Table of Content

CERTIFICATE ..... **iii**

DECLARATION BY THE CANDIDATE ..... **v**

COPYRIGHT TRANSFER CERTIFICATE ..... **vii**

Acknowledgments ..... **ix**

Table of Content ..... **xi**

List of Figures ..... **xv**

List of Tables ..... **xvii**

List of Abbreviations ..... **xviii**

List of Symbols ..... **xx**

Preface ..... **xxii**

CHAPTER 1: INTRODUCTION **1**

1.1 Introduction 1

1.2 Background 1

1.3 Motivation 4

1.4 Problem Statement 5

1.5 Contributions and Objectives of the Thesis 5

1.6 Organization of the Thesis 5

CHAPTER 2: THEORETICAL BACKGROUND AND LITERATURE REVIEW 7

2.1 Theoretical Background 8

2.1.1 Features 8

2.1.2 Mapping of Relevant Features with Abnormalities 15

2.1.3 Performance Metrics 16

2.2 Literature Review 20

2.2.1 Video Summarization and Redundant Image Elimination 20

2.2.2 Image Enhancement and Interpretation 23

2.2.3 Segmentation and Region Identification 25

2.2.4 Computer-Aided Abnormality Detection 27

2.2.5 Image and Video Compression 37

2.3 Discussion 39

2.4 Conclusion 39

CHAPTER-3: DESIGN AND IMPLEMENTATION OF FRAMEWORK FOR THE RESTORATION AND ENHANCEMENT OF CAPSULE ENDOSCOPY IMAGES 41

3.1 Introduction 41

3.2 Methods and Model 44

3.2.1 Total Variation (TV) Model 46

3.2.2 Fourth Order Partial Differential Equations (PDE) 47

3.2.3 High Boost to Retain the Lost Components 48

3.2.4 Control Parameters to Govern the Blending of the Model 48

3.3 Results and Discussion....49
3.3.1 Dataset and Experimental Setup....49
3.3.2 Performance Criteria....49
3.3.3 Results....51
3.4 Conclusion....55
CHAPTER-4 AN EFFECTIVE APPROACH FOR SEGMENTATION OF MULTIPLE ABNORMALITIES FROM CAPSULE ENDOSCOPY IMAGES....57
4.1 Introduction....57
4.2 Methods and Models....58
4.2.1 Pre-Processing using Contrast Stretching....58
4.2.2 Segmentation using Improved GMM....59
4.2.3 Results and Analysis of Proposed Segmentation Method....63
4.3 Evaluation of Proposed Segmentation Approach in Classification of Abnormalities....67
4.3.1 Feature Extraction, Selection, and Fusion....67
4.3.2 Results....69
4.4 Conclusions....70
CHAPTER-5 HIGH VARIANCE AND LOW CORRELATION BASED DATA REDUCTION AND FEATURE SELECTION APPROACH....73
5.1 Introduction....73
5.2 Methods and Models....75
5.2.1 Pre-processing of Input Image....76
5.2.2 HVLC Based Data Reduction and Feature Selection Approach....77

5.3 Classification using Different Classifiers 79

5.4 Results and Discussion..... 80

5.5 Conclusion 83

CHAPTER-6 AUTOMATIC ABNORMALITY DETECTION IN CAPSULE ENDOSCOPY USING CONVENTIONAL MACHINE LEARNING AND DEEP LEARNING 85

6.1 Introduction..... 85

6.2 Materials and Methods..... 87

6.2.1 Conventional Machine Learning..... 90

6.2.2 Deep Learning..... 91

6.2.3 Dataset..... 93

6.3 Results and Discussion..... 93

6.4 Conclusion 96

CHAPTER-7 CONCLUSION AND FUTURE WORK 97

7.1 Conclusions..... 97

7.2 Future Work 99

REFERENCES..... 101

LIST OF PAPERS PUBLISHED /PRESENTED /COMMUNICATED 113