

# Recognition Method of Sports Training Based on Intelligent Information Platform

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## ABSTRACT

With the wide development of sports nowadays, many kinds of sport applications have appeared and changed the living styles of people all around the world. There are many factors that are important for sports, such as the environment and exercise. At present, there are still some shortcomings in sports training management all around the world. For example, the unscientific is unclear, the training purpose is not strong, and the assistant decision-making means are backward. In this way, these issues jointly make the sport training process difficult. In this way, this paper applies the multi-agent technology to the system, designs an intelligent information sports training management and recognition method based on intelligent agents, and carries on the concrete implementation in certain environments. The corresponding experimental results indicate that the accuracy and intelligence of the training recognition system can be improved greatly and effectively.

## KEYWORDS

Agent, Intelligent Information Platform, Sport Recognition, Sport Training

## 1. INTRODUCTION

With the vigorous development of national fitness activities, great changes have taken place in people's concept of life (Wang et al. 2020). In some large and medium-sized cities, consumption for health has become a fashion to improve the quality of life in the new era. National fitness exercise has also become a long-term national policy of our country. According to relevant statistics, the overall physical quality of our people shows a downward trend, among which the declining trend of physical quality of college students is the most serious. At present, our government attaches great importance to this problem, and has issued many corresponding policies and methods to deal with it, but the effect is not obvious (Tan et al. 2015).

There are many influencing factors, among which the formulation of sports training plan and the implementation of sports training methods are not scientific enough is one of the most important factors (Fister et al. 2017). Due to the uneven level of PE teachers, there is a strong personal subjective consciousness in formulating sports training plans and methods, which can not effectively formulate scientific plans and methods according to students' personal physical quality.

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as a result, students' active participation in physical training is not high enough, and the training effect is not obvious, which restricts the effective development of students' physical quality to a certain extent (Balsalobre et al. 2021).

In the last century, M.S.Scott Morton, taught by Massachusetts University of Technology, put forward the training recognition system for the first time (Gauthier et al. 1998). Among many intelligent information technologies, training identification system is applied to sports planning, training, daily management and other fields, and a lot of practical experience and achievements have been obtained in the process of practice and system application (Park 2020). It has gone through a long period of development from the training and recognition of the original two-database structure to the intelligent training and recognition system based on artificial intelligence. The emergence of intelligent decision-making system has not only aroused widespread concern, but also become the focus of scientific research in the industry and even countries all over the world (Schneider et al. 2019).

At present, intelligent decision-making systems mostly adopt the method of scientific theory and provide users with scientific and reasonable decision-making through the method of communication between human and computer (Mujika et al. 2017). However, the relevant research of experts and scholars from all over the world in the field of sports training management is only limited to a certain athlete or a specific project, but there is little research on the intelligent decision-making system on how to improve the physical quality of college students. The purpose of this paper is to improve the efficiency of the current sports training management. Besides, this paper also targets on developing the scientific and effective sports training plans and training methods in line with college students (Zahran et al. 2019).

## **2. RELATED WORK**

The training recognition system is a system which takes the computer as the main means, uses the theories and technologies of management science, operational research and control science, and intelligently supports the decision-making activities through the mutual communication and operation with the computer (Ejimabo et al. 2015s). The main focus of this paper was to help managers to make correct decisions using semi-structured or unstructured data, to improve the decision-making efficiency, and to create an intelligent working environment in which the knowledge information are shared.

Agent technology (Jack et al. 2015) is a kind of computer system or entity which can run autonomously in dynamic environment and has high autonomous ability. Be able to perceive the changes in different environments and actively make corresponding adjustments with the changes. Among the many studies of Agent, the most classic and widely taught is the discussion of "weak definition" and "strong definition" of Agent by Wooldridge et al. The most basic features of each Agent include autonomy (Wang et al. 2018), responsiveness, goal orientation, and environmental orientation. Strong definition adds spiritual concepts such as knowledge, goal, responsibility and ability on this basis (Li et al. 2021). How to solve the problem of mutual cooperation between Agent is one of the problems that people often encounter in the process of studying Agent.

The emergence of MAS is to focus on the negotiation and cooperation between Agent based on the original Agent (Sachs et al. 2019). The collaborative problem-solving ability of MAS is stronger than that of Agent alone, which provides a natural, convenient and optimal solution for complex problems, and effectively connects with the existing software system, effectively improves the execution ability of the system, and has strong stability (Zheng et al. 2020).

