

# **Particle Swarm Optimization Methods for Pattern Recognition and Image Processing**

by

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## Abstract

Pattern recognition has as its objective to classify objects into different categories and classes. It is a fundamental component of artificial intelligence and computer vision. This thesis investigates the application of an efficient optimization method, known as Particle Swarm Optimization (PSO), to the field of pattern recognition and image processing. First a clustering method that is based on PSO is proposed. The application of the proposed clustering algorithm to the problem of unsupervised classification and segmentation of images is investigated. A new automatic image generation tool tailored specifically for the verification and comparison of various unsupervised image classification algorithms is then developed. A dynamic clustering algorithm which automatically determines the "optimum" number of clusters and simultaneously clusters the data set with minimal user interference is then developed. Finally, PSO-based approaches are proposed to tackle the color image quantization and spectral unmixing problems. In all the proposed approaches, the influence of PSO parameters on the performance of the proposed algorithms is evaluated.

**Key terms:** Clustering, Color Image Quantization, Dynamic Clustering, Image Processing, Image Segmentation, Optimization Methods, Particle Swarm Optimization, Pattern Recognition, Spectral Unmixing, Unsupervised Image Classification.

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“Obstacles are those frightening things you see when you take your eyes off your goal.”

*Henry Ford*

“You will recognize your own path when you come upon it, because you will suddenly have all the energy and imagination you will ever need.”

*Jerry Gillies*

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# Contents

## Chapter 1

Introduction.....	1
1.1 Motivation.....	1
1.2 Objectives .....	2
1.3 Methodology .....	3
1.4 Contributions.....	4
1.5 Thesis Outline .....	5

## Chapter 2

Optimization and Optimization Methods.....	7
2.1 Optimization .....	7
2.2 Traditional Optimization Algorithms .....	10
2.3 Stochastic Algorithms .....	11
2.4 Evolutionary Algorithms .....	12
2.5 Genetic Algorithms.....	15
2.5.1 Solution Representation .....	16
2.5.2 Fitness Function .....	16
2.5.3 Selection.....	17
2.5.4 Crossover .....	19
2.5.5 Mutation.....	20
2.5.6 The Premature Convergence Problem .....	22
2.6 Particle Swarm Optimization.....	23
2.6.1 The PSO Algorithm .....	23
2.6.2 The <i>lbest</i> Model .....	26
2.6.3 PSO Neighborhood topologies .....	28
2.6.4 The Binary PSO .....	29
2.6.5 PSO vs. GA.....	31
2.6.6 PSO and Constrained Optimization.....	32
2.6.7 Drawbacks of PSO.....	33
2.6.8 Improvements to PSO .....	34
2.7 Ant Systems .....	45
2.8 Conclusions.....	46

## Chapter 3

Problem Definiton.....	47
3.1 The Clustering Problem .....	47
3.1.1 Definitions.....	48
3.1.2 Similarity Measures .....	49
3.1.3 Clustering Techniques .....	51
3.1.4 Clustering Validation Techniques.....	64
3.1.5 Determining the Number of Clusters.....	69
3.1.6 Clustering using Self-Organizing Maps.....	75

3.1.7 Clustering using Stochastic Algorithms.....	78
3.1.8 Unsupervised Image Classification.....	82
3.2 Image Segmentation using Clustering.....	83
3.2.1 Thresholding Techniques.....	84
3.2.2 Edge-based Techniques.....	84
3.2.3 Region growing Techniques.....	85
3.2.4 Clustering Techniques.....	85
3.3 Color Image Quantization.....	89
3.3.1 Pre-clustering approaches.....	91
3.3.2 Post-clustering approaches.....	94
3.4 Spectral Unmixing.....	97
3.4.1 Linear Pixel Unmixing (or Linear Mixture Modeling).....	98
3.4.2 Selection of the End-Members.....	100
3.5 Conclusions.....	103
Chapter 4	
A PSO-based Clustering Algorithm with Application to Unsupervised Image	
Classification.....	104
4.1 PSO-Based Clustering Algorithm.....	104
4.1.1 Measure of Quality.....	104
4.1.2 PSO-Based Clustering Algorithm.....	105
4.1.3 A Fast Implementation.....	107
4.2 Experimental Results.....	108
4.2.1 <i>gbest</i> PSO versus K-Means.....	111
4.2.2 Improved Fitness Function.....	114
4.2.3 <i>gbest</i> PSO versus GCPSO.....	115
4.2.4 Influence of PSO Parameters.....	116
4.2.5 <i>gbest</i> PSO versus <i>state-of-the-art</i> clustering algorithms.....	122
4.2.6 Different Versions of PSO.....	126
4.2.7 A Non-parametric Fitness Function.....	128
4.2.8 Multispectral Imagery Data.....	129
4.2.9 PSO for Data Clustering.....	134
4.3 Conclusions.....	134
Chapter 5	
SIGT: Synthetic Image Generation Tool for Clustering Algorithms.....	136
5.1 Need for Benchmarks.....	136
5.2 SIGT: Synthetic Image Generation Tool.....	138
5.2.1 Synthetic Image Generator.....	139
5.2.2 Clustering Verification Unit.....	141
5.3 Experimental Results.....	144
5.4 Conclusions.....	146

