1. RESEARCH INTRODUCTION

1.1. STEGANOGRAPHY AND STEGANALYSIS

1.2. PROBLEM STATEMENT

1.3. RESEARCH MOTIVATION

1.4. RESEARCH OBJECTIVES

1.5. EXISTING RESEARCH AND PROPOSED STEGANALYZER

1.6. FRAMEWORK OF UNIVERSAL STEGANALYZER IMPLEMENTED IN THIS RESEARCH

1.7. REVIEW OF EXISTING RESEARCH

1.7.1. JPEG Steganographic Methods

1.7.1.1. JSteg

1.7.1.2. Outguess

1.7.1.3. JP Hide and Seek

1.7.1.4. StegHide

1.7.1.5. Model Based Steganography (MBS)

1.7.1.6. Modified Matrix Encoding (MME)

1.7.1.7. F5 Algorithm

1.7.2. Spatial Steganographic Methods

1.7.2.1. LSB Steganography

1.7.2.2. Pixel Value Differencing

1.7.2.3. Palette Based Steganography

1.7.3. Image Steganalysis Methods

1.7.3.1. Binary similarity measures (BSM)
1.7.3.2. Image quality metrics 13
1.7.3.3. Markov features 13
1.7.3.4. Steganalysis with Transform features 13
1.7.3.5. Co-occurrence matrix 14
1.7.3.6. Histogram features 14
1.7.3.7. High dimensional features 14
1.7.4. Feature Reduction in Image steganalysis 14
1.7.5. Bio-inspired Optimization 15
1.7.6. Classifiers in Image Steganalysis 17
1.7.6.1. Fusion classifiers from Data Fusion schemes 18
1.8. OVERVIEW OF THE THESIS 18

2. JPEG STEGANALYSIS WITH UNSUPERVISED OPTIMIZATION 20
2.1. IMAGE DATABASE 20
2.2. CREATION OF STEGO IMAGES IN JPEG DOMAIN 20
2.3. FEATURE EXTRACTION 23
2.3.1. Calibrated Markov and Histogram Features 23
2.3.2. Co-occurrence Features of Difference in DCT Coefficients 25
2.4. UNSUPERVISED OPTIMIZATION 27
2.5. CLASSIFICATION 29
2.5.1. Single Classifiers 30
2.5.2. Fusion Classifiers 33
2.6. RESULTS AND CLASSIFICATION ACCURACIES 37
2.6.1. Results and Classification Accuracies of CMDCT features 38
2.6.2. Results and Classification Accuracies of COD features 39
2.6.2.1. Euclidean distance based optimization 39
2.6.2.2. Mahalanobis distance based optimization 42
2.7. CHAPTER SUMMARY 43
3. JPEG STEGANALYSIS WITH ANTLION OPTIMIZER 45

3.1. FEATURE EXTRACTION 45

3.1.1. Co-occurrence of selected DCT Coefficients 45

3.1.2. All Possible Co-occurrences of DCT Coefficients 46

3.2. OPTIMIZATION WITH ANT LION OPTIMIZER 49

3.3. RESULTS AND CLASSIFIER ACCURACIES 55

3.3.1. Results and Classification of DCT-300p Features 55

3.3.2. Results and Classification of DCT23230 Features 56

3.4. COMPUTATION TIME ANALYSIS 67

3.5. CHAPTER SUMMARY 68

4. SPATIAL DOMAIN STEGANALYSIS 69

4.1. CREATION OF STEGO IMAGES IN SPATIAL DOMAIN 69

4.2. FEATURE EXTRACTION 71

4.2.1. Co-occurrences of Noise residuals 71

4.3. OPTIMIZATION 75

4.3.1. Unsupervised Optimization 75

4.3.2. Antlion based Optimization 76

4.4. CLASSIFICATION ACCURACIES 77

4.4.1. Classification of S-34671 features by Unsupervised optimization 77

4.4.2. Classification of S-34671 features by ALO optimizer 79

4.5. COMPUTATION TIME ANALYSIS 81

4.6. CHAPTER SUMMARY 82

5. PERFORMANCE EVALUATION OF THE UNIVERSAL STEGANALYSER 83

5.1. UNIVERSAL STEGANALYSIS METHODS IMPLEMENTED 83

5.1.1. JPEG methods 83
5.1.1.1. JPEG US 548
5.1.1.2. JPEG US 8726
5.1.1.3. JPEG ALO 48600
5.1.1.4. JPEG ALO 23230

5.1.2. Spatial methods
5.1.2.1. SPT US 34671
5.1.2.2. SPT ALO 34671

5.2. COMPARISON OF ALL US AND ALO METHODS IN THIS RESEARCH

5.3. COMPARISON WITH EXISTING STATE OF ART

5.4. COMPARISON WITH RECENT METAHEURISTIC ALGORITHMS

5.5. COMPARISON OF COMPUTATION TIME

5.6. SIGNIFICANCE OF THIS RESEARCH

6. CONCLUSION AND FUTURE WORK

6.1. CONCLUSION

6.2. RESEARCH CONTRIBUTION

6.3. FUTURE WORK

REFERENCES

APPENDICES

LIST OF PUBLICATIONS

VITAE