## **3. SYSTEM STRUCTURE**

According to the characteristics of college students' sports training management, combined with the characteristics of Agent and Multi-agent, the frame diagram of college students' sports training

management decision-making system based on Multi-Agent is shown in figure 1, and four types of Multi-Agent are defined (Zhang et al. 2021):

- **Interface Agent:** Mainly used to implement interaction with decision makers. In the process of interaction, interface Agent can actively detect the changes of the environment and obtain the main characteristic information such as habits, hobbies and habits of decision-making users, so as to provide the best user interface and provide decision-making users with a unified idea of auxiliary decision-making.
- **Blackboard controls Agent:** The blackboard control Agent is the control center of the whole system. It mainly controls the blackboard and other Agent in the system directly or indirectly. Through the cooperation principle between its own knowledge base and Agent, the problem to be solved is divided into several corresponding sub-problems, and then assigned to different levels of the blackboard to manage each level accordingly to eliminate the conflict between different decisions of Agent.
- **Function Agent:** Its function is to sort the information received from the blackboard and get the goals that need to be solved, then divide the related targets into several small tasks and transfer them to one or more decision agent for execution.
- **Decision Agent:** Each decision Agent corresponds to the decision maker or relevant departments in the system to complete each specific decision task of the whole system. Under the restriction of the corresponding function Agent, with the help of the cooperation between the decision Agent, the decision is realized.

### 3.1 The Agent Design

Nowadays, the software development for system Agent is only in a new category of software development, because the relevant theoretical knowledge and application technology in the field of Agent are not mature enough, a unified development model has not been formed. At present, most of them use object-oriented technology to develop systems with some basic characteristics of Agent (Gronauer et al. 2022). The idea of implementation is to try to convert objects into Agent. Make the changed object have some basic characteristics such as the reactivity and autonomy of Agent. The function realization of Agent needs three parts: knowledge reasoning, communication and execution module as seen in figure 2.

The main task of the communication module is to receive the information transmitted by the external environment or other Agent, and to transform the information into a mode that Agent can understand, and at the same time send this information to the external environment or other Agent. Knowledge reasoning module, which has the characteristics, methods and behavior norms of Agent. It

Figure 1. System framework

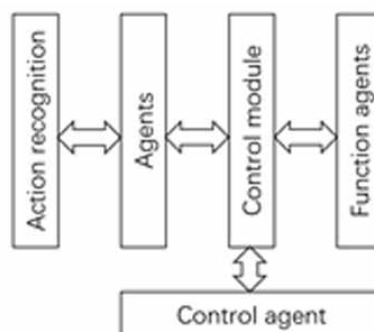
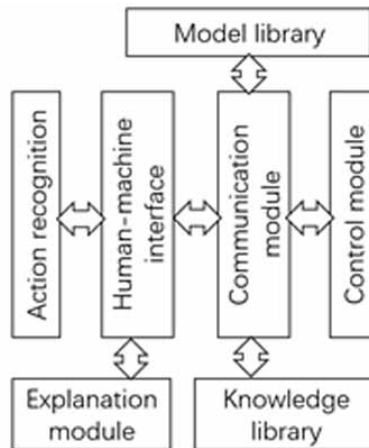


Figure 2. Main modules of this framework



can be carried out more automatically, which provides a factual basis for the implementation of Agent independent activities. The execution module is a specific decision-making component within the Agent, which makes specific judgments according to the attributes, methods and behavior principles in the knowledge module, and updates the knowledge of the knowledge reasoning unit in time.

### 3.2 Communication

In the decision-making system of sports training management for college students based on Multi-Agent, the blackboard module is used between Multi-Agent to realize the communication between Agent. The blackboard in Multi-Agent provides the scope of work, and Agent can exchange information, data and knowledge with each other. Agent has filled in the information items on the blackboard when it was first created and can be shared with other Agent at the same time, and the blackboard can be accessed at any time to meet the specific needs of Agent in order to get more new information. Agent uses screening method to extract the information they need. Agent in the blackboard system, they do not communicate with each other, and each Agent independently solves the sub-problems solved. Function Agent decomposes a problem into several sub-problems. Now, let more Agents participate in the solution work to temporarily form an alliance to solve the problem. After the situation that the alliance solution work is finished, the alliance will be automatically dissolved after the completion of the task by using the function agent to transmit its information back to the blackboard for summary, and finally feedback to the corresponding Agent interface and transfer it to the user.

