4 Literature Survey 19
1.5 Thesis Organization 26

Chapter 2: Mathematical Preliminaries 27
2.1 Discrete Wavelet Transform (DWT) 27
2.2 Integer Discrete Cosine Transform (IDCT) 28
2.3 Matrix Decomposition Method 31
2.3.1 Singular Value Decomposition *31*
2.3.2 QR Decomposition *31*
2.4 Chaotic Map 32
2.4.1 Piece-wise Non-linear Chaotic Map *32*
2.4.2 Arnold Transformation *32*
2.5 Log-polar Mapping 33
2.6 Decimal Sequence Generation 34
2.7 KAZE Features 35

Chapter 3: A Chaos Based Robust and Secure Image Hashing Framework 37
3.1 Proposed Chaos-based Hash Generation Process 37
3.1.1 Image Pre-processing: Image Normalization *37*
3.1.2 Hash Sequence Construction *38*
3.2 Experimental Results and Discussion 39
3.2.1 Robustness Analysis *40*
3.2.2 Discriminative Capability *42*
3.2.3 Key Dependence *43*
3.3 Summary 44

Chapter 4: A New Robust Reference Image Hashing System 45
4.1 Local Image Contrast 45
4.2 Proposed Hashing system 46
4.2.1 Reference Image Generation *46*
4.2.2 Perceptual Feature Extraction *46*
4.2.3 Hash Sequence Construction *47*
4.3 Experimental Results and Discussion 48

4.4 Robustness Test 49
4.4.1 Discriminative capability 52
4.4.2 Unpredictability of image hash 53
4.5 Sensitivity Analysis 54
4.5.1 Computation Complexity 54
4.6 Performance Comparison 56
4.7 Summary 58

Chapter 5: A Novel Biometric Inspired Robust Security Framework For Medical Images 59
5.1 Parameterized all phase biorthogonal sine transform 60
5.2 Proposed biometric inspired encryption system 63
5.2.1 Key Generation Inspired by Biometrics 63
5.2.2 Proposed Encryption Technique 64
5.2.3 Decryption Process 65
5.3 Experimental Results and Discussion 65
5.3.1 Perceptual Security Analysis 65
5.3.2 Key Space Analysis 66
5.3.3 Key Sensitivity Analysis 67
5.3.4 Edge Similarity Analysis 68
5.3.5 Edge Distortion Analysis 69
5.3.6 Statistical Analysis 70
5.4 Efficiency of Decryption Process 70
5.5 Comparative Analysis 73
5.6 Summary 76

Chapter 6: A Simplified Watermarking Algorithm Based on Lifting Wavelet Transform 77
6.1 Proposed Framework 77
6.1.1 Watermark Embedding Process 77
6.1.2 Watermark Extraction Process 78
6.2 Experimental Results and Discussion 79
6.2.1 Imperceptibility of the Proposed Scheme 80
6.2.2 Attack Analysis 81
6.2.3 Comparative Analysis 85
6.3 Security Analysis 88
6.3.1 Key Space Analysis 88
6.3.2 Sensitivity Analysis 89
6.4 Summary 91

Chapter 7: A new robust watermarking system in Integer DCT domain 93
7.1 Dynamic Stochastic Resonance 93
7.1.1 Mathematical Formulation for DSR 94
7.1.2 Selection of Parameters 95
7.2 Proposed Watermarking System 97
7.2.1 Key Generation: Rectification of False-positive Detection 97
7.2.2 Embedding Process 98
7.2.3 Extraction Process 99
7.3 Experimental Results and Discussion 101
7.3.1 Experimental Set-up 101
7.3.2 Imperceptibility of the Proposed Technique 101
7.3.3 Robustness of the Proposed Technique: Attack Analysis 103
7.3.4 Efficiency of Key Generation Process 109
7.3.5 Embedding Capacity of Proposed Scheme 111
7.3.6 Computation Complexity of Proposed Scheme 111
7.3.7 Comparative Analysis 112
7.3.8 Suitability of Watermark 112
7.4 Summary 115

Chapter 8: Conclusions and Future Work 117
8.1 Conclusion 117
8.2 Future Work 118

References 123