BACTERIAL FORAGING OPTIMIZATION ALGORITHM FOR NEURAL NETWORK LEARNING ENHANCEMENT

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To my beloved mother, to the spirit of my father, to my big brother Yahya ,
to my beloved brothers, to my beloved sisters, to my beloved wife ,
to our children Ahmed and Rana.

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ABSTRACT

Backpropagation algorithm is used to solve many real world problems using the concept of Multilayer Perceptron. However, main disadvantages of Backpropagation are its convergence rate is relatively slow, and it is often trapped at the local minima. To solve this problem, in literatures, evolutionary algorithms such as Particle Swarm Optimization algorithm has been applied in feedforward neural network to optimize the learning process in terms of convergence rate and classification accuracy but this process needs longer training time. To provide alternative solution, in this study, Bacteria Foraging Optimization Algorithm has been selected and applied in feedforward neural network to enhance the learning process in terms of convergence rate and classification accuracy. One of the main processes in Bacteria Foraging Optimization algorithm is the chemotactic movement of a virtual bacterium that makes a trial solution of the optimization problem. This process of chemotactic movement is guided to make the learning process of Artificial Neural Network faster. The developed Bacteria Foraging Optimization Algorithm Feedforward Neural Network (BFOANN) is compared against Particle Swarm Optimization Feedforward Neural Network (PSONN). The results show that BFOANN gave better performance in terms of convergence rate and classification accuracy compared to PSONN.

ABSTRAK

Algoritma Rambatan Balik (BP) digunakan untuk menyelesaikan banyak masalah dunia nyata menggunakan konsep Perseptron Pelbagai lapisan. Namun, kelemahan utama algoritma BP adalah kadar penumpuan yang lambat, dan sering terperangkap di lokasi minimum tempatan. Untuk mengatasi masalah ini, dalam literatur, algoritma evolusi seperti Pengoptimuman Partikel Berkelompok (PSO) telah dilaksanakan dalam rangkaian saraf tiruan suapan depan untuk mengoptimumkan proses pembelajaran dari sudut kadar penumpuan dan ketepatan klasifikasi namun proses ini memerlukan masa latihan yang lama. Untuk memberikan penyelesaian alternatif, dalam kajian ini, algoritma pengoptimuman bakteria carian (BFO) telah dipilih dan diterapkan pada jaringan saraf tiruan suapan depan untuk meningkatkan proses belajar dari segi kadar penumpuan dan ketepatan klasifikasi. Salah satu proses utama dalam algoritma BFO adalah gerakan *chemotactic* dari bakteria maya yang membuat percubaan penyelesaian bagi masalah pengoptimuman. Proses gerakan *chemotactic* dipandu untuk menyelesaikan masalah Jaringan Neural buatan (ANN) dengan lebih cepat. Gabungan algoritma BFO dan ANN (BFOANN) yang dibangunkan dibandingkan dengan PSO dan ANN (PSONN). Keputusan kajian menunjukkan bahawa BFOANN memberikan hasil yang lebih baik dari sudut konvergensi dan ketepatan klasifikasi dibandingkan dengan PSONN.