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Research Article

Influence of Intelligent Internet of Things Technology on Taekwondo Athletes' Competitive Ability

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To maintain an advantage in the development of competitive sports, a country should explore the gap between Taekwondo athletes and other elite athletes. By comparing and analyzing to find out the reasons, it can create favorable conditions for the project and strive for greater advantages, which is the top priority for the project to develop. The purpose of this paper is to use the intelligent Internet of Things technology to analyze the factors affecting the competitive ability of Taekwondo athletes. Aiming at the competitive ability of Taekwondo, it analyzes the three aspects of psychological ability, technical ability, and tactical ability to construct a model of Taekwondo athletes' competitive ability. And for the indicators in the model, the intelligent Internet of Things technology is used to detect them in real time to achieve the best model construction effect. The experiment of this paper found that the competitive ability model of Taekwondo athletes' combining psychological ability, technical ability, and tactical ability is relatively successful. The Taekwondo competitive ability of athletes based on model analysis is almost the same as the competitive ability scored by experts, and the error is within 5%. It shows that psychological ability, tactical ability, and technical ability have important influence on the competitive ability of Taekwondo.

1. Introduction

In recent years, due to the adjustment of the Taekwondo arena and the revision of the competition rules, competitive competitions have begun to encourage athletes to attack. Particularly in the revision of the rules in 2017, the change of directly adding points to the opponent made the athletes pay more attention to the timing of the attack, which also puts forward higher requirements for the competitive ability of the world's outstanding taekwondo athletes. In competitive taekwondo competition, using reasonable techniques to attack is an important way to get the score. Only on the basis of mastering various techniques and tactics can athletes conduct effective attacks and win the game. Moreover, by analyzing the influencing factors of competitive ability, it is possible to improve or train the places with greater influence in a targeted manner, which can effectively improve the competitive level. Therefore, it is particularly necessary to analyze the influencing factors of Taekwondo's competitive ability.

The research on athletic ability is particularly important to the development of sports. With the increasing importance of sports in China, there are more and more studies on athletic ability. Camagni applied the competition model of global economy to the competition model of Taekwondo and constructed a novel competition model of Taekwondo [1]. Buser et al. found that boys are more likely than girls to choose to compete, and they explained the gender differences in this competitiveness [2]. Vendrell-Herrero and Wilson explained the competitive ability from the policy formulation [3]. Cohen and Tubb drew on the competition model of environmental regulation to study the physical training of athletes [4]. Although the "North American School" rarely sees a complete competitive sports theory, it is based on the characteristics of athletes' competitive practice at different levels, mainly from the perspectives of biology and sports medicine, and studies the molecular biological mechanism and physiological system of athletes' bodies, as well as the working mechanism of athletes, biomechanical diagnosis and analysis of technical movements, psychological characteristics of athletes and their interventions, basic principles of load stimulation and stress, and specific problems in training and competition practice, such as reaction, fatigue recovery, and sports nutrition, sports rehabilitation, and injury prevention and treatment [5, 6]. However, the theory they put forward is too general, and few studies are aimed at the competitive ability of Taekwondo.

Taekwondo, as a popular, highly appreciated, and competitive sport, has many studies on it. The purpose of Kimberly's study was to find out whether Korean Taekwondo martial arts training is beneficial to undergraduate students (UG) in dealing with psychological stress [7]. Ardalan et al. aimed to determine the anthropometric attributes of judo, karate, and Taekwondo athletes. Through the follow-up survey analysis of 180 athletes in the United States, they determined the indicators of the physical tree measurement of athletes [8]. Su et al. aimed to explore the effects of Taekwondo training on children's cognitive function and academic self-efficacy [9]. Cho et al. distributed a self-completed questionnaire to 401 adolescents over the age of 10 to explore the overall effect of Taekwondo on physical health [10]. Jung and Song aimed to investigate the effects of Taekwondo training on abdominal fat and bone metabolism in obese adolescents [11]. Chang and Hwang aimed to develop an acceptance and commitment therapy- (ACT-) based intervention program for adolescent Taekwondo athletes [12]. However, the content of relevant research pays more attention to Taekwondo exercise and the impact of Taekwondo exercise on physical health, and there is a lack of research on Taekwondo competitive ability.

Expert survey results show that the average score of psychological ability is 4.8 points, the average score of technical ability is 4.9 points, and the average score of tactical ability is 4.9 points. This shows that the indicators selected in the construction of the competitive ability model in this paper are more effective and can be used to evaluate the competitive ability of Taekwondo athletes. The innovation of this paper is as follows: For the detection of model indicators, using the intelligent Internet of Things technology, this paper designs an RFID dynamic detection algorithm. For the algorithm in this paper, in the experiment, it is compared with traditional algorithms, such as FAST, and the throughput rate and time slot are analyzed. It is found that the algorithm in this paper can effectively detect the index data constructed by the model.

2. Ability Monitoring of Taekwondo Athletes Based on Intelligent Network Technology

2.1. Competitive Ability of Taekwondo Athletes. There are more and more competitive Taekwondo athletes, more and more attention is paid to competitive competitions, and the game is more and more enjoyable to watch. The competitive ability of the world's top Taekwondo athletes in the competition is directly related to the victory or defeat of the whole game. Therefore, it is necessary to study the competitive ability of the world's top Taekwondo athletes [13, 14]. Taekwondo techniques and tactics are the core part of Taekwondo's competitive ability and are also the basis of other elements of competitive ability. The research on Taekwondo athletes' competitive ability should start with techniques and tactics. Competitive taekwondo competition is ultimately a test of athlete's scoring ability, and the one with the highest score within the specified time wins. To this end, the athletes on both sides will use various offensive behaviors, such as attacking, counterattacking, or counterattacking. It is not difficult to see the importance of competitive ability in taekwondo competition. Then, how to measure the competitive ability of a world-class taekwondo athlete is very important [15]. At present, there is no clear definition of the concept of taekwondo athletes' competitive ability, and there is no evaluation index and evaluation standard for the world's outstanding Taekwondo athletes' competitive ability. This article will analyze the competitive ability of the world's outstanding Taekwondo athletes from the perspective of technical and tactical methods, screen the competitive ability indicators, collect indicators through video playback, and establish individual scoring standards and grade evaluation standards.

As shown in Figure 1, in the process of Taekwondo sports training or competition, the physical quality of Taekwondo players has a decisive impact on the competition performance. For Taekwondo players, the level of their own balance ability has an important influence on their performance of technical movements on the one hand, and on the other hand, on this basis, the stable performance of various skills of athletes during the competition will directly affect the final ranking of the sport [16]. Muscle strength in the core region was first proposed by European and American experts and researchers, who applied it to experiments on bodybuilding plasticity and exercise recovery after sports injuries. After a period of development, muscle strength in the core area was further simplified as core strength and began to be introduced into sports-related research. As far as the current situation is concerned, China's research on muscle strength in the core area is still at the beginning level, and related research can only be imported from abroad, and no self-independent system has been formed at all, let alone a wider scope. Judging from the current research literature, many experts and scholars believe that the core area refers to the position of people's waist and abdomen, mainly including people's waist muscles and hip muscles. Core strength is the muscle power produced by the muscles in the core area of the human body. Core strength training can maintain the stability of the body during exercise, improve the power transmission capacity of the kinematic chain during the body movement, and reduce the probability of injury, thereby contributing to the improvement of sports performance [17]. Therefore, if you want to achieve excellent results in Taekwondo sports, athletes must have good physical fitness. On this basis, athletes' ability to balance and control their bodies during competition or training directly affects their athletic performance, as shown in Figure 2.