In the blackboard system, Agent extracts and exchanges information from the common areas provided by the blackboard. It is suitable for communication with low frequency and large capacity. The mode of communication that accords with the negotiation and cooperation discussion process of decision-making plan in sports training management.

## 4. SYSTEM DESIGN AND IMPLEMENTATION

### 4.1 Design

In the management and decision-making system of college students' physical training based on Multi-Agent, the object-oriented model is used to represent the model base. Several models can be stored and managed as an object, and the interface matching with the knowledge base system is provided.

The function of the model base system:

1. It has the ability to express and deal with knowledge, and can effectively provide the construction and manipulation of the model system, the knowledge in the field of sports training and the experience of decision makers.
2. Provide the basic method of model manipulation and the best selection strategy.
3. Ability of learning and self-analysis.
4. Provide the phase separation mechanism between models.
5. Provide the explanation mechanism of the final result of the model.

The first step is to do a good job in the construction of the basic structure of the knowledge base, and then according to the knowledge provided by sports experts, absorb and extract the rules and store them in the knowledge base system. The knowledge base is mainly used to store the rules related to decision-making, and each rule will be automatically or artificially added a weight coefficient, and when the knowledge rules work, there will be many rules that meet the corresponding conditions. at this time, we will extract the rules with the highest weight coefficient for reasoning in order to solve the conflict phenomenon of the matching problem. While the production rules are stored, the new rules generated in the decision-making process are also stored in the knowledge base. Knowledge is classified according to different topics for decision-making use.

## 4.2 The Training Design

The data in the sports training management system mainly come from the student information management system of a school, the sports performance management system of the clothing college, the sports training plan database, the sports project database and so on. The model is divided into prediction and optimization model, case clustering model, regression model, EMSR model and so on. There are prediction plan rules in the rule base. For example, the rules of comprehensive evaluation of physical fitness, the rules of sports training means, the rules of intermittent arrangement of physical training, and so on. The decision-making and analysis process of plan formulation and implementation is as follows:

1. Collect the basic physical fitness data and standard test data of 40 students in the class, and input the time schedule of the training plan into the interface. The weekly training plan is still a semester training plan, a phased plan or a continuous plan, and there is also a specific schedule for classes. The basic physical fitness data and standard test data of 40 people are stored in the database, the time arrangement data are temporarily stored in the blackboard, and corresponding rules are formed to guide the generation of the training plan.
2. After the interface Agent transmits the plan information request to the blackboard control Agent, the blackboard control decomposes the problems to be dealt with one by one into several sub-problems, such as physical fitness evaluation, training plan arrangement, training time arrangement and so on, according to the rules of knowledge base and cooperation. Then these sub-questions are handed over to the physical fitness evaluation function Agent, training plan arrangement function Agent, training time arrangement function Agent and so on.
3. Each function Agent classifies the tasks transmitted from the blackboard, classifies them according to the needs of the tasks, and divides them into several small tasks that can be completed independently by Agent. For example, the physical fitness evaluation function Agent can be divided into height, weight, vision, coordination, heart rate, vital capacity, grip strength and other small tasks, and then handed over to the corresponding decision-making Agent to make decisions.
4. Each functional Agent feeds back the sub-results of decision-making Agent reasoning to the blackboard, which is summarized in the unit, and the sub-results such as height, weight, eyesight,

coordination, heart rate, vital capacity, grip strength, the best method of physical fitness evaluation, the best training plan arrangement and the best training time are summarized into a total result, and finally displayed to the planner in the form of a solid table through the interface Agent. And give the corresponding explanation.

5. RESULT EVALUATION

5.1 Experimental Setup

In order to verify the feasibility and effectiveness of the proposed algorithm, the algorithm is used to analyze the performance of video action recognition through simulation experiments. in the simulation experiment, 10 athletes were selected and each athlete was asked to demonstrate various simple sports movements, and a total of 600 sports action videos were obtained. each action video randomly contains a group of fixed 5 actions. It consists of walking, running, bending, squatting and sitting. In the experiment, 400 actions are divided into training sets, and the remaining 200 action videos are used as test sets. in order to complete the horizontal comparison of the action recognition algorithm.

