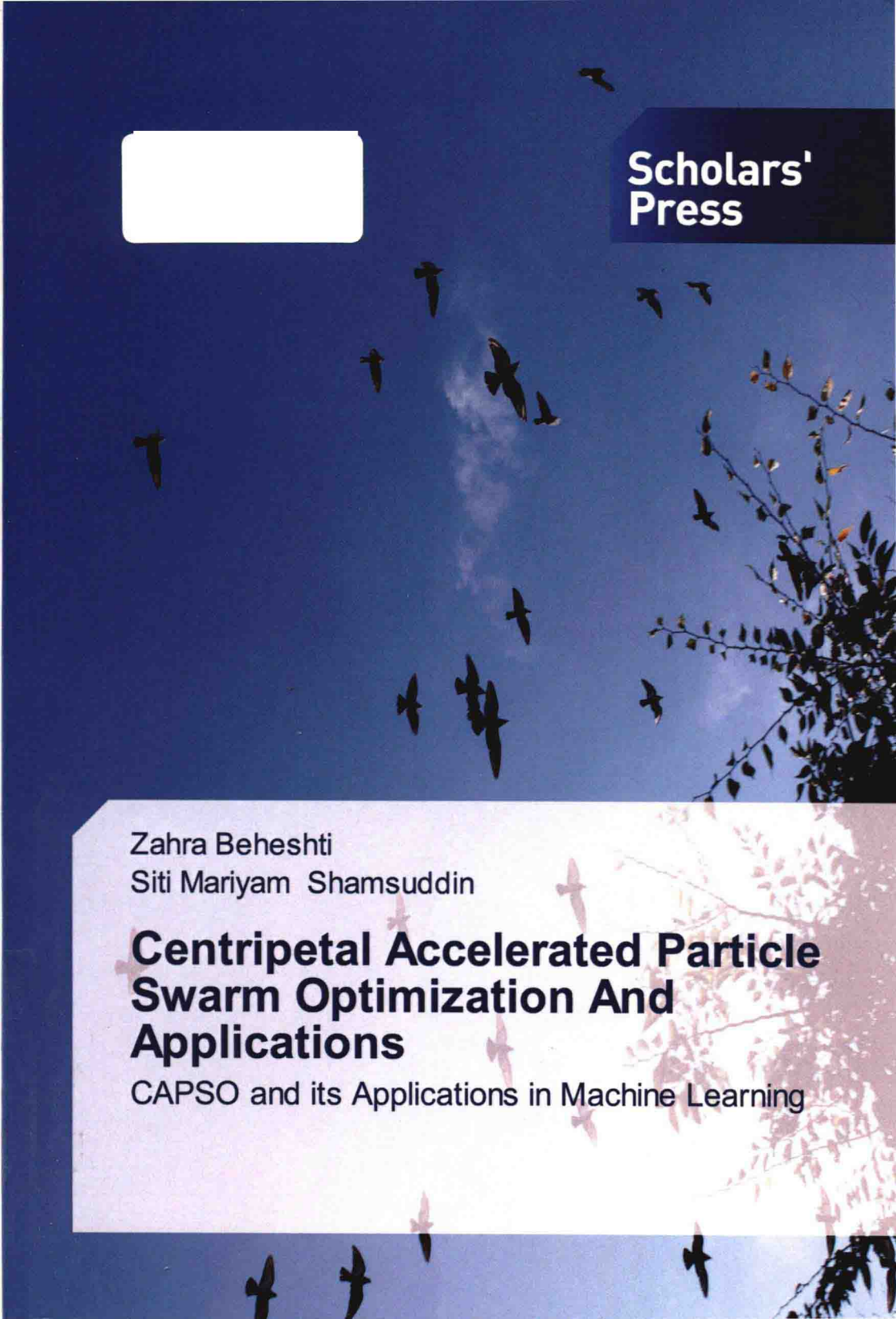

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Centripetal Accelerated Particle Swarm Optimization And Applications

CENTRIPETAL ACCELERATED PARTICLE SWARM OPTIMIZATION AND APPLICATIONS

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This Thesis is dedicated to my beloved family for their endless support and encouragement.