2.2. IoT Health Monitoring Model. Radio Frequency Identification (RFID) has a unique ID in the world, so the RFID system can transmit a signal within a certain frequency to

Figure 1: Some classic movements of Taekwondo.

Figure 2: Influencing factors of competitive ability.

quickly identify the ID [18]. It can not only greatly reduce the time-consuming of the algorithm, but also alleviate the influence of factors such as line-of-sight detection and the environment, so it is widely used in identity recognition in life. RFID technology can use radio frequency signals to collect tag information noncontact in a specific frequency band, and the signal can be propagated through non-line-of-sight. In addition, RFID tags have the characteristics of low price, light weight, and

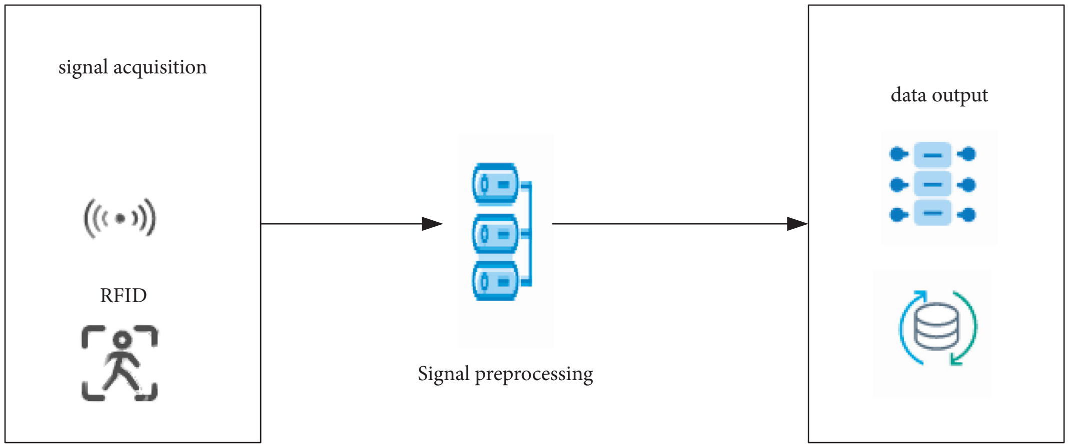


Figure 3: RFID identification process.

large information storage space [19], and are often used in supermarkets, libraries, and other places.

RFID-based monitoring systems are improving people's way of life. According to whether the monitored target needs to wear any related facilities, the monitoring technology is further subdivided into two categories: contact and non-contact. However, the actual situation is that the multipath information is different in different places, and the signal will be reflected to different degrees by different objects, thereby presenting different multipath information. Therefore, this technique can only achieve high-precision recognition in the training environment.

As shown in Figure 3, RFID electronic tags are unique in the world due to a built-in ID code, so they have also been developed in the field of wearable devices. At present, most wearable device research and development companies build RFID tags into wearable devices to realize functions such as mobile payment, bus card swiping, and smart access control. If the RFID electronic tag can be used in the sports testing process of athletes, the identity of the athlete can be bound, and the authenticity of sports testing data can also be guaranteed to a certain extent. It can be seen from the above that with the rapid development of wearable technology and the urgent requirements of current athletes' physical health. In this paper, an athlete's fitness monitoring bracelet is designed that combines various functions of physical health data collection and effective identity matching. It can collect real-time data from athletes' exercise process and centralized testing in various aspects so as to reduce accidents during exercise and prevent data fraud during sports testing [20].

In reality, the body's movement process can generate a variety of data, including exercise time, exercise speed, distance, creatine, and calories. If these data can be efficiently and accurately monitored, the purpose of guiding and adjusting the exercise of athletes can be achieved, and the physical quality of athletes can be improved. In addition, through real-time monitoring of athletes' daily activities, unexpected situations that may occur due to excessive exercise during exercise can be prevented in time, and the occurrence of tragedies during exercise can be minimized. Wearable devices are popular at home and abroad as a device that can monitor human body movement. They can continuously collect data such as movement speed, calories, and sleep status through various sensor chips installed inside them. The main function of the earliest wearable devices is step counting, which can help people count the total number of steps in walking, running, and other sports in a day, and then calculate the distance and calories burned according to related algorithms. With the rapid development of sensor technology and the gradual deepening of kinematics research, smart sports bracelets integrating heart rate sensors, temperature sensors, acceleration sensors, and so on have entered daily life. The new smart sports bracelet not only adds a variety of sports modes to the traditional step counting function, such as walking, running, and swimming, but also provides new functions, such as heart rate detection, body temperature detection, and sleep depth detection. These new smart sports bracelets are not only easy to carry, but also provide people with effective sports information in real time. It can help people plan scientific exercise methods and achieve the purpose of exercising to improve human immunity.

In view of the above shortcomings of the existing monitoring technology, this paper aims to use the RFID system to achieve target monitoring. Even though some related research scholars have designed some monitoring systems using RFID equipment, most of them are designed for equipment-related target monitoring. In addition, a rest interval for user activities is forced; otherwise, the start and end of activities cannot be recognized, which brings certain limitations.

2.3. RFID Anticollision Algorithm Based on Equal-Area Division. When using RFID technology to obtain information such as the positions and movements of Taekwondo athletes, since a tag may be accepted by multiple readers, or a reader has multiple tag responses, the RFID anticollision algorithm should be designed. Aiming at the shortcomings of existing algorithms, this chapter proposes an RFID collision avoidance algorithm (BEAD) based on equal-area division as an RFID collision avoidance algorithm for health monitoring bracelets.