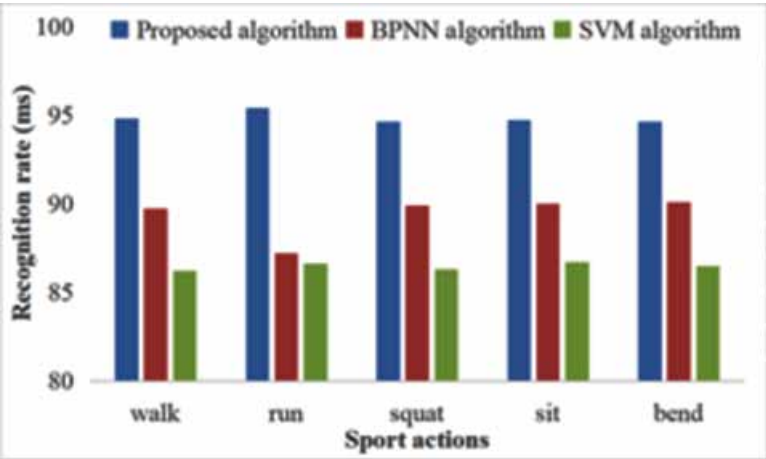
In this paper, the main fluid video action recognition algorithm BP Neural Network (BPNN) (Cui et al. 2019) is compared with Gaussian mixture model (Gaussian Mixture Model, GMM) and support vector machine (SVM) (Cervantes et al. 2020). BPNN algorithm for sports action recognition to build a three-layer BP neural network, when optimizing neural network parameters. The population of BPNN algorithm is set to 40, each particle dimension is 20, and the iteration is 1000 times. The mixed model of five Gaussian models is constructed for the action video frame by the GMM inverse SVM algorithm, and then the radial basis function is selected in the SVM classifier, and the penalty parameter and kernel function parameter are 0.01 and 0. 2.

5.2 Experimental Results

Figure 3 shows the comparison results of the average recognition rate of sports video actions including the walk, run, squat, sit and bent, that is, five action types. From the results in figure 3, we can see that:

- 1. The proposed method in this paper is better in expression, and the recognition rate of the hybrid kernel method is higher than that of the traditional machine learning methods such as BPNN and SVM, which effectively reduces the error recognition rate. The hybrid kernel method uses

Figure 3. Recognition rate of different algorithms



**Table 1. Recognition time of different algorithms (ms)**

Sport actions	Proposed algorithm	BPNN algorithm	SVM algorithm
walk	289	317	356
run	277	298	323
squat	258	273	298
sit	299	319	347
bend	328	379	445

linear kernel function and radial basis function respectively. The local action difference and the whole action outline needed for sports recognition are obtained.

2. Compared with the traditional Gaussian mixture model, the fusion invariance feature integrates more dimensional features and expresses the key features of distinguishing actions. in fact, in the original features of sports action recognition, there are more repetitive features and useless features, which will have a negative impact on the classifier. therefore, after using Gaussian mixture model to construct fusion invariance features, this paper uses Gaussian mixture model to construct fusion invariant features. By means of projection dimension reduction, the key features to distinguish different actions are extracted from the fusion invariant features. the classification is completed through these features, which greatly improves the result of video action recognition.

In addition, Table 1 shows the average recognition time of the three contrast algorithms in five common sports movements, such as walking, running, squatting, sitting and bending. From the statistical results in Table 1, it can be seen that the recognition time of the fusion invariance feature and the hybrid kernel method proposed in this paper is the shortest. Although the fusion invariance feature calculates a large number of Gaussian mixture models and their gradient features. However, after the dimension reduction of projection transformation, the dimension of fusion invariance features is greatly reduced, so the time complexity of hybrid kernel method is lower. The classification efficiency of hybrid kernel method is significantly higher than that of traditional SVM and BPNN methods, and it can complete real-time online video action recognition and meet the needs of practical applications.

## 6. CONCLUSION

In this paper, we have discover that it becomes very difficult for college sport education teachers to work out on a scientific and effective training plan according to the actual situation of students, when required to be combined with multi-agent technology. Hence, this paper designs a management and decision-making system for college students' physical and sport training. This work can tailor a scientific and effective training plan for college students and it has a certain application value in the management of college sports training. The experimental results indicate that this work can achieve higher training rates.

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