# Contents

Acknowledgment iv  
Abstract v  
Contents vii  
List of abbreviations xi  
List of Figures xiii  
List of Tables xvi  
List of Algorithms xviii  

## Chapter 1: Object Recognition For Robot Vision

1.1 Introduction 01  
1.2 Object recognition System 02  
1.3 Complexity of Object Recognition 03  
1.3.1 Procedure for PR System Engineering 05  
1.4 Different Pattern Recognition Approaches 06  
1.5 Robot Vision 07  
1.6 Pattern recognition for Computer Vision 12  
1.7 Why Probabilistic Models 13  

## Chapter 2: Literature Survey

2.1 Introduction 15  
2.2 Pattern recognition System 17  
2.2.1 Template Matching 18  
2.2.2 Statistical Approach 18  
2.2.3 Syntactic Approach 19  
2.2.4 Neural Network Approach 19  
2.3 Literature on Pattern recognition 20  
2.3.1 Statistical Pattern Recognition 21  
2.3.2 Classifiers 26  

vii
Chapter 3: Feature Extraction Techniques

3.1 Introduction

3.2 Processing of Objects for Feature Extraction
   3.2.1 Binarisation
   3.2.2 Spatial Filtering
   3.2.3 Boundary Detection
   3.2.4 Spatial Smoothing
   3.2.5 Noise Eliminations
   3.2.6 Normalisation
   3.2.7 Segmentation
### Chapter 3: Feature Extraction and Selection

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3.1</td>
<td>Objects of Known Geometric Structure</td>
<td>86</td>
</tr>
<tr>
<td>3.3.2</td>
<td>Objects of Fixed font Character Shape</td>
<td>86</td>
</tr>
<tr>
<td>3.3.3</td>
<td>Complex Object</td>
<td>87</td>
</tr>
</tbody>
</table>

### Chapter 4: Object Recognition and Results

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>Statistical Pattern Recognition Technique</td>
<td>114</td>
</tr>
<tr>
<td>4.2</td>
<td>Minimum Distance Classifier</td>
<td>116</td>
</tr>
<tr>
<td>4.3</td>
<td>Classification Using Neural Network</td>
<td>118</td>
</tr>
<tr>
<td>4.3.1</td>
<td>General Learning Rule</td>
<td>119</td>
</tr>
<tr>
<td>4.3.2</td>
<td>Backpropogation Training Algorithm</td>
<td>121</td>
</tr>
<tr>
<td>4.4</td>
<td>Recognition Results for Geometric Shape Objects</td>
<td>121</td>
</tr>
<tr>
<td>4.4.1</td>
<td>Recognition Procedure</td>
<td>123</td>
</tr>
<tr>
<td>4.4.2</td>
<td>Training</td>
<td>124</td>
</tr>
<tr>
<td>4.4.3</td>
<td>Recognition</td>
<td>125</td>
</tr>
<tr>
<td>4.5</td>
<td>Recognition Results for Geometric Shape Objects</td>
<td>125</td>
</tr>
<tr>
<td>4.5.1</td>
<td>Recognition Procedure</td>
<td>127</td>
</tr>
<tr>
<td>4.5.2</td>
<td>Image Boundary following algorithm</td>
<td>129</td>
</tr>
<tr>
<td>4.5.3</td>
<td>Cursor and Condition Code algorithm</td>
<td>130</td>
</tr>
<tr>
<td>4.5.3.1</td>
<td>Direction Code algorithm</td>
<td>130</td>
</tr>
<tr>
<td>4.5.3.2</td>
<td>Boundary Following algorithm</td>
<td>131</td>
</tr>
<tr>
<td>4.5.3.3</td>
<td>Boundary following for L Shape Object</td>
<td>132</td>
</tr>
</tbody>
</table>
Chapter 4: Fourier Descriptors from Boundary Data

4.5.4 Fourier Descriptors from Boundary Data 135

4.6 Character shaped Objects 140

4.7 Recognition Result for Complex Objects 142

4.7.1 Algorithm for Merging 144

4.7.2 Algorithm for Grouping 144

4.7.3 Classification Technique 145

4.7.4 Preprocessing 146

4.7.5 Edge Extraction and Separation 146

Chapter 5: Conclusions and Future Scope

5.1 Introduction 148

5.2 Conventional Recognition Algorithms 149

5.2.1 Recognition Based on Euclidean Distance 149

5.2.2 Recognition Using NN network 150

5.2.3 Recognition Using Fuzzy Image Processing 151

5.2.4 Recognition Using Neuro-Fuzzy Algorithm 154

5.2.5 Recognition using the HMM and NN 155

Bibliography 161

Publications Based on the research work 178

Vita 179