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The Research Review of Target Object Recognition Method

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Abstract

Object recognition is to separate the object to be recognized from the background environment in the original image obtained by the visual system. The common methods mainly include threshold segmentation, K-means clustering algorithm, artificial neural network and K-nearest neighbor method (KNN). In order to improve the accuracy and efficiency of object recognition, the method of optimization algorithm is often adopted, that is, a combination of various algorithms, using their respective advantages to achieve the purpose. This paper mainly introduces the optimal neural network K-means clustering and the combined application of neural network and K-means clustering.

Keywords

Object Recognition; Optimized Neural Network; K -means Clustering.

1. Introduction

In the agricultural field, in the process of picking fruits and vegetables, the first thing to do is to identify and locate the fruits through the visual system. The performance of visual system determines the accuracy and efficiency of fruit recognition and positioning, and also has a direct impact on the picking effect of robots. At present, the target object identification and positioning methods emerge in different groups at home and abroad. Nowadays, the commonly used object image segmentation algorithm mainly includes threshold segmentation method, color difference method, artificial neural network, K-means clustering algorithm, support vector machine method (SVM), K nearest neighbor method (KNN) and a variety of hybrid algorithm. This paper mainly introduces the three methods of optimal neural network, K-means clustering and the combined application of neural network and K-means clustering.

2. Object recognition based on machine learning

Machine learning is the use of data, or past experience, to optimize the performance criteria of computer programs. Machine learning algorithms are classified into supervised learning, unsupervised learning, reinforcement learning and evolutionary learning. Supervised learning algorithms start with a set of correct answers (the training set), train and adjust until they respond correctly to all possible inputs. According to the types of predictive variables: if the predictive variables are continuous, it belongs to the regression problem. If the predictor variable is an independent category (qualitative or categorical discrete value), it is a classification problem. Unsupervised learning algorithms compare inputs to each other to find unknown structures or trends in the data to identify similarities and then classify them. Although the original data does not contain any labels, the data can be consolidated (grouped or clustered) or simplified (dimensions reduction, removal of unnecessary variables or detection of outliers). [1,2] Reinforcement learning algorithms are the intermediate stage between supervised and unsupervised learning. When the algorithm outputs an incorrect answer, it will report an error and explore different answers until it outputs the correct answer. Evolutionary learning is to simulate the survival and reproduction process of microorganisms

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in their living environment, so that the algorithm has the characteristics of self-organization, self-adaptation and self-learning, and can not be limited by the nature of the problem, so as to effectively deal with the complex problems difficult to solve by the traditional optimization algorithm.

2.1. Object recognition based on neural network

Quantum genetic fuzzy neural network object recognition model is a fuzzy neural network model optimized by quantum genetic algorithm, which can preserve the boundary information of the object image well and realize object recognition effectively [3].

Firstly, object images in natural environment are collected and converted into HSI type color space. Then, a 5-layer regularized fuzzy neural network model is established for object recognition. Then, the quantum genetic algorithm is used to improve the fuzzy neural network model, so as to realize the combination of global search ability and local refinement ability, and improve the network performance. Finally, the network parameters are determined and the object recognition is realized by combining the mathematical morphology operation.

Quantum genetic algorithm and the traditional error back propagation of BP neural network algorithm is organic combination of the global search ability and can realize the complementary advantages of local refining capacity, complete the adjustment of the network parameters, which can be considered as the objective function for error function E a minimization process, optimizing the network before the blur center and width of the variance, and the network output layer connection weights. The specific process of the algorithm is shown in Figure 1, in which the coding of the quantum genetic algorithm and the design of the fitness function are the keys to the optimal working state of the model.

