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# Discussion on establishment of systems related to functions of computer system in the developing process of sports assistant training

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## ABSTRACT

In order to make the sports assistant training more scientific, training efficiency higher, training results better, systems related to the functions of the computer system based on machine vision is established in this study, using advanced computer technology to identify the number of rings instead of traditional visual inspection. The system built in this study is adopted with camera to shoot the image of target position, monitor and record the data of shooting results at shooting position in real time, and then analyze and process the collected monitoring data, finally get the data required for sports assistant training, and then analyze the statistical property of the data obtained for single assistant training and the assistant training with whole process and evaluate the scheme of assistant training. The assistant training systems built in this study can well analyze and evaluate the date of training results in real time and can provide more scientific and reasonable methods for sports assistant training. University education is mainly to train high quality talents, and college physical education is the powerful means to develop students' all-around development on morality, intellectuality and physicality. This study has improved the college physical education by establishing systems related to the functions of the computer system based on machine vision, according to specific situations of college physical education and summarized and evaluated the quality evaluation system of college physical education from the angle of combination of quantification and determination on nature as well as has drawn some valuable conclusions.

## KEYWORDS

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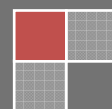
## INTRODUCTION

The traditional sport training is mainly conducted by designing the training rhythm and training methods according to analysis and guidance by the coach. With rapid development of computer technology, many research staffs use computer technology in sports training to analyze and summarize laws of sports, sports effect athletes' characteristics and laws of the sports science, to improve the scientificity and effectiveness of the training and provide advanced technical support.

Currently, the computer assistant training technology has been applied for many sports training, Lou Ming and other persons[1] applied the computer information management technology into diving training in 2001; and Cui Wei and other persons[2] used the computers to analyze the sports loads of athletes and guide and training in 2003; Zhu Dong[3] used the computer assistant training in martial arts training in 2004; Xiong Yuan and other persons[4] designed the data management system for diving to manage and process the training data; Huang Rumin used the computer assistant training system in football training in 2005.

Shooting is a greater kind of sports in competitive sports, the common characteristic is to determine the strengths and weaknesses by the final number of rings, and there are similarities for methods to determine the number of rings. Because the traditional method to identify the number of rings is adopted with visual inspection to identify it, which lacks of effectiveness in training, and cannot summarize the change law of the design data in detail, in terms of this deficiency, computer vision is brought in the shooting training in this study, and the computer is used to identify the number of rings and count the change of the shooting parameters and building systems related to computer functions so as to evaluate the training results and provide the reference methods for assistant training.

## VISUAL ASSISTANT TRAINING SYSTEM

The systems built in this study is taken with shooting assistant training as examples and the computer technology and image processing techniques are utilized to realize the collection of number of rings of the shooting, statistics of shooting results and deviation, playback of a segment of the training, analysis of historical data of shooting and shooting laws, and give a set of training scheme automatically to guide the training according to the specific situations of the athletes. What is shown in Figure 1 is the overall structure of the system.
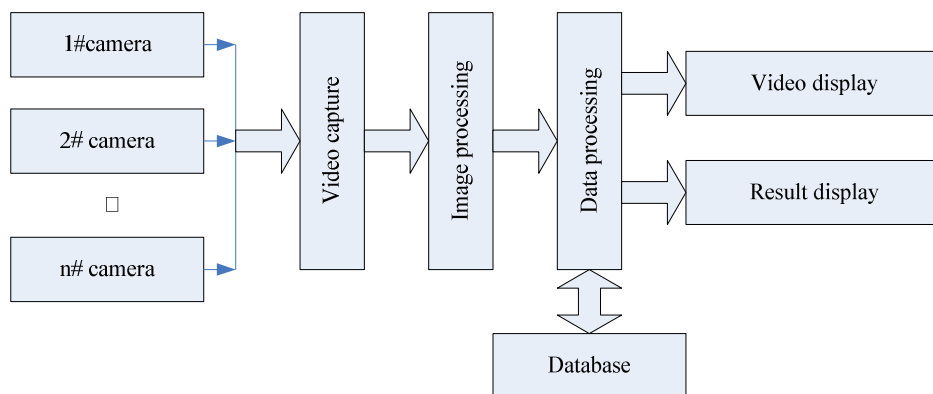


**Figure 1 : Computer vision assistant training system**

The system is adopted with several cameras to capture the images of several target positions, which can monitor the shooting results and data of several shooting positions at the same time. And the property weight of the index is to reflect the degree concerned by the students. According to above-mentioned conclusions, improve the essential attribute firstly: for example, the teacher introduces the course outline at the beginning of semester; the teachers use different teaching methods to help students; the teachers demonstrate correct sports skills to help students and so on, for these attributes, the students may take them for granting, when being provided with the essential attributes, the degree of satisfaction of teaching quality cannot be increased, but when lacking of essential attributes, the degree of satisfaction of teaching quality may be decreased, according to deviation of statistics of last or several shooting data, to give reference target for shooting corrections.