Chapter 6	
Dynamic Clustering using Particle Swarm Optimization with Application to Unsupervised Image Classification.....	153
6.1 The Dynamic Clustering using PSO (DCPSO) Algorithm.....	153
6.1.1 Validity Index .....	158
6.1.2 Time Complexity .....	158
6.2 Experimental results.....	159
6.2.1 Synthetic images .....	162
6.2.2 Natural images .....	163
6.2.3 Comparison with GA and RS .....	166
6.2.4 Swarm Size .....	167
6.2.5 The Termination Criteria .....	168
6.2.6 $p_{ini}$ and $N_c$ .....	171
6.2.7 Comparison of <i>gbest-</i> , <i>lbest-</i> and <i>lbest-to-gbest</i> -PSO.....	173
6.2.8 Multispectral Imagery Data .....	174
6.3 Conclusions.....	175
Chapter 7	
Applications .....	177
7.1 A PSO-based Color Image Quantization Algorithm .....	177
7.1.1 The PSO-based Color Image Quantization (PSO-CIQ) Algorithm.....	178
7.1.2 Experimental Results .....	181
7.2 A PSO-based End-Member Selection Method for Spectral Unmixing of Multispectral Satellite Images.....	192
7.2.1 The PSO-based End-Member Selection (PSO-EMS) Algorithm .....	192
7.2.2 Experimental Results .....	195
7.3 Conclusions.....	207
Chapter 8	
Conclusion .....	208
8.1 Summary .....	208
8.2 Future Research .....	210
Bibliography .....	213
Appendix A	
Definition of Terms and Symbols.....	238
Appendix B	
Derived Publications .....	239

## List of Figures

Figure 2.1: Example of a global minimizer $x^*$ as well as a local minimizer $x_B^*$ .....	10
Figure 2.2: General pseudo-code for EAs.....	13
Figure 2.3: General pseudo-code for PSO .....	27
Figure 2.4. A diagrammatic representation of neighborhood topologies .....	29
Figure 3.1: General pseudo-code for SOM.....	76
Figure 3.2: Rectangular Lattice arrangement of neighborhoods .....	77
Figure 3.3: General simulated annealing based clustering algorithm.....	78
Figure 3.4: General pseudo-code for GA-based clustering algorithm.....	80
Figure 4.1: The PSO clustering algorithm .....	107
Figure 4.2: Data set consisting of synthetic, MRI and LANDSAT images.....	110
Figure 4.3: PSO Performance on Synthetic Image .....	112
Figure 4.4: The Segmented Synthetic Images .....	113
Figure 4.5: The Segmented MRI Images .....	113
Figure 4.6: The Segmented Lake Tahoe Images .....	113
Figure 4.7: Effect of swarm size on synthetic image.....	118
Figure 4.8: Effect of swarm size on MRI image.....	119
Figure 4.9: The Landsat MSS test images of Lake Tahoe .....	132
Figure 4.10: The Thematic Maps for Lake Tahoe Image Set .....	133
Figure 5.1: The synthetic image generator algorithm.....	140
Figure 5.2: The clustering verification algorithm .....	143
Figure 6.1: The DCPSO algorithm .....	156
Figure 6.2: Natural Images .....	160
Figure 6.3: 6-Clusters thematic map obtained using DCPSO.....	175
Figure 7.1: The PSO-CIQ algorithm.....	180
Figure 7.2: Quantization results for the Lenna image using PSO-CIQ .....	184
Figure 7.3: Quantization results for the peppers image using PSO-CIQ .....	185
Figure 7.4: Quantization results for the jet image using PSO-CIQ .....	186
Figure 7.5: Quantization results for the mandrill image using PSO-CIQ.....	187
Figure 7.6: The PSO-EMS algorithm .....	195
Figure 7.7: AVHRR Image of UK, Size: 847x1009 , 5 bands, 10-bits per pixel .....	199
Figure 7.8: Species concentration maps resulting from the application of ISO-UNMIX to unmix the Lake Tahoe test image set.....	200



Figure 7.9: Species concentration maps resulting from the application of PSO-EMS to unmix the Lake Tahoe test image set.....	201
Figure 7.10: Species concentration maps resulting from the application of ISO-UNMIX to unmix the UK test image set .....	202
Figure 7.11: Species concentration maps resulting from the application of PSO-EMS to unmix the UK test image set.....	203

