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Intelligent computing system based on pattern recognition and data mining algorithms

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ABSTRACT

The integration of intelligent system mainly includes the application of intelligent technology, such as artificial intelligence and computational intelligence method, which is used in different levels of the system. This paper introduces the application and technology of several intelligent system integrations, the advantages and disadvantages of learning theory and expert system. Neural network is applied in intelligent systems and we use scope reviewed several new development of intelligent technology, plus this paper describes the development direction of the intelligent system. This paper introduces the basic concepts of data mining, including data mining technology, artificial intelligence, machine learning, statistical analysis, fuzzy logic, pattern recognition and artificial neural networks and other technologies. We analyze the structure of the general algorithm of data mining, and classify the data mining technology in details, including more than 10 techniques of decision tree technology, neural network technology, rough set and fuzzy set. Finally, the research directions of data mining in artificial intelligence, e-commerce applications and mobile communication computing are discussed.

1. Introduction

In recent years, with the continuous development of intelligent calculation method, the model of intelligent computing methods in dynamic optimization application increased significantly, including ant colony algorithm, genetic algorithm, particle swarm algorithm, differential evolution algorithm, cultural algorithm and so on. The above calculation method does not need to rely on gradient information, which has a wide range of use, and the calculation method does not need to set the initial point, so it is easy for us to operate. These intelligent computing methods are often based on population probability search, in general, they will not fall into local extremum. Therefore, the intelligent computing method can solve the limitations of the traditional calculation method through the system dynamic optimization method, and improve the accuracy and efficiency of solving the dynamic optimization problem [1,2].

Artificial intelligence is a branch of computer science. It is applied to many fields, such as expert system, pattern recognition, neural network and so on. From the point of view of its functions, it must be a comprehensive fringe science which combines calculation, control theory, information technology, linguistics and other disciplines. In addition to numerical calculation and data processing, another important application of computer is the development and application of artificial intelligence. How to use computers to simulate part of human intelligence activities is the research direction of artificial intelligence systems. The cognitive system of artificial intelligence is based on logic, and its deductive reasoning is performed by symbolic processing [3,4]. The intelligent system is relatively fragile and lacks stability, which is also sort of the key and difficult point for the future development of intelligence (Fig. 1).

The theory of intelligent computing is mainly based on connectionism, and it intersects with the mathematical methods such as fuzzy mathematics and iterated function system, which has formed many developing directions. Artificial neural networks, genetic algorithms, evolutionary computation, artificial life, ecological computing, immune information processing, multi-agent systems, etc. can all be included in intelligent computing. In the study of human intelligence behavior, most human activities involve more, and the solution of large complex problems needs collaborating by many professionals or organizations. "Collaboration" is one of the main forms of human intelligence behavior, and distributed artificial intelligence is about to meet this demand. With

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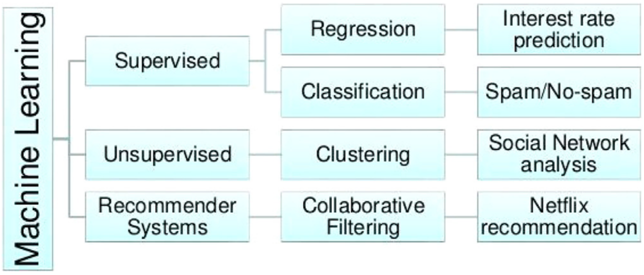

Fig. 1. Intelligent computing system.

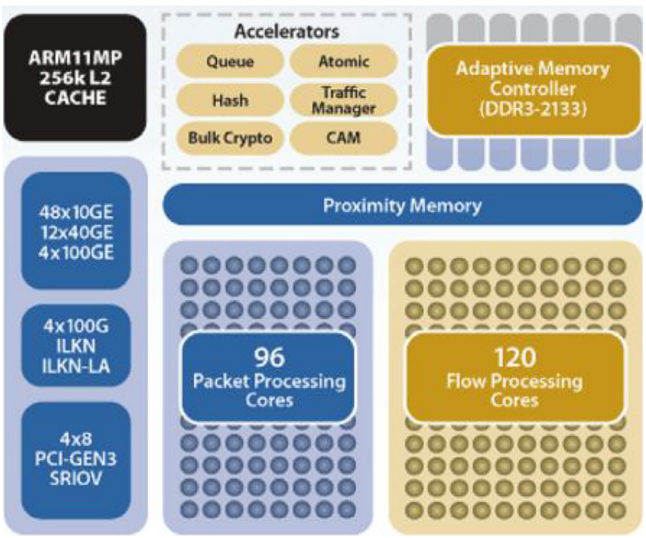

Fig. 2. Heterogeneous processor: Netronome x86 + NFP.