## SHOOTING DATA PROCESSING

The data processing is mainly based on analysis of process data of shooting collected by computer, to statistic the shooting scores and to keep the shooting results. Functions Xiof this part mainly include image filtering, geometrical correction of image, image segmentation, results calculation, data storage and results display. Figure 2 is the schematic diagram of the module.
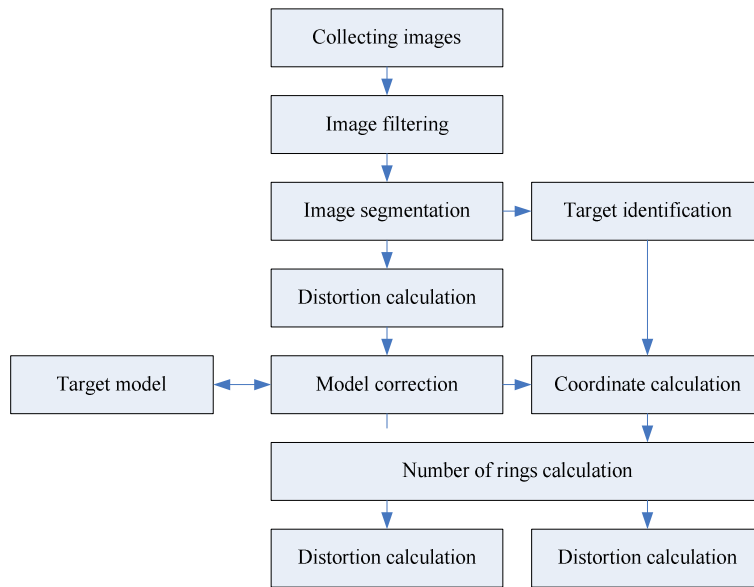
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┌─────────────────────┐
│  Collecting images  │
└─────────────────────┘
           │
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┌─────────────────────┐
│   Image filtering   │
└─────────────────────┘
           │
           ▼
┌─────────────────────┐      ┌─────────────────────┐
│ Image segmentation  │─────▶│ Target identification│
└─────────────────────┘      └─────────────────────┘
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┌─────────────────────┐                 │
│Distortion calculation│                │
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│ Target model │◀▶│ Model correction│◀─│                     │
└──────────────┘  └─────────────────┘  └─────────────────────┘
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              ┌─────────────────────────────┐
              │ Number of rings calculation │
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         │Distortion calculation│ │Distortion calculation│
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**Figure 2 : Principle for shooting data processing**

Image processing includes the image preprocessing, image segmentation, model correction and other parts contents. Attribute of attractive quality shall be improved: for example, the coach uses different methods to help the athletes[7]; the coach respects the student's opinions and communicates with the athletes; the coach creates happy learning atmosphere and so on. The university can take the attribute as competitive capital, if the coach can use different teaching methods, achieve teacher-student interaction in the teaching, this will improve the quality of physical education, which is the best strategy to improve the degree of satisfaction of the athletes, so the gray level images shall be processed.

## 1IMAGE PREPROCESSING

Assume that the RGB image to be processed is $I_0$, in order to facilitate calculation, $I_0$ is required to be converted to gray level image I. Now, the commonly-used formula of RGB gray level conversion:

$$I(x, y) = 0.299I_0(r, x, y) + 0.587I_0(g, x, y) + 0.114I_0(b, x, y)$$

(1)

In above formula: I(x, y) is the value of gray level image at (x, y), $I_0$(r, x, y) is red gray value of RGB image at coordinate (x, y), $I_0$(g, x, y) is the green gray value of RGB image at coordinate (x, y), $I_0$(b, x, y) is the blue gray value of RGB image at (x, y). The traditional cognition to the teaching quality in the past is single dimension, namely, while meeting the attribute of teaching quality, the students will satisfy; but while not meeting the attribute of teaching quality, the students will not satisfy. But the evaluation of the teaching quality with single dimension is too monotonous, and cannot illustrate fully the students' evaluation; therefore, weighted summation shall be used to calculate actually in certain environment.

$$\begin{cases} I(x, y) = w_1 I_0(r, x, y) +_1 w_2 I_0(g, x, y) + w_3 I_0(b, x, y) \\ w_1 + w_2 + w_3 = 1 \end{cases}$$