## List of Tables

Table 4.1: Comparison between K-means and PSO .....	112
Table 4.2: 2-component versus 3-component fitness function .....	115
Table 4.3: PSO versus GCPSO .....	116
Table 4.4: Effect of inertia weight on the synthetic image .....	120
Table 4.5: Effect of inertia weight on the MRI image .....	120
Table 4.6: Effect of acceleration coefficients on the synthetic image .....	121
Table 4.7: Effect of acceleration coefficients on the MRI image .....	121
Table 4.8: Effect of sub-objective weight values on synthetic image .....	123
Table 4.9: Effect of sub-objective weight values on MRI image .....	124
Table 4.10: Comparison between K-means, FCM, KHM, H2, GA and PSO for fitness function defined in equation (4.6).....	125
Table 4.11: Comparison of different PSO versions .....	127
Table 4.12: Comparison between K-means, FCM, KHM, H2, GA and PSO for fitness function defined in equation (4.7).....	130
Table 4.13: Comparison between different non-parametric fitness function .....	131
Table 4.14: Comparison between K-means, <i>gbest</i> PSO and <i>lbest-to-gbest</i> PSO when applied to multispectral image set.....	131
Table 5.1: Synthetic image details and classification accuracy .....	148
Table 5.2: Synthetic images, Histograms and Thematic Maps.....	149
Table 5.2 ( <i>continued</i> ).....	150
Table 5.2 ( <i>continued</i> ).....	151
Table 5.2 ( <i>continued</i> ).....	152
Table 6.1: Additional synthetic images used along with the corresponding histograms .....	161
Table 6.2: Experiments on synthetic images .....	163
Table 6.3: Experiments on natural images.....	164
Table 6.4: Samples of segmented images resulting from DCPSO using $V$ .....	165
Table 6.4: Samples of segmented images resulting from DCPSO using $V$ ( <i>continued</i> ) .....	166
Table 6.5: Comparison of PSO-, GA- and RS- versions of the proposed approach..	167
Table 6.6: Comparison of PSO- and GA- versions of the proposed approach using a swarm size $s = 20$ .....	168

Table 6.7: Effect of termination criterion $TC_1$ on the DCPSO using a swarm size $s = 20$ and $TC_2 = 2$ .....	170
Table 6.8: Effect of termination criterion $TC_2$ on the DCPSO using a swarm size $s = 20$ and $TC_1 = 50$ .....	171
Table 6.9: Effect of $p_{ini}$ on the DCPSO using a swarm size $s = 20$ .....	172
Table 6.10: Effect of $N_c$ on the DCPSO using a swarm size $s = 20$ .....	173
Table 6.11: Comparison of <i>gbest-</i> , <i>lbest-</i> and <i>lbest-to-gbest-</i> PSO versions of DCPSO using $V (s = 20)$ .....	174
Table 7.1: Comparison between SOM, GCMA and PSO-CIQ .....	183
Table 7.2: Effect of $V_{max}$ on the performance of PSO-CIQ using Lenna image (16 colors) .....	188
Table 7.3: Effect of the swarm size on the performance of PSO-CIQ using Lenna image (16 colors) .....	189
Table 7.4: Effect of the number of PSO iterations on the performance of PSO-CIQ using Lenna image (16 colors).....	189
Table 7.5: Effect of $p_{kmeans}$ on the performance of PSO-CIQ using Lenna image (16 colors) .....	190
Table 7.6: Effect of the number of K-means iterations on the performance of PSO-CIQ using Lenna image (16 colors).....	191
Table 7.7: Comparison of <i>gbest-</i> , <i>lbest-</i> and <i>lbest-to-gbest-</i> PSO versions of PSO-CIQ using Lenna image (16 colors).....	191
Table 7.8: Comparison between ISO-UNMIX and PSO-EMS .....	198
Table 7.9: Effect of $V_{max}$ on the performance of PSO-EMS using Lake Tahoe image set .....	198
Table 7.10: Effect of the swarm size on the performance of PSO-EMS using Lake Tahoe image set .....	204
Table 7.11: Effect of the number of PSO iterations on the performance of PSO-EMS using Lake Tahoe image set.....	204
Table 7.12: Effect of $p_{kmeans}$ on the performance of PSO-EMS using Lake Tahoe image set .....	205
Table 7.13: Effect of the number of K-means iterations on the performance of PSO-EMS using Lake Tahoe image set .....	206
Table 7.14: Comparison of <i>gbest-</i> , <i>lbest-</i> and <i>lbest-to-gbest-</i> PSO versions of PSO-EMS using Lake Tahoe image set .....	206