# Table of Contents

List of Figures xiii
List of Tables xv

## Chapter 1

01 – 48

**Introduction to Soft Computing & Image Processing**

Abstract 2
1.1 Introduction 3
1.2 Application of Soft Computing 4
1.3 Neural Network Biological & Artificial Paradigm 6
   1.3.1 Biological Neuron 6
   1.3.2 Artificial Neuron 8
   1.3.3 Characteristics of ANN 9
1.4 Neural Network Models 10
   1.4.1 Feed Forward Neural Network Architecture 10
   1.4.2 Feed Back Neural Network Architecture 11
   1.4.3 Auto-associative Neural Network Architecture 11
   1.4.4 Hetero-associative Neural Network Architecture 12
   1.4.5 Neural Network as Associative Memories 12
   1.4.6 Recurrent Neural Networks 13
      1.4.6.1 Partially Recurrent Neural Networks 14
      1.4.6.2 Fully Recurrent Neural Networks 15
   1.4.7 Stochastic Artificial Neural Network 16
1.5 Learning (Training) and Recalling (Generalization) of ANN 16
   1.5.1 Supervised Learning Methods 18
   1.5.2 Unsupervised Learning methods 19
   1.5.3 Reinforcement Learning in Neural Network 20
   1.5.4 Evolutionary Learning in Neural Network 21
   1.5.5 Learning Algorithms of ANN 21
      1.5.5.1 Hebbian Learning 22

-(x)-
Chapter 2

Literature Review: Pattern Recognition and Its Techniques

Abstract 50

2.1 Introduction 51

2.2 Pattern Recognition 53

2.3 Statistical Methods of Pattern Recognition 56

2.4 Neural Network Based Methods 59

2.5 Pattern Recognition using GA and Neural network system 65

2.6 Conclusion 68

{(x)-}
Chapter 3

Research Methodology

Abstract 71
3.1 Introduction 72
3.2 Research Design 73
3.3 Feature Extraction Methods 74
  3.3.1 Edge Dilation (ED) Method 75
  3.3.2 Fast Fourier Transform (FFT) Method 76
  3.3.3 Self-Organizing Map (SOM) Method 76
3.4 Genetic Algorithm (GA) 78
  3.4.1 Mutation Operator 79
  3.4.2 Cross over Operator 79
    3.4.2.1 Local Cross Over 80
    3.4.2.2 Global Cross Over 80
3.5 Conclusion 81

Chapter 4

Experiments and Simulation

Abstract 84
4.1 Introduction 85
4.2 Feature Extraction 90
  4.2.1 Edge Dilation 91
  4.2.2 Fast Fourier Transform 93
  4.2.3 Self-Organizing Maps (SOM) 96
4.3 Hopfield Neural Network 99
  4.3.1 Hebbian Rule 99
  4.3.2 Pseudo Inverse Rule 103
  4.3.3 Hybrid Learning Rule 104
4.4 Simulation Design 106
4.4.1 Implementation of ED, FFT & SOM 107
4.4.2 Implementation of GA 116
   4.4.2.1 The Mutation Operator 118
   4.4.2.2 Crossover 119
   4.4.2.3 Fitness Function 121
4.5 Result and Discussion 122
4.6 Conclusion 140

Chapter 5 142 - 146

Conclusion

5.1 Conclusion 143

References 147 - 163
Appendix - A : An Introduction to MatLab 164 - 191
Appendix - B : Research Paper published 192 - 217
Appendix - C : Profile of Research Supervisor & Scholar 218 - 229