FLINDERS UNIVERSITY
ADELAIDE AUSTRALIA

Improved Clustering and Soft Computing Algorithms

by

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January 1, 2004

A thesis presented to the
Flinders University of South Australia
in total fulfillment of the requirements for the degree of
Doctor of Philosophy

Adelaide, South Australia, 2004

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Abstract

Clustering algorithms have been widely applied and different approaches have been developed for different domains of application. This thesis investigates efficient and effective clustering and soft computing algorithms. In the investigation of k-medoids algorithms, several improved algorithms are proposed, such as the *Clustering Large Applications Based on Simulated Annealing* ($CLASA$) algorithm, the *Multi-Centroids with Multi-Runs Sampling Scheme* ($MCMRS$) and *Incremental Multi-Centroid, Multi-Run Sampling Scheme* ($IMCMRS$) algorithms. The *Partial Distance Search* (PDS), *Triangular Inequality Elimination* (TIE) and *Previous Medoid Index* are also presented to improve the clustering speed of k-medoids based algorithms. In addition, a new memory utilization scheme is derived and applied to efficient k-medoids algorithms.

In the investigation of centroid-based clustering algorithms, the tabu search with simulated annealing algorithm is proposed and applied to codebook design for vector quantization. Genetic clustering is also presented for mean-residual vector quantization. Several theorems based on Hadamard Transform for nearest neighbour search are presented and applied to efficient cluster (codeword) search for vector quantization. A label bisecting clustering algorithm is proposed and applied to create a robust watermarking technique.

Parallel particle swarm optimization based on three communication strategies are proposed to solve the problems in which the relationship between parameters are either independent, loosely correlated, strongly correlated or unknown. Seven communication strategies for *Ant Colony Systems* (ACS) are proposed to improve the ACS for the traveller salesman problem and the *Constrained Ant Colony Optimization* ($CACO$) based on the quadratic metric, sum of k nearest neighbour distance, constrained addition of pheromone and a shrinking range strategy is also proposed and demonstrated to be better than the *Ant Colony Optimization with Different Favor* ($ACODF$).

Certification

I certify that this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

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Signed Dated

Shu-Chuan Chu

Acknowledgements

I would like to first thank my supervisor, Professor John F. Roddick, for his constant guidance, patience and encouragement.

I would like to thank the principal of National Kaohsiung University of Applied Sciences, Professor Jen-Yi Lin, and the former principal, Professor Kuang-Chih Huang without whose high level of support and help, I cannot contentedly continue to finish this work in my academic career. Further, I would like to extend my thanks to other colleagues and friends who have provided help and advice during my PhD study. Without particular order, thanks to: Professor Wen-Kuei Cheng, Professor Bin-Yi Liao, Chin-Shiuh Shieh and Chin-Yen Chang.

Finally, I wish to dedicate this thesis to my husband, my mother and my parents in law who have guided me all through my life. I would like to thank them for all the love, suggestions and encouragements.

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January 2004
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