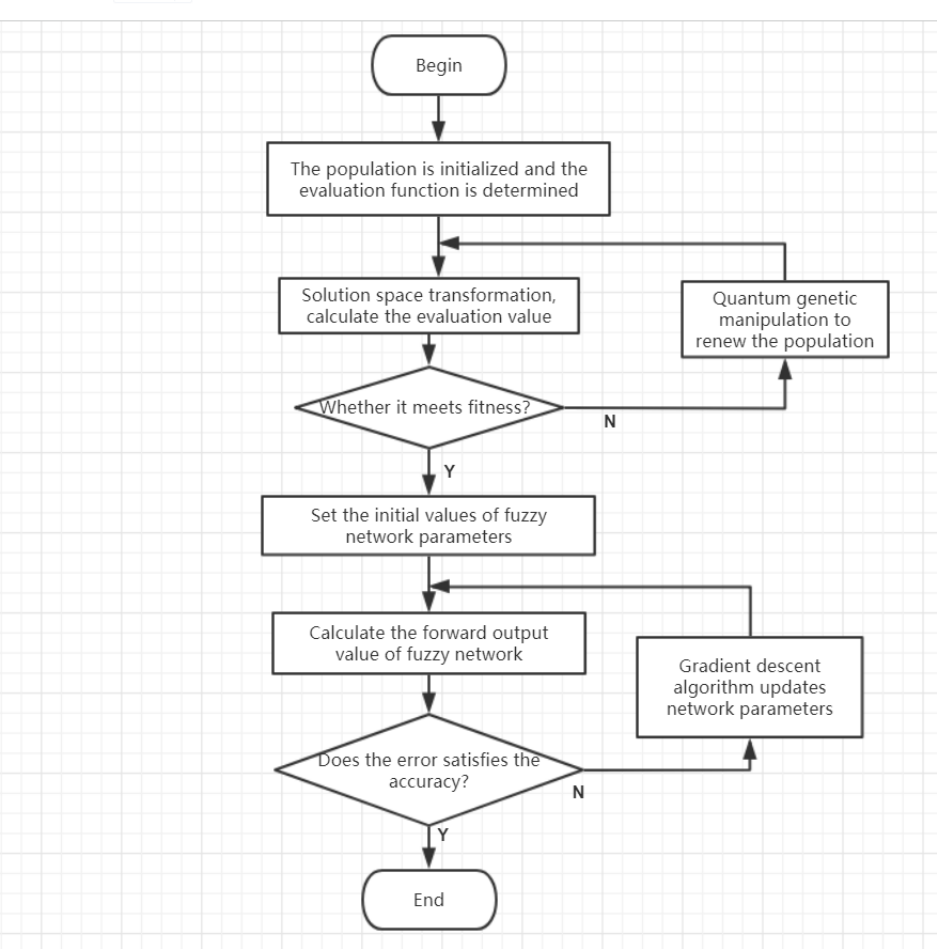

Fig. 1 Flow chart of quantum genetic algorithm

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2.2. Object recognition based on K-means clustering algorithm

K-means clustering algorithm is an unguided learning algorithm, which divides single data into specified clusters through iterative search [4]. Assuming that the target is to be aggregated into k types, the specific steps of the k-means clustering algorithm are as follows:[4]

1) Select the initial clustering center of K as: Z1(1), Z2(1),..., Zk (1);

2) In the NTH iteration, the sample set {Z} is classified as follows: For I,j=1,2...K, I indicates j, if | | Z - what Zj had (n) | | < | | Z ∈ Zi (n) | |, the Z ∈ Sj (n);

3) Let the center of the new class obtained from 2) be Zj(n+1), so that it can reach the minimum;

4) For all j=1,2...,k, if Zj(n+1)=Zj(n), then the iteration ends; Otherwise, n=n+1, go to Step 2) and continue.In the k-means clustering algorithm, the classification number K will have an impact on the image clustering effect. For example, if the clustering number K is set to 3, the image identifying apples can be divided into three categories: fruit, branches and leaves, soil and sky.

2.3. K-means clustering algorithm and RBF neural network combination

In order to further improve the accuracy and speed of object recognition, so as to improve the efficiency of object recognition. The above two algorithms can be organically combined, so an object recognition method based on K-means clustering and radial neural network based on genetic algorithm and least mean square algorithm optimization is proposed [5].

Firstly, K-means clustering algorithm is used to segment the collected object images in Lab color space, and the RGB, HSI color feature components, circular variance, density, circumference square area ratio, and HU invariant rectangular feature components of the segmented images are extracted respectively. Then, in order to get the object recognition model, these extracted features can be used as the input variables of the neural network to train the RBF neural network. Because RBF neural network vector fitting, low deficiencies, introducing genetic algorithm for RBF hidden layer neurons number and connection weights are optimized, two hybrid coding evolutionary optimization at the same time, finally re-use LMS to further learning connection weights, thus established the new neural network optimization model (GA - RBF - LMS), in order to improve the efficiency of neural network and the identification accuracy [5].

3. Summary

With the development of science and technology, intelligent algorithms are constantly updated and developed. There are numerous intelligent algorithms for object recognition, and these algorithms also have their own advantages and disadvantages. As an important part of the robot, the visual system determines the efficiency, speed and quality of the robot. Therefore, improving the performance of the visual system is of great significance to the development of robots and modern science and technology. This paper mainly introduces three algorithms: optimal neural network, K-means clustering and the combined application of neural network and K-means clustering.

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