2.3.1. Basic Definition. First, the maximum power recognition range of the reader is determined, and the tags within the recognition range are grouped equally. The number of labels identified each time is limited, and the existing label estimation algorithm is optimized. On the basis of analyzing the number of labels and time slots, the optimal time slots are adjusted so that the number of labels estimated each time corresponds to the time slots, thereby improving the system throughput. The specific probability is expressed as follows:

$$P(X=k)=C_m^k\cdot\left(\frac{1}{T}\right)^k\cdot\left(1-\frac{1}{T}\right)^{m-k}. \tag{1}$$

In the equation, $k\in[0,m]$ and k are rounded; take $k=-1$, and calculate the probability of one-to-one label selection:

$$P_g=P(X=1)=C_m^1\cdot\left(\frac{1}{T}\right)^1\cdot\left(1-\frac{1}{T}\right)^{m-1}=\frac{m}{T}\cdot\left(1-\frac{1}{T}\right)^{m-1}. \tag{2}$$

The same can be obtained:

$$P_l=P(X=0)=C_m^0\cdot\left(\frac{1}{T}\right)^0\cdot\left(1-\frac{1}{T}\right)^{m-0}=\left(1-\frac{1}{T}\right)^m. \tag{3}$$

Then, $k\geq 2$ at that time; a one-to-many label is expressed as follows:

$$\begin{aligned}a_g^{T,m}&=T\cdot P_g=m\left(1-\frac{1}{T}\right)^{m-1},\\ a_l^{T,m}&=T\cdot P_l=T\left(1-\frac{1}{T}\right)^m,\\ a_e^{T,m}&=T\cdot P_e=T-a_l^{T,m}-a_g^{T,m}.\end{aligned} \tag{4}$$

The specified system throughput rate is 1:

$$S_{RFI\ D}=\frac{a_g^{T,m}}{T}=\frac{m}{T}\left(1-\frac{1}{T}\right)^{m-1}. \tag{5}$$

Derivation of (6) gives

$$\frac{ds}{dm}=\frac{1}{T}\cdot\left(1-\frac{1}{T}\right)^{m-1}+\frac{m}{T}\cdot\left(1-\frac{1}{T}\right)^{m-1}In\left(1-\frac{1}{T}\right), \tag{6}$$

$$T=\frac{1}{1-e^{-1/m}}\approx\frac{1+m^{-1}}{1+m^{-1}-1}=m+1. \tag{7}$$

In practice, a small error is usually required, and the derivative with respect to ξ yields a minimal value:

$$\partial\frac{\varepsilon^2}{k}=2\left[\xi T_{e(n)}-2.3922T_{e(n)}\right]T_{e(n)}. \tag{8}$$

The dynamic prediction weights are

$$\xi=\frac{2.3922\cdot T_{e(n+1)}}{T_{e(n)}}. \tag{9}$$

Substituting ξ into (9), the number of predicted labels in the next round is

$$m=\frac{2.3911\left[T_{e(n)}\right]^2}{T_{e(n-1)}}. \tag{10}$$

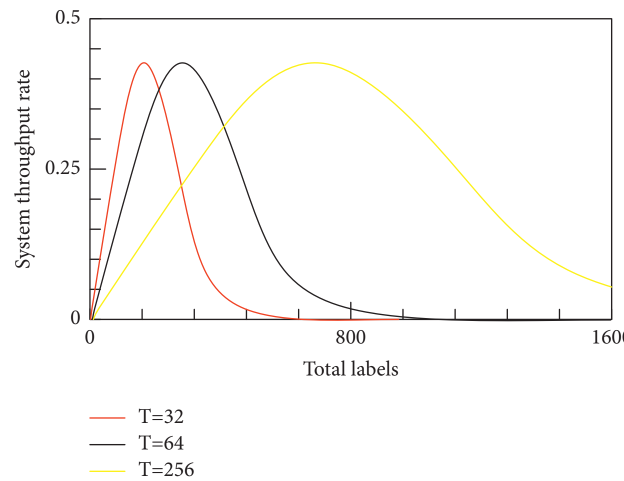


Figure 4: The relationship between the number of tags and the throughput rate.

2.3.2. Adjustment of the Optimal Number of Time Slots. Since the cost of labels is limited by hardware conditions, the number of time slots cannot be allocated arbitrarily, so it is necessary to optimally group labels on the basis of label estimation and dynamically adjust the number of time slots on this basis to further improve the system throughput.

Figure 4 shows the influence trend of the increase in the number of tags on the change of the system throughput under different fixed time slot numbers. It can be seen from the figure that the intersection of the number of two adjacent time slots is the critical point where the number of tags affects the change of the system throughput. The number of adjacent two fixed time slots is substituted into equation (12) to obtain the number of labels corresponding to the number of time slots, and the critical point of the grouping is further obtained. The throughput relationship between the number of adjacent time slots can be expressed as follows:

$$S_1=S_2=\frac{m}{T}\cdot\left(1-\frac{m}{T}\right)^{m-1}=\frac{m}{2T}\cdot\left(1-\frac{1}{2T}\right)^{m-1}. \tag{11}$$

Substitute the entire set of numbers into equation (11) one after another starting from 1 to get

$$m=1+\frac{In2}{In[(2T-1)/(2T-2)]}. \tag{12}$$

For example, when $T=2^2$, take $m=5$; then, 5 is the maximum number of labels when the number of time slots is 2^2, and the grouping results are listed in Table 1.

2.3.3. Algorithm Performance Analysis. In the simulation experiment, it is assumed that the labels are distributed uniformly, the number of system labels is set to 1500, and the initial time slots of the BEAD algorithm, FSA_256 algorithm, and DFSA algorithm are all set to 256. To increase the authority of the test results, let the number of tags start from 50 until the total number of tags increases to 1500. In order to analyze the effectiveness of the BEAD algorithm, the simulation results of each change are recorded, and the

Table 1: Correspondence between time slots and number of packets.

Number of time slots t	2^2	2^4	2^6	2^8	2^8	2^8
Minimum number	1	10	40	160	300	700
Labels maximum number	5	20	80	320	600	1400
Labels grouping number n	1	1	1	1	2	4

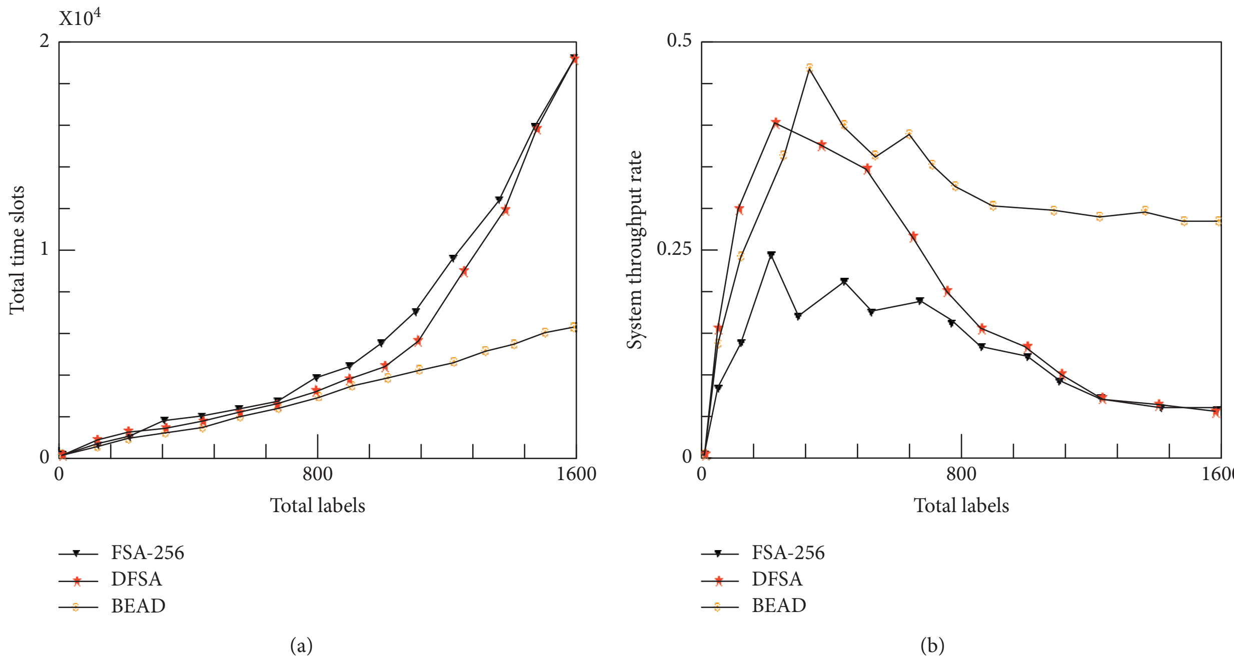


Figure 5: Algorithm performance analysis. (a) Comparison of total time slots. (b) Comparison of throughput.

average of each simulation result is taken. The results are shown in Figure 5. It can be seen that the performance of the algorithm designed in this paper has great advantages in total time slots and throughput.

