

# TABLE OF CONTENTS

---

<b>TABLE OF CONTENTS</b> .....	X
<b>LIST OF ABBREVIATIONS</b> .....	XIII
<b>LIST OF SYMBOLS</b> .....	XV
<b>LIST OF KEYWORDS</b> .....	XVII
<b>LIST OF FIGURES</b> .....	XVIII
<b>LIST OF TABLES</b> .....	XXII
<b>PREFACE.....</b> .....	XXIII
<b>CHAPTER 1: INTRODUCTION</b> .....	1
1.1. BACKGROUND .....	1
1.2. MOTIVATION.....	3
1.3. OBJECTIVE OF THE THESIS .....	6
1.4. CONTRIBUTIONS .....	7
1.5. ORGANIZATION OF THE THESIS.....	9
<b>CHAPTER 2: THEORETICAL BACKGROUND</b> .....	10
2.1. INTRODUCTION .....	10
2.2. TRANSMISSION AND EMISSION TOMOGRAPHY.....	13
2.3. MEDICAL IMAGE RECONSTRUCTION OVERVIEW .....	15
2.3.1. ANALYTICAL METHODS .....	18
2.3.2. ITERATIVE METHODS .....	21
2.3.2.1. Algebraic methods.....	25
2.3.2.2. Statistical methods.....	28
2.4. LITERATURE SURVEY.....	35

2.5. NOISE MODEL .....	50
2.5.1. POISSON NOISE MODEL .....	50
2.5.2. GAUSSIAN NOISE MODEL .....	51
2.5.3. GAUSSIAN-POISSON NOISE MODEL .....	53
2.6. MAXIMUM A POSTERIORI (MAP) ESTIMATION .....	55
2.7. REGULARIZATION .....	56
2.8. PERFORMANCE MEASURES .....	59
2.9. DATASET DESCRIPTION .....	62

**CHAPTER3: STUDY OF REGULARIZED STATISTICAL APPROACHES FOR CT/PET/SPECT IMAGE RECONSTRUCTION..... 65**

3.1. INTRODUCTION .....	65
3.2. BACKGROUND .....	68
3.3. PROPOSED METHODS AND MODELS .....	74
3.3.1. ON THE CHOICE AND EVALUATION OF REGULARIZATION PRIORS IN PENALIZED MAXIMUM-LIKELIHOOD IMAGE RECONSTRUCTION FOR CT/PET.....	75
3.3.1.1 SIMULATION AND RESULTS ANALYSIS .....	78
3.3.2. A PDE BASED EXPECTATION MAXIMIZATION ALGORITHM ADAPTED TO POISSON NOISE FOR MEDICAL IMAGE RECONSTRUCTION.....	85
3.3.2.1 SIMULATION AND RESULTS ANALYSIS .....	86
3.4. DISCUSSIONS .....	93
3.5. CONCLUSION .....	93

**CHAPTER 4: A HYBRID-CASCADED ITERATIVE FRAMEWORK FOR PET AND SPECT IMAGE RECONSTRUCTION 95**

4.1 INTRODUCTION.....	96
4.2 BACKGROUND .....	99
4.3 PROPOSED MODELS.....	104
4.3.1 MLEM BASED HYBRID-CASCADED FRAMEWORK FOR PET AND SPECT IMAGE RECONSTRUCTION ALGORITHM .....	104
4.3.1.1 PROPOSED METHOD AND MODEL.....	105
4.3.1.2 RESULTS AND DISCUSSIONS .....	111

4.3.2 AN EFFICIENT AND MODIFIED MEDIAN ROOT PRIOR (MRP) BASED FRAMEWORK FOR PET/SPECT RECONSTRUCTION ALGORITHM .....	121
4.3.2.1 PROPOSED METHOD AND MODEL.....	121
4.3.2.2 RESULTS AND DISCUSSIONS .....	124
4.3.3 AN OSEM BASED HYBRID-CASCADED FRAMEWORK FOR PET/SPECT IMAGE RECONSTRUCTION.....	129
4.3.3.1 PROPOSED METHOD AND MODEL.....	130
4.3.3.2 RESULTS AND DISCUSSIONS .....	135
4.4 RESULTS AND DISCUSSIONS.....	146
4.5 OVERALL COMPARISONS OF PROPOSED MODEL 1, 2, AND MODEL 3 .....	144
4.6 CONCLUSION .....	147
<b>CHAPTER 5: A NON-LINEAR CONVEF-AD BASED APPROACH FOR LOW-DOSE SINOGRAM RESTORATION .....</b>	<b>149</b>
5.1 INTRODUCTION.....	150
5.2 BACKGROUND WORK .....	154
5.3 THE PROPOSED FRAMEWORK FOR SINOGRAM RESTORATION .....	165
5.4 RESULTS AND DISCUSSIONS.....	172
5.5 CONCLUSION .....	177
<b>CHAPTER 6: CONCLUSION AND SCOPE FOR FUTURE WORK.....</b>	<b>186</b>
6.1 MAIN CONCLUSIONS OF THE THESIS .....	178
6.2 SCOPE FOR FUTURE WORKS.....	181
REFERENCES .....	183
LIST OF PUBLICATIONS .....	193
COPIES OF PUBLICATIONS.....	195
PERSONAL PROFILE.....	163