# List of Figures

1.1 Clustering Process .............................................................. 9
1.2 Pattern Recognition Process ................................................. 18

2.1 Taxonomy of Clustering ...................................................... 25
2.2 Taxonomy of Partitional Clustering ........................................ 28

3.1 Average Clustering metric for Data set 3.1......................... 77
3.2 Average Clustering metric for Data set 3.2......................... 78

4.1 Structure of Neural Network .............................................. 86
4.2 Average Performance of Neural Network Algorithms ........... 97

5.1 Rough Neural Network ....................................................... 106
5.2 Handwritten digits from German postcodes ......................... 113
5.3 Analysis of Predicted Accuracy for 16x16 digit data set ........ 125
5.4 Analysis of Predicted Accuracy for 4x4 digit data set .......... 126

6.1 Structure of processing the mammogram images ............ 130
6.2 Statistical Features .......................................................... 134
6.3 Statistical Features (cont.) ................................................. 135
6.4 Mammogram Image -1....................................................... 137
6.5 Performance Analysis of Mammogram Image -1............ 138
6.6 Segmented Images of Mammogram Image -1................. 139
6.7 Segmented Images of Mammogram Image -1 (cont.) .... 140
6.8 Mammogram Image -2....................................................... 141
6.9 Performance Analysis of Mammogram Image -2........... 142
6.10 Segmented Images of Mammogram Image -2
6.11 Segmented Images of Mammogram Image - 2(cont.)
6.12 Mammogram Image - 3
6.13 Performance Analysis of Mammogram Image - 3
6.14 Segmented Images of Mammogram Image - 3
6.15 Segmented Images of Mammogram Image - 3(cont.)

7.1 Colour Image - 1
7.2 Performance of Colour Image - 1
7.3 Segmented Images of Colour Image - 1
7.4 Segmented Images of Colour Image - 1 (cont.)
7.5 Colour Image -2
7.6 Performance of Colour Image - 2
7.7 Segmented Images of Colour Image - 2
7.8 Segmented Images of Colour Image - 2 (cont.)
7.9 Colour Image - 3
7.10 Performance of Colour Image -3
7.11 Segmented Images of Colour Image -3
7.12 Segmented Images of Colour Image - 3 (cont.)
List of Tables

3.1 Clustering metric for 30 patterns of Data set 3.1...... 72
3.2 Clustering metric for 60 patterns of Data set 3.1...... 73
3.3 Clustering metric for 90 patterns of Data set 3.1...... 73
3.4 Clustering metric for 120 patterns of Data set 3.1 ............ 74
3.5 Clustering metric for 30 patterns of Data set 3.2...... 74
3.6 Clustering metric for 60 patterns of Data set 3.2...... 75
3.7 Clustering metric for 90 patterns of Data set 3.2...... 75
3.8 Clustering metric for 120 patterns of Data set 3.2 ............ 76
3.9 Average Clustering Metric for Dataset 3.1 ............ 77
3.10 Average Clustering Metric for Data set 3.2 ............ 78

4.1 Description of the two species (classes) of iris data ............ 93
4.2 Description of the two classes of Fat oil data ............ 93
4.3 Percentage of Accuracy of Clustering .................... 96

5.1 Results of KRNN for 16x16 pixels .................. 115
5.2 Analysis of KRNN for 16x16 pixels .................. 115
5.3 Results of WKRNN for 16x16 pixels .................. 116
5.4 Analysis of WKRNN for 16x16 pixels .................. 116
5.5 Results of KRNNCSD for 16x16 pixels .................. 118
5.6 Analysis of KRNNCSD for 16x16 pixels .................. 118
5.7 Results of KRNN for 4x4 pixels .................. 120
5.8 Analysis of KRNN for 4x4 pixels .................. 120
5.9 Results of WKRNN for 4x4 pixels .................. 122
5.10 Analysis of WKRNN for 4x4 pixels .................. 122
# List of Algorithms

1. Forgy’s Algorithm ................................................................. 63
2. K-means Clustering Algorithm ............................................ 64
3. Weighted K-means Clustering Algorithm ........................... 67
4. K-CSD Clustering Algorithm .............................................. 68
5. SD-means Clustering ............................................................ 69
6. Kohonen’s Neural Network Clustering ................................. 86
7. Weighted Kohonen’s Neural Network ................................. 89
8. Kohonen’s Neural Network Clustering based on CSD ................................. 91
9. Kohonen’s Rough Neural Network ...................................... 107
10. Weighted Kohonen’s Rough Neural Network ...................... 109
11. Kohonen’s Rough Neural Network Clustering based on CSD ................................................................. 110
12. Customer Segmentation Model ............................................ 180