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Editorial Open Access

# Self-organization and Intelligence

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## Editorial

Self-organization (SO) is one of the key issues for generating true intelligence. Without SO, human brains and human societies will just be chaotic systems. The basic SO mechanism is the Leader-Following (LF) behavior. With LF behavior, a complex system can become very well organized after many generations. Without LF behavior, however, even a relatively small dynamic system can become intractable. In fact, the basic learning rule in the well-known Self-Organizing Map (SOM) algorithm is LF. Here, for any given data point, neurons close to the winner tries to imitate the winner, so that they can behave in a similar way for similar data. The basic learning rule in Particle Swarm Optimization (PSO) is also LF. In PSO, each particle tries to imitate the behavior of the local or global leader, while trying to preserve its own search history. Thus, although SOM and PSO are different, both of them are LF based SO algorithms.

In SOM and PSO neurons or particles just move (in the search space) in a direction so that they can become more similar to the winner or leader after moving. This is nothing but Lamarckian evolution. It is well-known that Lamarckian evolution is not good if the search space is complex or dynamically changing. A better way is Darwinian evolution, and Standard Genetic Algorithm (SGA) is a typical example. From the above discussion we may naturally wonder if GA is also an SO algorithm. In fact it is. In SGA, leaders or individuals with high fitness values have higher opportunity for reproducing offspring, and the whole population will behave similar to the leader(s) after many generations. In SGA, individuals do not "know" the leader to imitate. Good traits are preserved based only on the survival the fittest principle.

It is known that Darwinian evolution like SGA alone is neither efficient nor effective for solving large scale complex problems. A better way is to combine Darwinian and Lamarckian evolutionary algorithms. This kind of hybrids is known as the Memetic Algorithms (MAs). In a MA, good traits of good individuals can be evolved and imitated, and the population can self-organize during evolution. In general, MAs can be very efficient and effective for solving complex problems.

From the above discussions we may see that different algorithms developed in different contexts may actually share the same principle. I believe that the International Journal of Swarm Intelligence and Evolutionary Computation can provide for researchers and practitioners a forum to publish new ideas, new concepts, and new results; and at the same time, a platform to find common theories behind different algorithms and different applications.