3. Construction of Athlete Competitive Ability Model

3.1. Indicator Selection. By interviewing relevant experts, reviewing documents, watching video replays, and so on, combined with the components of competitive ability and the characteristics of Taekwondo, this paper determines the primary selection indicators on the basis of previous research. The selected primary selection indicators have relevant literature as reference. In this study, the integrated data and related systems are decomposed into elements, and the decomposed elements are used as evaluation indicators.

The competitive ability of the world's top Taekwondo athletes is composed of many factors, and each factor contains secondary and tertiary indicators. In order to reflect the competitive ability of Taekwondo athletes through indicators, it is necessary to find out all the constituent factors and the indicators contained in them. This requires that the indicators cover a wide range, the content of the indicators should be specific, and the indicators should be operational. In view of the suggestions obtained from the expert interviews, starting from the three dimensions of technical ability, tactical ability, and psychological ability, it is most appropriate to study the competitive ability of the world's top Taekwondo athletes in combination with the athletes in the competition.

Taking into account the characteristics of competitive Taekwondo, combined with relevant research on the technical statistics of fighting projects, it is found that technology and tactics cannot be separated in terms of reflecting competitive ability. In the game, questions such as which technique to use and whether the technique needs to be combined all reflect the tactical ability of the athlete. At the same time, tactical capabilities serve technology. Therefore, Taekwondo techniques and tactics should be fully considered when studying the competitive ability of Taekwondo athletes. Combined with the advice of interview experts, the technical statistics and analysis of Taekwondo projects, and the requirements for quantitative processing of evaluation indicators, this paper will select indicators from the perspective of technical ability and tactical ability and select the quantifiable indicators as the last-level indicators.

Combined with relevant literature and expert advice, this study collects the indicators of the competitive ability evaluation index system of athletes in other sports and then draws on relevant knowledge such as sports training and sports measurement to integrate and classify the extracted indicators. Finally, strictly following the construction principles of scientificity, comprehensiveness, objectivity, operability, and simplicity in establishing the competitive ability evaluation index system of world outstanding Taekwondo athletes, the primary selection index was determined. The experts interviewed include college Taekwondo teachers, Taekwondo referees, and front-line coaches from various cities (the coaches have more than ten years of teaching experience and the students have won the first place in competitions at or above the municipal level). The details of the experts are shown in Table 2.

The initial selection of indicators includes two first-level indicators of technical ability and tactical ability, and four second-level indicators of technical use times, technical scores, tactical use times, and tactical scores, as well as 18 three-level indicators including the number of straight punches, the number of horizontal kicks, the score of straight punches, and the number of active offensive tactics. The details of the primary selection indicators are shown in Table 3.

3.2. Indicator Selection Results

3.2.1. Survey and Analysis of First-Level Indicator Experts. Expert survey results show that the average score of psychological ability is 4.8 points, the average score of technical ability is 4.9 points, and the average score of tactical ability is 4.9 points. It is generally considered that indicators with an average score of less than 3.5 are inappropriate indicators and should be considered for replacement or deletion under the advice of experts. Obviously, experts believe that it is appropriate to study the competitive ability of competitive Taekwondo athletes from two aspects of technical ability and tactical ability. The survey statistics of the first-level indicator experts are shown in Table 4.

3.2.2. Survey Results and Analysis of Secondary Indicators Experts. The secondary indicators of the primary selection include four items: the number of technical uses, the technical score, the number of tactical use, and the tactical score. Expert survey results show that the average score of technical use is 4.6 points; the average score of technical score is 4.8 points; the average score of tactical use is 4.4 points; and the average score of tactical score is 4.2 points. The average scores of the four secondary indicators are all greater than 3.5 points. As can be seen from Table 5, experts believe that it is appropriate and desirable to study the athletic ability of athletes from the two aspects of the number of technical and tactical use and the score. At the same time, the number of tactical use and the score of tactical score are lower than the number of technical use and technical score.

3.2.3. Survey Results and Analysis of Experts on Three-Level Indicators. There are 18 third-level indicators in the primary selection indicators. Due to the continuous refinement of the indicator system, the selection of indicators should be more specific and more operable; the results of the expert survey are shown in Figure 6.

Table 2: Details of experts.

Name	Job title
Li	Professor
Wang	Professor
Sun	Associate professor
Cai	Lecturer (outstanding athlete)
Sand	Lecturer (outstanding athlete)
Hu	First class referee
Ouyang	Secondary referee
Xie	Secondary referee
Yellow	Head coach
Money	Head coach

Experts put forward suggestions for modification and addition of certain indicators. For example, some experts pointed out that the turning technique includes three techniques: back kick, whirlwind kick, and back spin kick. The importance, usage habits, and scores of these three technologies are different, and it will be more complete to list these three technologies separately. Some experts pointed out that there is a lack of hook kick technology in the index system. Although hook kick technology is not used much in competitions, hook kick technology is also a part of reflecting the athletic ability of athletes. Indicators such as the number of hook skills used and the score of hook skills should be increased.

3.2.4. Coefficient of Variation Analysis. This round of expert questionnaire survey uses WPS Office XLS and statistical software SPSS19.0 to build a database, calculate the standard deviation and mean of each index, and finally obtain the coefficient of variation of each index. The coefficient of variation is used to observe the degree of dispersion of the data. It is generally believed that the coefficient of variation is greater than or equal to 0.15, and the expert coordination of this level of indicators is not enough, and the issue of whether to delete the indicators affecting the coefficient of variation should be considered, as shown in Table 6.

The calculation method of the coefficient of variation is standard deviation/average. After calculation, the average coefficient of variation of the indicators at all levels is obtained. Through the statistics of the coefficient of variation of the indicators at all levels, it can be found that the average coefficient of variation of the indicators at all levels is less than 0.15, which meets the basis for the selection of indicators in this study. Therefore, the indicators formed by consulting materials, interviewing experts, and watching videos were finally determined through two rounds of expert questionnaires and constituted the evaluation index system of the competitive ability of the world's outstanding Taekwondo athletes.

