Abstract

Adaptive filtering is a growing area of research due to its vast no of application in many fields and its numerous advantages over non adaptive filters. In fact there are many areas where the use of adaptive filters is becoming mandatory. Few of them are System Identification, Inverse Modeling, Linear Prediction, Feedforward Control etc. although enough work has been carried out on adaptive filters, still there are many fields where we can make significant contribution.

One is the developing adaptive filtering for systems which are having a multimodal error surface, like IIR filters as gradient based optimization techniques, which are used so far in the designing of these type of system get stuck to The multi-modal error surface of these system and causes the gradient based algorithms to be stuck at local minima and not converge to the global optimum, resulting in an unstable system. In this work, we have combined the advantages of both gradient based algorithm and global optimizations algorithm to make the adaptive filters capable of efficiently working for the system having multimodal error surface. In this new method we use LMS as gradient based algorithm and Ant Colony Optimization (ACO) & Particle swarm optimization (PSO) as global optimization algorithm. In which ACO take
inspiration from the behavior of real ant colonies to solve this type of optimization problems and PSO is a population based stochastic optimization technique developed by Dr. Eberhart and Dr. Kennedy in 1995, inspired by social behavior of bird flocking or fish schooling.

The algorithm is implemented using MATLAB, and the simulation results obtained shows that the proposed approaches is quite efficient, accurate and has a fast convergence rate. The results obtained also demonstrate that the proposed method can be efficiently used in designing and identification of systems having multimodal error surface.

References

17. Ioan Tabus, Stochastic gradient based adaptation: Least Mean Square (LMS) Algorithm, SGN 21006 Advanced Signal Processing: Lecture 5
18. P. Visu and E. Kannan, Traffic Parameterized ACO for Ad-Hoc Routing

Index Terms

Computer Science Algorithms

Keywords

IIR, LMS, Ant Colony Optimization, Particle Swarm Optimization, System Identification