(2)

(2)In the formula: $w_1$, $w_2$, $w_3$ are respectively the Ypbpr weight of RGB images, these values are collected in the experiment. The noise in the images shall be removed by means of weighting and filtering algorithm after shooting the gray level images.

$$\begin{cases} h_i = \begin{bmatrix} w_{11} & \cdots & w_{1l} \\ \vdots & & \vdots \\ w_{l1} & \cdots & w_{ll} \end{bmatrix} \\ \sum w_{ij} = 1 \end{cases}$$

(3)

The weighting and filtering algorithm of the images are:

$$I'(x, y) = \sum\sum w(x+i, y+i)I(x+i, y+i)$$
$$i \in [-(l-1)/2, (l-1)/2], i \in Z$$
$$j \in [-(l-1)/2, (l-1)/2], i \in Z,$$

(4)

FigureIn the formula: $w(x+i, y+j)$ is the element value of $h_1$ at $(x+i, y+j)$.

Generally take $w_{ij} = w_{i'j'} = 1/l^2$

**Image segmentation and model correction**

For the image I' after smoothing processing, the ring targets are needed to be segmented, and identify the central position and ring parameter, that is to say process the ring by digitization, thus the number of ring of shooting and position can be identified in subsequent processing. For considering the certainty of the target, the method of single threshold segmentation shall be used.

$$B(x, y) = \{1, I'(x, y) \geq G_{th} \ \ O, I'(x, y) < G_{th}\}$$

(5)

In the formula: B is the binary image segmented, and $G_{th}$ is the threshold value segmented.

In order to realize the digitization of the target, we use the model instead of image and use total correlation method and T inspection method for analysis, T inspection reaches the significant level (P<0.05) wholly, and the level of total correlation also reaches the significant level (P<0.05), finally reserve all the titles to perform the preparation for the later analysis. Firstly, assume that the credibility of each scale and total scale inspected is the coefficient of Cronbach. When the credibility x is more than 0.7, mean that the credibility is very high; when x is greater than 0.35 but less than 0.7, mean that the credibility is ordinary; when x is less than 0.35, mean that the credibility is very low. The coefficients of five levels x of positive titles in this questionnaire respectively are: tangibles coefficient is 0.85; reliability coefficient is 0.82; responsiveness coefficient is 0.74; indemnificatory coefficient is 0.66; empathy coefficient is 0.80; total scale coefficient is 0.86; getting correct target model. The diagram of imaging system is as shown in Figure 3.
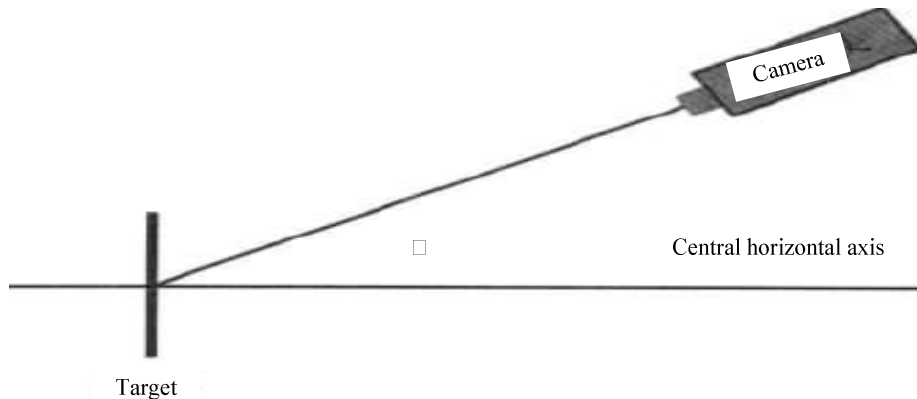


**Figure 3 : Imaging diagram**

Because of position deviation of the camera and target, the round ring transform into oval ring in the image gotten, the deformation size depends on included angle θ between the imaging axis and the central horizontal axis, the bigger the θ is, the bigger the deformation is, otherwise the deformation is smaller. According to the imaging principle in diagram 3, and the main method that the colleges use to train high quality talents is peak of college physical education, and is the important platform for the students to learn the theoretical knowledge and skills, and establish scientific idea. However, from the current situation of education in the colleges at present, there is downward trend for physical health status of the students in colleges, mainly expressed as: weakness, sub-health, emotional instability, etc, in addition to objective factors, the colleges have little input in the physical teaching quality evaluation, with no unified evaluation standard, failing to reflect the differences of physical education quality of each college, and to statistic the shooting data. The process of model correction is shown as in Figure 4.