In this paper, the Delphi method is used to determine the weights of each indicator, and the second round of expert questionnaires is conducted. In the expert questionnaire on the importance of the evaluation index of the competitive ability of the world's outstanding Taekwondo athletes, the experts make statistics on the importance of the index and then substitute the statistical data into the weight calculation

Table 3: Evaluation indexes of competitive ability of world excellent Taekwondo athletes.

First-level indicator	Secondary indicators	Three-level indicator
A mental ability	A1 is in a good mood	Good mentality before A11
		Good mentality in A12
		Good mentality after A13
	A2 is in very poor mental state	A21 was in poor mental state before the game
		Poor mental state in A22
		A23 mental state is very poor after the game
B technical ability	Number of times B1 technology is used	Number of times B11 straight punches are used
		Number of times B12 kicks are used
		B13 number of times of use of downslash
	B2 technical score	B21 straight punch use score
		B22 cross kick to use the score
		B23 down hack use score
C tactical ability	C1 tactical uses	C11 offensive tactics used
		C12 counterattack tactics used
		C13 counterattack tactical uses
	C2 tactical score	C21 offensive tactical score
		C22 counterattack tactical score
		C23 attack tactical score

Table 4: Statistics of the first-level indicator expert survey.

	Mental capacity	Technical skills	Tactical ability
Very suitable	8	9	9
Suitable	2	1	1
Generally	0	0	0
Inappropriate	0	0	0
Very inappropriate	0	0	0
The average score	4.8	4.9	4.9

Table 5: Statistical table of secondary indicator expert survey.

	Good mental state	Poor mental state	Technology usage	Technical score	Number of tactical uses	Tactical score
Very suitable	7	9	9	8	7	8
Suitable	3	1	1	1	2	2
Generally	0	0	0	1	1	0
Inappropriate	0	0	0	0	0	0
Very inappropriate	0	0	0	0	0	0
The average score	4.7	4.9	4.9	4.7	4.6	4.8

formula for calculation. Finally, the weight coefficients of the indicators at all levels are obtained, and the calculation formula is the weighted average divided by the sum of the weighted averages.

3.2.5. Indicator Weight Analysis. Figure 7 shows the weight of the world outstanding Taekwondo athlete's competitive ability evaluation index in reflecting the world's outstanding Taekwondo athlete's competitive ability, which constitutes the world's outstanding taekwondo athlete's competitive ability index weight model. Among them, "data weight" is obtained by calculating the scoring results of expert surveys and represents the weight coefficient of indicators at all levels relative to the indicators at the previous level. "Final weight" refers to the proportion of indicators at all levels relative to the overall goal of the world's outstanding Taekwondo athletes' competitive ability.

Data weights are used to calculate individual scoring standards and comprehensive scoring standards and to formulate scoring standards for the competitive ability of world-class Taekwondo athletes. The weights of the first-level indicators of technical ability and tactical ability are 0.5333 and 0.4667, respectively. It can be seen that the importance of technical ability is greater than that of tactical ability. The final weight is used to observe the proportion of each three-level indicator in the entire indicator system. The overall proportion of the number of straight punches is 0.0294, which may be because the number of punches used in the game is far less than that of the leg technique, and the attack efficiency and score of the straight punch are not as high as those of the leg technique. The largest proportion of the total score of the back spin kick is

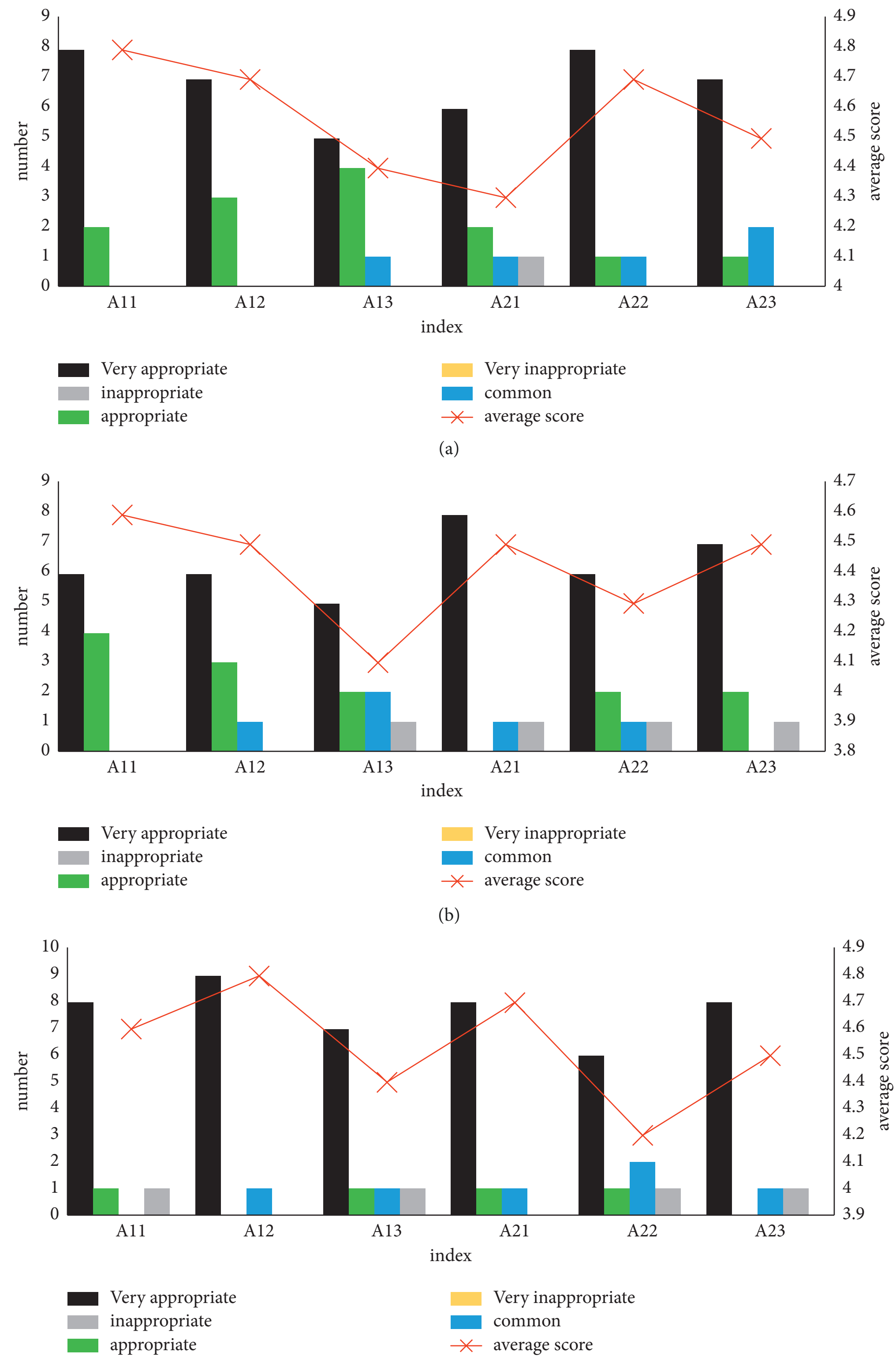


Figure 6: Statistical chart of expert survey on three-level indicators. (a) Statistical chart of expert survey of three-level indicators of psychological ability. (b) Statistical chart of expert survey on three-level indicators of technical ability. (c) Statistical chart of expert survey of third-level indicators of tactical ability.