ABSTRACT

Nowadays, meta-heuristic optimization algorithms have been extensively applied to a variety of Machine Learning (ML) applications such as classification, recognition, prediction, data mining and web mining, combinatorial optimization and so on. The majority of them imitate the behavior of natural phenomena to find the best solution. The algorithms find promising regions in an affordable time due to exploration and exploitation ability. Although the mentioned algorithms have satisfactory results in various fields, none of them is able to present a higher performance for all applications. Therefore, searching for a new meta-heuristic algorithm is an open problem. In this study, an improved Particle Swarm Optimization (PSO) scheme based on Newton's motion laws called Centripetal Accelerated Particle Swarm Optimization (CAPSO) has been proposed to accelerate learning process and to increase accuracy in solving ML problems. A binary mode of the proposed algorithm called Binary Centripetal Accelerated Particle Swarm Optimization (BCAPSO) has been developed for discrete (binary) search space. These algorithms have been employed for problems such as non-linear benchmark functions, Multi-Layer Perceptron (MLP) learning and the 0-1 Multidimensional Knapsack Problem (MKP). The results have been compared with several well-known meta-heuristic population-based algorithms in both continuous (real) and binary search spaces. From the experiments, it could be concluded that the proposed methods show significant results in function optimization for real and binary search spaces, MLP learning for classification problems and solving MKP for binary search space.

LIST OF ABBREVIATIONS

ABC	-	Artificial Bee Colony
ACC	-	Accuracy
ACO	-	Ant Colony Optimization
AE	-	Average Error
AI	-	Artificial Intelligence
AIS	-	Artificial Immune System
ANNs	-	Artificial Neural Networks
APSO	-	Adaptive Particle Swarm Optimization
AUC	-	Area Under Curve
BA	-	Bootstrap Algorithm
BCAPSO	-	Binary Centripetal Accelerated Particle Swarm Optimization
BGSA	-	Binary Gravitational Search Algorithm
BO	-	Bees Optimization
BP	-	Back-Propagation algorithm
BPSO	-	Binary Particle Swarm Optimization
CAPSO	-	Centripetal Accelerated Particle Swarm Optimization
CAPSO-MLP	-	Particle Swarm Optimization Multi-Layer Perceptron
CD	-	Check-and-Dropt
CEM	-	Cross Entropy Method
CLPSO	-	Comprehensive Learning Particle Swarm Optimization
COPs	-	Combinatorial Optimization Problems
CP	-	Charged Particle

CS	-	Cuckoo Search
CSS	-	Charged System Search
DSA	-	Differential Search Algorithm
DE	-	Differential Evolution
DMS-PSO	-	Dynamic Multi-Swarm Particle Swarm Optimization
FA	-	Firefly Algorithm
FFNN	-	Feed–Forward Neural Network
FN	-	False Negative
FP	-	False Positive
GA	-	Genetic Algorithm
GbSA	-	Galaxy-based Search Algorithm
GLS	-	Guided Local Search
GPSO	-	Global-topology Particle Swarm Optimization
GSA	-	Gravitational Search Algorithm
GSA-MLP	-	Gravitational Search Algorithm Multi-Layer Perceptron
GSO	-	Glowworm Swarm Optimization
HMM	-	Hidden Markov Model
HMO	-	Honey-bee Mating Optimization
HPSO-TVAC	-	Hierarchical Particle Swarm Optimizer with Time-Varying Acceleration Coefficients
HS	-	Harmony Search
ICA	-	Imperialist Competition Algorithm
ICA-MLP	-	Imperialist Competition Algorithm Multi-Layer Perceptron
ICRO	-	Improved Check-and-Repair Operator
ILS	-	Iterated Local Search
IWD	-	Intelligent Water Drops
KH	-	Krill Herd

LBCAPSO	-	Local-topology Binary Centripetal Accelerated Particle Swarm Optimization
LCAPSO	-	Local-topology Centripetal Accelerated Particle Swarm Optimization
LPSO	-	Local topology Particle Swarm Optimization
MAE	-	Mean Absolute Error
MKP	-	Multidimensional Knapsack Problem
ML	-	Machine Learning
MLP	-	Multi-Layer Perceptron
MOGA	-	Multi-Objective Genetic Algorithm
MS	-	Monkey Search
MSE	-	Mean Square Error
PF	-	Penalty Function
PSO	-	Particle Swarm Optimization
PSO-MLP	-	Particle Swarm Optimization Multi-Layer Perceptron
RBF	-	Radial Basis Function
RFD	-	River Formation Dynamics
ROC	-	Receiver Operating Characteristics
RSO	-	Reactive Search Optimization
SA	-	Simulated Annealing
SD	-	Standard Deviation
SO	-	Spiral Optimization
SS	-	Scatter Search
TLBO	-	Teaching-Learning-Based Optimization
TN	-	True Negative
TP	-	True Positive
TS	-	Tabu Search
UCI	-	University of California at Irvine

VNS	-	Variable Neighborhood Search
VPSO	-	Von –Neumann topology Particle Swarm Optimization
WNN	-	Wavelet Neural Network

LIST OF APPENDICES

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