the development of computer network and programming, distributed artificial intelligence has become a new research hotspot in artificial intelligence field. The main research purpose in logic or intelligent distributed dynamic author is figuring how to coordinate their behavior, and how to coordinate their knowledge, skills and planning, in order to solve the single objective or multi-objective problem, and to provide an effective way to support collaborative work of large and complex intelligent systems or computer design. The nature of the distributed system determines is complex, nonlinear, and it achieves a higher order state through coordination among subsystems [5,6].

Intelligent computing is a comprehensive technical system which integrates many advanced technologies and latest trends in the field of IT infrastructure, and it has the characteristics of automation, integration and security. It includes large-scale data, as well as emerging services delivery models such as cloud computing (Fig. 2).

Along with the development of the connection technology, recently the industry is an important trend from the original computer to the computing ability of transformation, which is now no longer adhere to a device, requiring more emphasis on the existence of computing power [7]. This trend has affected our lives in every way, and the trend has created a variety of new products, such as digital signage, kiosks, and other infrastructure connected devices. The most critical thing is the different equipment, which has its own computing power, on the other hand, they are connected together, providing us with new opportunities and new needs. Embedded system has been widely used in the entire electronic industry, involving control systems, calculation and other processing applications.

2. Intelligent computing system

Based on the comprehensiveness of artificial intelligence system, its development is bound to be the integration of many intelligent technologies. Intelligent information processing system of human-machine systems can help us make scientific decisions in complex computing problems, and the application of expert system technology in this area has been very skilled in various fields resulting some remarkable achievements. But the most important problem of the development of expert system is knowledge acquisition and processing. The knowledge of each subject and the strict distinction between them make it difficult to deal with the intelligent system. Therefore, integration of intelligent technology and expert system, such as fuzzy logic and neural networks, has become an inevitable trend [5,8].

On the basis of the theories of statistics, set theory, information theory and artificial intelligence, people put forward a variety of data mining techniques and methods based on intelligent computing, and formed their own characteristics and general application fields. In general there are several basic techniques: the imitation biotechnology, statistical methods, collective methods, decision trees, fuzzy systems, cloud theory, self-organizing mining technology. These technologies have the following inner features. (1) The evolution strategy is optimized to one of the functions and then carry on the evolution operation to obtain the optimal solution, and it optimizes the function to take the maximum value or the minimum value which is not limited. Firstly, determined the evolution object, while namely treats optimized the variable. How two parts calculate the evolution function and the general ground may use the ES algorithm in the objective function cluster question, however we usually only can obtain the approximate optimal solution and the overall situation optimal solution. (2) The self-organizing feature mapping network method is an unsupervised clustering method, which gathers data through repeated learning to compete with the current object through several units. The unit which is close to the current object becomes an active or winning unit. To get closer to the input object, adjusting the weight of the winning cell and its nearest neighbor. (3) Group intelligence provides a basis for finding solutions to complex distributed problems without centralized control or providing a global model. The main idea is to use the group intelligence algorithm to cluster, and to reduce the knowledge of the data vector group randomly into a two-dimensional plane, and then to produce some virtual ants in a given plane. (4) Realistic data is usually complex or mixed, structured and unstructured, and incomplete, which is characterized, such as these complex data sets. The simple distance measure is not enough to measure the similarity or distinguish important features. Therefore, we need to find new measures and design based on the new measure of clustering analysis methods in order to deal with complex data sets.

2.1. Electric power system

The development trend of power system automation is monitoring into to the open-loop closed-loop control, where high voltage is extended to low voltage. Among them, the main application of artificial intelligence technology is the diagnosis of power equipment fault [9,10].

At present, the main technologies used in power system fault diagnosis are ANN/ES/GA/Petri/FST and so on. The core problem of fault diagnosis is information extraction, and the uncertainty of information increases the difficulty of information extraction. To solve this problem, there are expert system based fault diagnosis, neural network based fault diagnosis and fault diagnosis based on optimization technology.

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