Table 6: Statistics of coefficient of variation of the second round of expert questionnaires.

Indicator level	Mean coefficient of variation
First-level indicator	0.0901
Secondary indicators	0.1301
Third-level indicator	0.1305

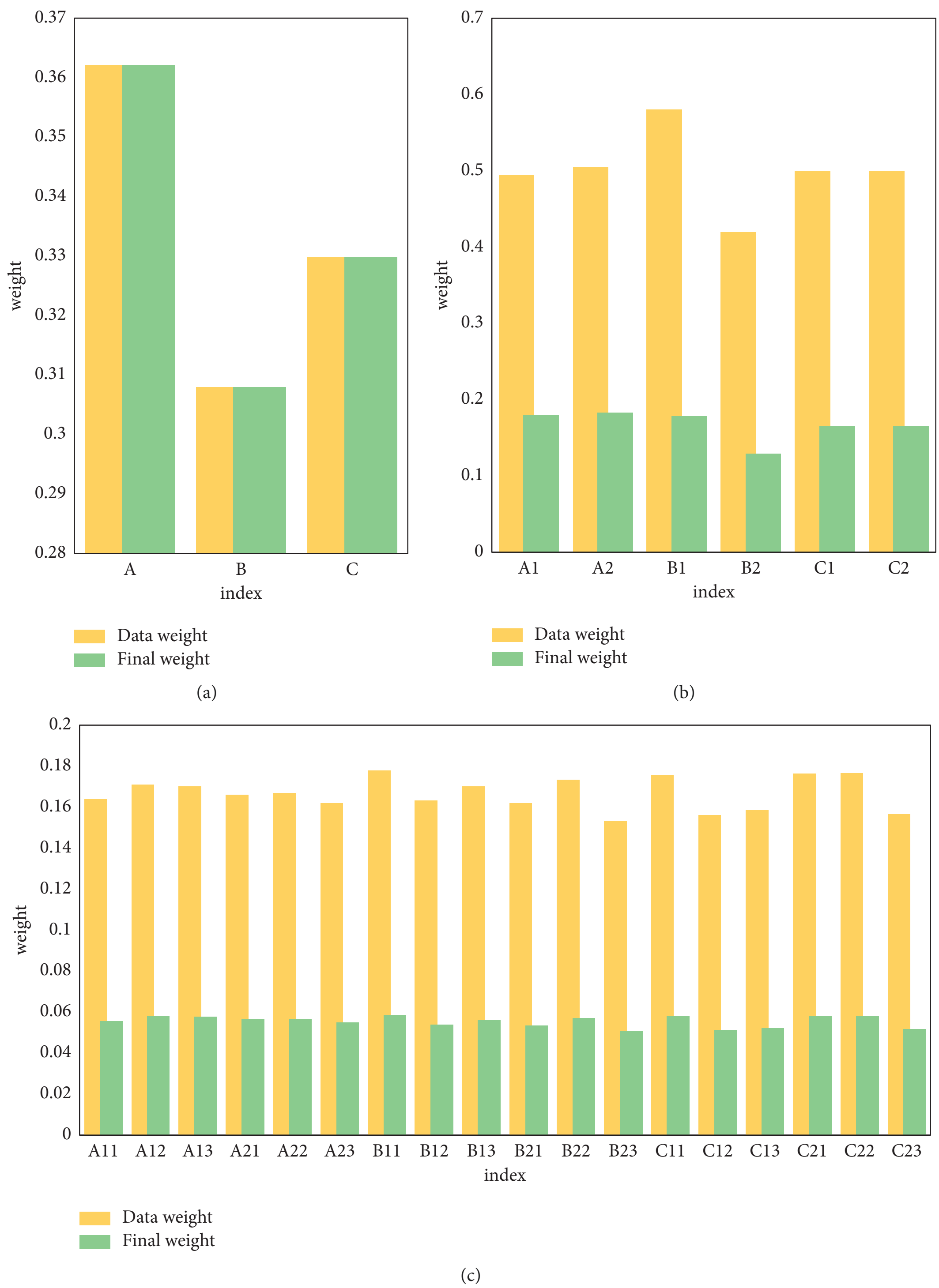
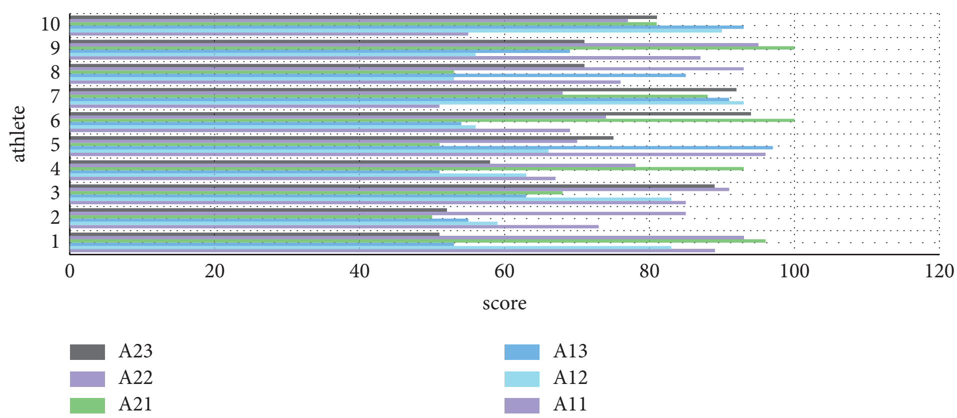


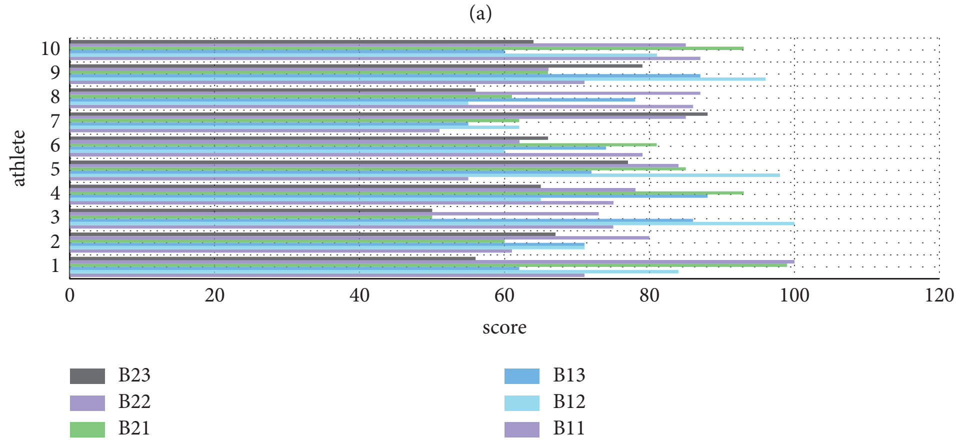
Figure 7: Weights of competitive ability evaluation indicators. (a) Primary indicator. (b) Secondary indicator. (c) Three-level indicators.

