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A classification rules extraction algorithm base on fish swarm optimization

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ABSTRACT *: Group classification rules extraction is an important task in pattern recognition. In this paper, we proposed a classification rules extraction algorithm base on fish swarm optimization. There are two main works in this article: firstly, fish swarm optimization is introduced. Secondly, a classification rules extraction algorithm is proposed. The proposed algorithm provides a good practicability and a promising future for pattern identification.*
Keywords - *classification rules extraction, fish swarm optimization, Intelligent Optimization.*

I. INTRODUCTION

Intelligent optimization algorithm is the collective behavior of decentralized, self-organized systems, natural or artificial which has been widely application in many areas, such as neural network training [1], communication networks [2], classification and clustering [3].

Artificial fish swarm algorithm [4, 5] is a behavior-based artificial intelligence method which simulates the behavior of the fish in the water to solve the optimization problem. Artificial fish swarm algorithm evolved from the behavior of fish [6] in the water looking for food. If we planted food in front of an area in the fish ponds, and there will be a lot of fish concentrated over. Fish in the water generally have three behaviors such as feeding, cluster, rear. Artificial fish swarm algorithm have the features: (a)converges faster, it can be used to solve the problem of real time requirements;(b)It can be used to quickly get a feasible solution for less precision problem;(c)It does not require strict mechanism and an accurate description of the problem, which makes its application range widely expanded.

We proposed a new classification rule acquisition method based on artificial fish swarm algorithm. The classification based on fish swarm optimization has good global convergence which is better than the traditional intelligent optimization algorithm.

This paper is organized as follows. Firstly, artificial fish swarm algorithm is introduced. Secondly, a classification rules extraction algorithm is presented. Finally some analysis and conclusions are given on the systems.

II. ARTIFICIAL FISH SWARM ALGORITHM

Supposed the state vector of artificial fish swarm is $X=(x_1,x_2\cdots x_n)$, where $x_1,x_2\cdots x_n$ is each real time status of the fish, i.e. the optimization process variables of each fish. The food concentration in this position of fish is expressed as $y=f(x)$, where y is the objective function value, which means that the distance between the artificial fish as $d_{i,j}=\left\|X_i-X_j\right\|$, i and j is a random fish. $Visual$ is the distance perception of artificial fish from the artificial fish. The artificial fish occurs only in the inner radius of the circle to the length of the field of vision various acts. $Step$ means the maximum step size of artificial fish. δ is the degree of congestion factor. The following behavior conditions can help to get the minimum value.

(1) Foraging behavior

Supposed the state of artificial fish is X_i, Select a state X_j within its sensing range randomly. If X_j superior to X_i, then move to X_j; on the contrary, selected randomly state X_j and determine whether to meet the forward conditions; repeated several time, if still not satisfied forward conditions, then move one step randomly.

(2) Flocking behavior

Supposed the current state of artificial fish is X_i ($d_{i,j} < Visual$), number of artificial fish for n_f, if $n_f < \delta$ indicates that the partners have more food and less crowded, if Y_c better than Y_i,then go forward toward the center of the direction of the partnership, otherwise perform foraging behavior.

(3) Rear-end behavior

Supposed the state of artificial fish is X_i, explore its optimal state $X_{\max}$ from Visual neighbors, $X_{\max}$ better than Yi. The number of partners of $X_{\max}$ is n_f, if $n_f < \delta$ indicates that near distance have more food and not too crowded, further move to the front of $X_{\max}$ position; otherwise perform foraging behavior.

The artificial fish swarm algorithm is shown as algorithm 1.

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1). Initialize the parameters of artificial fish, such as $Step$, $Visual$, the number of exploratory try number, maximum number of iterations ,randomly generated n fish;
2). Set bulletin board to record the current status of each fish, and select the optimal value recorded;
3). Behavior selection, implementation of foraging behavior, flocking behavior, rear-end behavior and special foraging behavior;
4). Optimal value in bulletin board is updated;
5). Whether the termination condition is satisfied? if not satisfied, return to step 2.

Algorithm 1 Artificial fish swarm algorithm

The flow chat of artificial fish swarm algorithm is shown as figure 1.

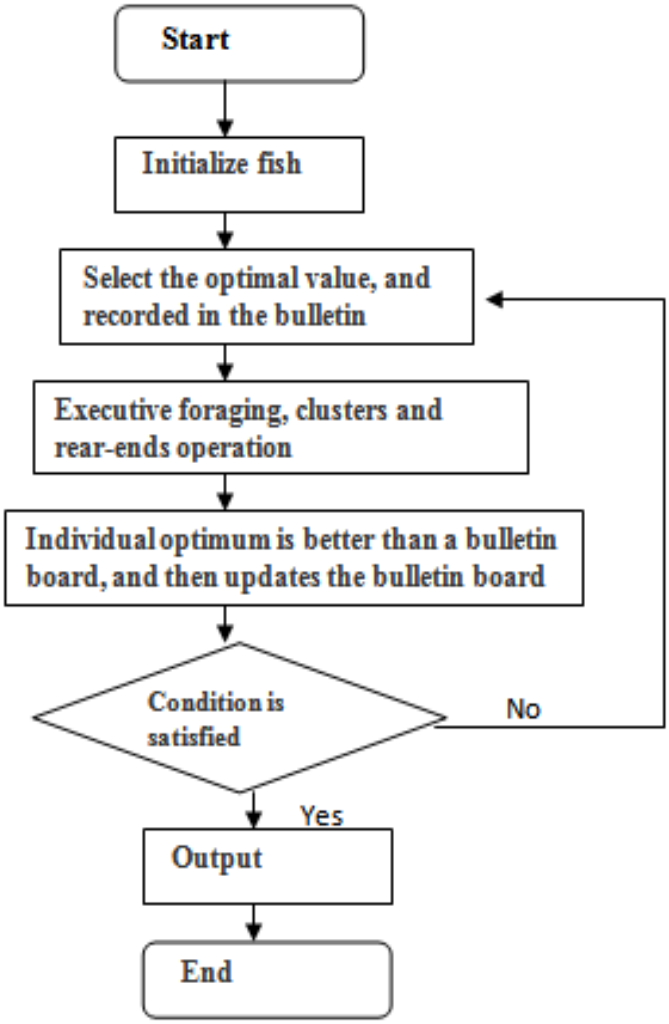

Fig. 1. Flow chat of artificial fish swarm algorithm

III. CLASSIFICATION RULES EXTRACTION ALGORITHM BASE ON FISH SWARM OPTIMIZATION

The classification rules can be described as:

$if \ \ feature1\_\min < x_1 < feature1\_\max$,

$feature2\_\min < x_2 < feature2\_\max$,

……

$featuren\_\min < x_n < featuren\_\max$,

then class_x.

Supposes each fish is

$X = (x_1, x_2 \cdots x_n)$, where $x_i = (feature\_i\_\min, feature\_i\_\max)$.

The class classification rules extraction algorithm base on fish swarm optimization is shown as follows.

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1). A fish on behalf of a classification rule, initialize a certain number of fish, and form fish swarm;
2). Set bulletin board to record the current status of each fish, and select the optimal value to record;
3). Behavior selection, implementation of foraging behavior, flocking behavior, rear-end behavior and special foraging behavior;
4). Optimal value in bulletin board is updated;
5). Whether the termination condition is satisfied? if not satisfied, return to step 2;
6).Output optimal solution

Algorithm 2 Artificial fish swarm algorithm

IV. CONCLUSION

In this paper, we proposed a classification rules extraction algorithm base on fish swarm optimization which provides a good practicability and a promising future for pattern classification. We will apply it to other areas.

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