CONTENTS

Title	Content	Page
	Declaration by Research Scholar—Originality of Research Work Certificate of Supervisor Thesis Approval Form Declaration by Research Scholar – Submission of Thesis Acknowledgement Contents List of Figures List of Tables Abstract	No. I III III IV V VI VIII IX X
Chapter: 1		1
1.1		1
1.2	e i	2 2 3 3
1.3 1.4		3
1.5		3
1.6		4
1.7	Face Detection Algorithm	5
	1.7.1 Evolution of Face Detection Algorithms	5
	1.7.2 Key Approaches to Face Detection	6
	1.7.3 Mathematical Explanation of Face Detection Algorithms 1.7.4 Challenges in Face Detection	8 11
	1.7.4 Chantenges in Pace Detection 1.7.5 Applications of Face Detection	12
1.8	Literature Review	12
1.9	Applications and Future Directions	14
1.10	1	17
1.11		18
Chapter: 2	Spatial Domain Watermarking	19
2.1		19
2.2	Invisible Watermarking	19
	2.2.1 Correlation-Based Method	19
2.3	$\boldsymbol{\varepsilon}$	20
2.4		21
Chantam 3		23 24
Chapter: 3	Transform Domain Video Watermarking	
3.1	Discrete Cosine Transform 3.1.1 Embedding Process	24 25
	3.1.2 Extraction Process	27
	3.1.3 Results	27
	3.1.4 Observations and Results	29
	3.1.5 Observations	29

3.2	 3.1.6 Comparison - Correlation based watermarking Method DWT in Image Processing 3.2.1 Introduction 3.2.2 Applications of DWT 	29 29 29 34
	3.2.3 Advantages of DWT	34
	3.2.4 Embedding Process 3.2.5 Extraction Process	35 36
	3.2.6 Results	37
Chapter: 4	3.2.7 Observations3.2.8 Comparison - Correlation Method & DCT MethodSingular Value Decomposition-SVD based Watermarking	38 39 40
4.1	Introduction	40
	4.1.1 Properties of SVD	40
	4.1.2 Practical Example of SVD	41
	Advantages of SVD in Digital Watermarking Applications of SVD in Watermarking Advantages of SVD-Based Watermarking Limitations of SVD-Based Watermarking Embedding Process Extraction Process SVD-Based Watermarking with Binary Messages 4.8.1 Embedding Process	41 42 42 43 43 43 44 44
	4.8.2 Extraction Process	45
4.9 4.10	Results and Observations Comparative Observations	47 47
Chapter: 5	Hybrid Method for Watermarking	48
5.1 5.2 5.3 5.4 5.5	Embedding Algorithm and Results Extracting Algorithm and Results Results Observations Comparison with other methods such as Correlation, DCT,	48 50 51 55 55
	DWT, and SVD	
Chapter: 6	Simulation Results	56
Appendix A Appendix B	Bibliography Publication Plagiarism Report	79 84 99

List of Figures

Figure 2.1	Generation of Pseudo Random Sequence	20
Figure 2.2	Example of Correlation based watermarking method with $K = 100$	21
Figure 2.3	Recovered Messages	22
Figure 2.4	Various values of K (a) Frame 1-Watermarked (b) Recovered Messages	23
Figure 3.1	(a) DCT based classification of Frequency (b) Values of Quantization given in the JPEG compression Scheme	26
Figure 3.2	DCT based Watermarking with K=100 and BS=8	28
Figure 3.3	Recovered Messages	28
Figure 3.4	With Various values of K (a) Frame 1 - Watermarked (b) Messages at the	29
	receiver end	
Figure 3.5	Filtering or decomposition process at its most basic level	32
Figure 3.6	Analysis with down sampling	32
Figure 3.7	Multiple-level decomposition or analysis	33
Figure 3.8	Basic decomposition steps for images	34
Figure 3.9	DWT based watermarking method with K=100 and BS=8	37
Figure 3.10	Recovered Messages	38
Figure 3.11	Results with various gain factors	38
Figure 4.1	SVD with K=100	46
Figure 4.2	Recovered Messages	46
Figure 4.3	Various values of K (a) Frame 1-Watermarked (b) Messages at receiver end	47
Figure 5.1	Hybrid method with K=100	50
Figure 5.2	Recovered Messages	51
Figure 5.3	Results with Various Values of K	52
Figure 5.4	Results under Various Attacks with different Intensity values	56
Figure 6.1	: Comparison of all methods with various gain factors	59
Figure 6.2	Comparison of all methods in average filtering attack	60
Figure 6.3	Comparison of all methods in Gaussian low pass filtering attack	62
Figure 6.4	Comparison of all methods in median filtering attack	63
Figure 6.5	Comparison of all methods in compression attack	65
Figure 6.6	Comparison of all methods in color reduction attack	66
Figure 6.7	Comparison of all methods in histogram equalization attack	68
Figure 6.8	Comparison of all methods in linear motion of camera attack	69
Figure 6.9	Comparison of all methods in rotation attack	71
Figure 6.10	Comparison of all methods in Gaussian noise attack	72
Figure 6.11	Comparison of all methods in salt & pepper noise attack	74
Figure 6.12	Comparison of all methods in speckle noise attack	75
Figure 6.13	Comparison of all methods in cropping attack	77
Figure 6.14	Comparison of all methods in high pass filtering attack	78
Figure 6.15	Comparison of all methods in Elapsed Time	79

List of Tables

Table 2.1	Results with K=100 & BS=8	23
Table 2.2	Results with various values of K	24
Table 3.1	DCT based watermarking with K=100 & BS=8	29
Table 3.2	DCT based watermarking with various values of K	29
Table 3.3	DWT with K=100 & BS=8	39
Table 3.4	DWT with Various values of K	39
Table 4.1	Example of SVD	42
Table 4.2	SVD with Various Frames with K=100	47
Table 4.3	SVD with various values of K.	48
Table 5.1	5 Frames with K=100	52
Table 5.2	Results with Various values of K	52