Table 7: Details of elite athletes at all levels.

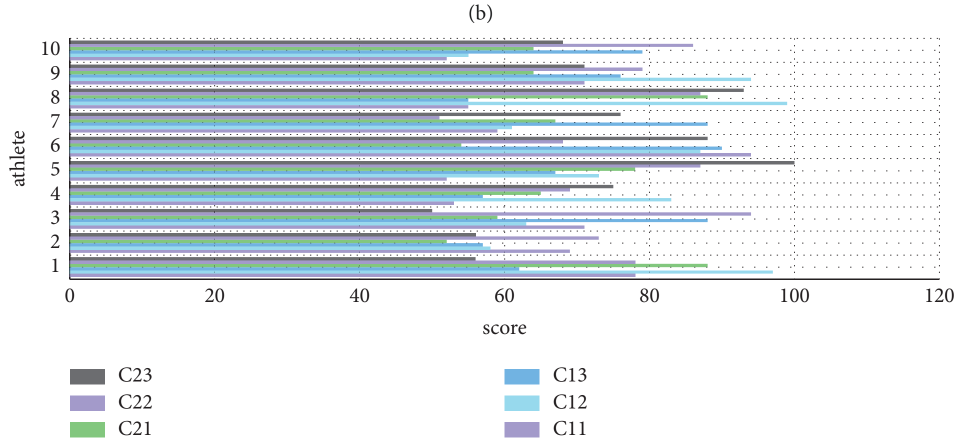
Gender	Level	Numbering
Female	46 kg	1
	53 kg	2
	62 kg	3
	73 kg	4
	Above 73 kg	5
Male	54 kg	6
	63 kg	7
	74 kg	8
	87 kg	9
	Above 87 kg	10



(a)



(b)



(c)

Figure 8: Analysis of the competitive ability of ten athletes. (a) Athlete mental ability score. (b) Athlete technical ability score. (c) Scoring of athlete's tactical ability.

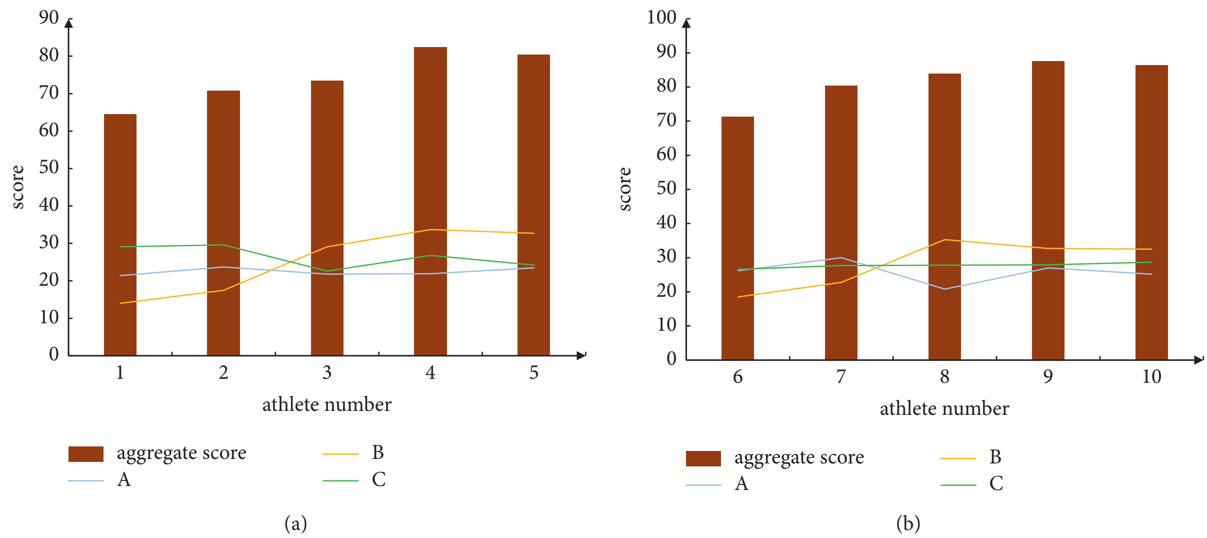


FIGURE 9: Competitive ability ranking. (a) Competitiveness of female athletes. (b) Men's athletic ability.

0.0440, mainly because the current rules support and advocate the use of difficult legwork and turning techniques for athletes with high concealment and high lethality. The technical score of the backspin kick is not only high, but also hitting the head position can easily cause the opponent to lose their will, thus gaining an overwhelming advantage.

3.3. Evaluation Results of Competitive Ability of Taekwondo Athletes. In order to verify the effectiveness of the evaluation indicators, this paper is divided into two experiments to verify. The first experiment is the evaluation of the competitive ability of the world's elite athletes. Through video analysis and expert evaluation analysis, the mental ability, technical ability, and tactical ability of the selected ten world-class Taekwondo athletes were judged, and the competitive ability of the athletes was divided through the index model.

In the second experiment, 10 random students from a class in a martial arts school were selected. Through field tests, their mental ability, technical ability, and tactical ability were judged, and the athletes' competitive ability was divided by the index model.

The purpose of constructing the evaluation standard is to measure the competitive ability of the world's top Taekwondo athletes. The individual evaluation results can be used to compare the athletes on a certain index horizontally, and it cannot be compared as a whole, nor can an overall score be obtained. Therefore, it is necessary to construct a comprehensive evaluation standard for the competitive ability of the world's outstanding Taekwondo athletes. The comprehensive evaluation result is calculated on the basis of the individual evaluation results combined with the contribution of each index to the entire system (the weights of indicators at all levels) so as to achieve the purpose of evaluation.

3.3.1. Evaluation Results of Elite Athletes. Because the three-level index determined in this study is a dynamic value, that is, the competitive ability of athletes in the face of different opponents is also different, it is unscientific to judge the competitive ability of a competitive Taekwondo athlete by only one game. Therefore, when we evaluate the competitive ability of the world's top taekwondo athletes, we should observe the athlete in many games.

This paper selects 5 athletes from 4 Olympic levels of men and women as statistical objects. The specific conditions of each athlete are shown in Table 7.

According to the individual scoring standard, use the COUNTIF function in the Excel table to calculate the scores of the world's top Taekwondo athletes in each indicator. The method for determining the score is that when the statistical data is between the two scores, the smaller score is taken as the single indicator score of the world's elite athletes. When the scores corresponding to the statistical data are the same, the maximum value is taken as the single index score of the world elite athletes. For example, when the score of the A210 back kick score is less than 0.60, the score is 50 points. According to this method, the individual index scores of the world's outstanding Taekwondo athletes are calculated, as shown in Figure 8.

The scores and rankings of each athlete's competitive ability are calculated, and the details are shown in Figure 9.

