The State of the Art of Neurodynamic Optimization: Past, Present, and Prospect

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Abstract – As an important tool for science research and engineering applications, optimization is omnipresent in a wide variety of settings. It is computationally challenging when optimization procedures have to be performed in real time to optimize the performance of dynamical systems. For such applications, classical optimization techniques may not be competent due to the problem dimensionality and stringent requirement on computational time. New paradigms are needed. One very promising approach to dynamic optimization is to apply artificial neural networks. Because of the inherent nature of parallel and distributed information processing in neural networks, the convergence rate of the solution process is not decreasing as the size of the problem increases. This talk will present the state of the art of neurodynamic optimization models and selected applications. Specifically, starting with the idea and motivation of neurodynamic optimization, I will review the historic review and present the state of the art of neurodynamic optimization with many individual models for convex and generalized convex optimization. In addition, I will present a multiple-time-scale neurodynamic approach to selected constrained optimization. Finally, I will introduce population-based collaborative neurodynamic approaches to constrained distributed and global optimization. By deploying a population of individual neurodynamic models with diversified initial states at a lower level coordinated by using some global search and information exchange rules based on swarm intelligence at a upper level, it will be shown that constrained global, combinatorial, and multi-objective optimization problems can be solved effectively and efficiently by means of neurodynamic optimization.

Jun Wang is the Chair Professor Computational Intelligence in the Department of Computer Science and School of Data Science at City University of Hong Kong. Prior to this position, he held various academic positions at Dalian University of Technology, Case Western Reserve University, University of North Dakota, and the Chinese University of Hong Kong. He also held various short-term visiting positions at USAF Armstrong Laboratory, RIKEN Brain Science Institute, Dalian University of Technology, Huazhong University of Science and Technology, and Shanghai Jiao Tong University (Changjiang Chair Professor). He received a B.S. degree in electrical engineering and an M.S. degree in systems engineering from Dalian University of Technology and his Ph.D. degree in systems engineering from Case Western Reserve University. His current research interests include neural networks and their applications. He published over 200 journal papers, 15 book chapters, 11 edited books, and numerous conference papers in these areas. He is the Editor-in-Chief of the IEEE Transactions on Cybernetics. He also served as an Associate Editor of the IEEE Transactions on Neural Networks (1999-2009), IEEE Transactions
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