From Figure 9, it can be roughly seen that athletes with higher weight classes have higher competitive abilities, which is consistent with what we usually think of as higher weight classes, stronger, and more competitive abilities. It is worth noting that the model evaluation found that the higher the body weight, the stronger the competitive ability.

3.3.2. Evaluation Results of Students in Martial Arts Class. This time, 10 students were randomly selected for the test. The evaluation indicators in this article were used to test the competitive ability and rank. The ranking results are compared with the ranking of the class to compare the evaluation effect of the model.

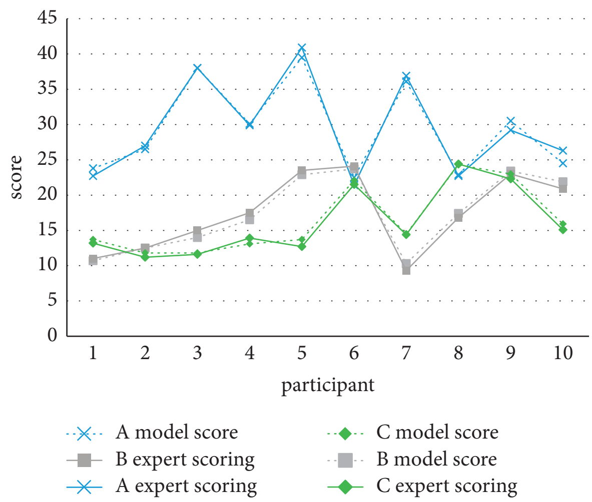


Figure 10: Model scoring versus expert scoring.

For the evaluation of mental ability, this paper measures the heart rate, respiratory rate, and body temperature before, during, and after the competition through the intelligent Internet of Things technology so as to comprehensively evaluate the mental ability of the participants. For technical ability and tactical ability, the action in the index is analyzed by evaluating the strength, speed and completeness of the action on the spot. Finally, compare the scores of the model evaluation with the on-site scores of the expert group teachers, and the results are shown in Figure 10.

4. Conclusions

Along with the outstanding achievements of Chinese excellent Taekwondo athletes in world competitions, Taekwondo has attracted more and more enthusiasts to participate in competitive competitions with its unique charm, in particular, the first-line Taekwondo gymnasts in various cities and the big athletes Taekwondo athletes and so on. This paper establishes an evaluation model for the competitive ability of Taekwondo athletes, including three second-level indicators and 18 third-level indicators of psychological ability, technical ability, and tactical ability. The validity of the evaluation model in this paper is also proved by experiments. However, there are also some defects in the evaluation model; for example, there are few subjects in the experiment, and there is no experiment for athletes and players from many countries, which leads to a large limitation of the model. Therefore, in the follow-up experiments, the author will take this as the object to conduct more in-depth research.

Data Availability

Data will be available from the corresponding author upon request.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

References

[1] R. Camagni, "On the concept of territorial competitiveness: sound or misleading?" *Roberto Camagni*, vol. 39, no. 13, pp. 2395–2411, 2017.

[2] T. Buser, N. Peter, and S. C. Wolter, "Gender, competitiveness, and study choices in high school: evidence from Switzerland," *The American Economic Review*, vol. 107, no. 5, pp. 125–130, 2017.

[3] F. Vendrell-Herrero and J. R. Wilson, "Servitization for territorial competitiveness: taxonomy and research agenda," *Competitiveness Review: An International Business Journal*, vol. 27, no. 1, pp. 2–11, 2017.

[4] M. A. Cohen and A. Tubb, "The impact of environmental regulation on firm and country competitiveness: a meta-analysis of the porter hypothesis," *Journal of the Association of Environmental and Resource Economists*, vol. 5, no. 2, pp. 371–399, 2018.

[5] M. Bernier, R. Codron, E Thienot, and J. F Fournier, "The attentional focus of expert golfers in training and competition: a naturalistic investigation," *Journal of Applied Sport Psychology*, vol. 23, no. 3, pp. 326–341, 2011.

[6] K. C. Pepijn, M. Kavussanu, and B. Claessens, "Moral-functioning across training and competition in sport," *International Journal of Sport and Exercise*, vol. 18, no. 2, pp. 239–255, 2020.

[7] P. . Kimberly, "The benefits of taekwondo training for undergraduate students: a phenomenological study," *Societies*, vol. 7, no. 3, p. 27, 2017.

[8] S. Ardalan, S. B. Stuwart, K. Mehdi, S. Ina, and L. E. T. Ching, "Kinanthropometric attributes of elite male judo, karate and taekwondo athletes," *Revista Brasileira de Medicina do Esporte*, vol. 23, no. 4, pp. 260–263, 2017.

[9] Y. C. Su, Y. I. Kim, and H. T. Roh, "Effects of taekwondo intervention on cognitive function and academic self-efficacy in children," *Journal of Physical Therapy Science*, vol. 29, no. 4, pp. 713–715, 2017.

[10] I. R. Cho, H. J. Park, and T. K. Lee, "The influence of taekwondo training on school-life adaptation and exercise value in the United States," *Journal of Exercise Rehabilitation*, vol. 14, no. 2, pp. 213–218, 2018.

[11] H. C. Jung and J. K. Song, "Decreased abdominal fat and improved bone metabolism after taekwondo training in obese adolescents," *Kinesiology*, vol. 50, no. 1, pp. 79–88, 2018.

[12] D. Chang and S. Hwang, "The development of anger management program based on acceptance and commitment therapy for youth taekwondo players," *Journal of Exercise Rehabilitation*, vol. 13, no. 2, pp. 160–167, 2017.

[13] M. V. Sevde, "Technical analysis of 2007 and 2017 world taekwondo women and men championship finals," *Turkish Journal of Sport and Exercise*, vol. 20, no. 3, pp. 256–262, 2018.

[14] Y. J. Ma, "Study on the technique and tactics characteristics of reverse round in world high level taekwondo competition," *Liaoning Sport Science and Technology*, vol. 44, no. 1, pp. 130–134, 2022.

[15] X. Shen and G. R. Yuan, "Affecting factors of the competitiveness of taekwondo athletes," *Bulletin of Sport Science & Technology*, vol. 23, no. 3, pp. 55-56, 2015.

[16] D.S Choi, E.Na Jung, and M.H Park, "Comparison of balance ability and physical fitness according to the growth period in taekwondo players," *Journal of Exercise Rehabilitation*, vol. 17, no. 5, pp. 354–361, 2021.

[17] Z. W. Xie, “The research statusquo and rational analysis of core strength training,” *Journal of Chengdu Sport University*, vol. 43, no. 3, pp. 62–69, 2017.
[18] B. Zhao and H. Y. Zhang, “Application and development of RFID technique,” *Electronic Design Engineering*, vol. 18, no. 10, pp. 56–67, 2010.
[19] C. B. Luo, Y. Peng, and B. Y, “Overview on RFID technology and application,” *Communications Technology*, vol. 42, no. 12, pp. 112–114, 2009.
[20] I. Cho, K. Kaplanidou, and S. Sato, “Gamified wearable fitness tracker for physical activity: a comprehensive literature review,” *Sustainability*, vol. 13, no. 13, p. 7017, 2021.