Based on such correction principles, the inspection system has not only realized multi-channel shooting data inspection in real time, but also improved the inspection precision and adaptability of use of the system, and improved the reliability of the system.
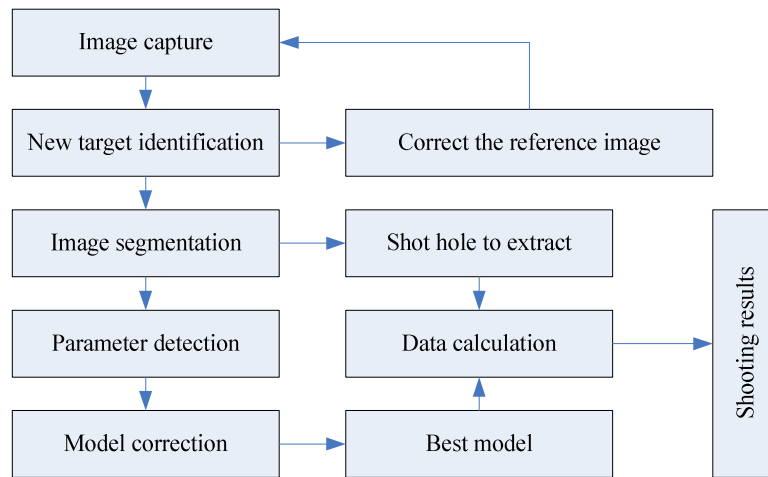
**Figure 4 : Correction principles for target model**

## COMPUTER ASSISTANT TRAINING

The system may make micro-analysis according to features of the collected data and distribution characteristics and changes of the data after a complete shooting, after the computer collects the various data of a shooting. Meanwhile, and the system can summarize the laws of results of the athletes according to the historical data, the system is also provided with the evaluation function to the training scores of the athletes and coaches, and can give a set of training scheme to the coach for reference according to specific situations of the athletes.

### Single data assistant training

Assume that data sets of shooting for 10 times are $C = \{ c_1, c_2, .., c_{10} \}$, $c_i$ is the current shooting data. Each design data includes two scales, which are scale of number of rings and position scale, the two scales are expressed in form of polar coordinates, thus the shooting results become like $c_i(r_i, \theta_i)$. When lacking of quality attribute, the students will not satisfy. For this reason, this text uses KANO two-dimensional questionnaire survey, and set forth the quality index formula, specific degree of satisfaction and dissatisfaction of the students in case of certain quality attribute can be calculated by this formula, and which can be taken as the important standard to improve the quality attribute. When the coefficient is near zero, it means that the quality attribute has smaller effects to the students, when the coefficient is near 1, it means that the quality attribute has bigger effects to the students, so take the last good target as the adjusting point to adjust.

### Assistant training with whole process

Assume that 10 times training are accomplished completely, data set collected is $C = \{ c_1, c_2, .., c_{10} \}$, and analyze the data sets for the data changes, location changes, distribution of bullet spots, effectiveness changes of data, deviation of bullet spots system and dispersibility evaluation of bullet spots in the training, and what is shown in Figure 5 is structure diagram of computer simulation training.

Analysis of data changes of ordered set of numbers $C = \{ c_1, c_2, .., c_{10} \}$, the original basic quality attribute may become indifferent quality due to changes of time and environment, from research results of the customer's mind and conclusion validated, attractive quality, expected quality and basic quality are all provided with the characteristics of subsidence gradually with changes of time, that is to say the attractive quality will become expected quality gradually after a period of time, and finally changes gradually into the basic quality. The change law reflects the features of gradual progressiveness of students' demand and difficulty of satisfaction, providing reference for state adjustment in the shooting.

The data statistical characteristics analysis includes mean off-center data, coordinates and radius of bullet spots set statistical circle, data dispersibility and credibility of each data. The off-center data is calculated by means of mean value of points.

$$
\begin{cases}
r_c = \dfrac{1}{10} \sum_{i=1}^{10} r_i \\[2mm]
\theta_c = \dfrac{1}{10} \sum_{i=1}^{10} \theta_i
\end{cases}
\tag{6}
$$

The size of the $|r_c - r_i|$ value reflects the size of random error, and there 23 quality attributes in total, among them, 9 basic quality attributes totally, accounting for 39.1% specific gravity; 5 attractive quality attributes in total, accounting for 21.7% specific gravity, which shows that the athletes have positive evaluation to the quality of the physical education, and the basic quality attribute shall be improved, and then expected attributes shall be improved in priority, and improve the attractive attribute in the long term. The structure of computer simulated routine design is shown as Figure 5.
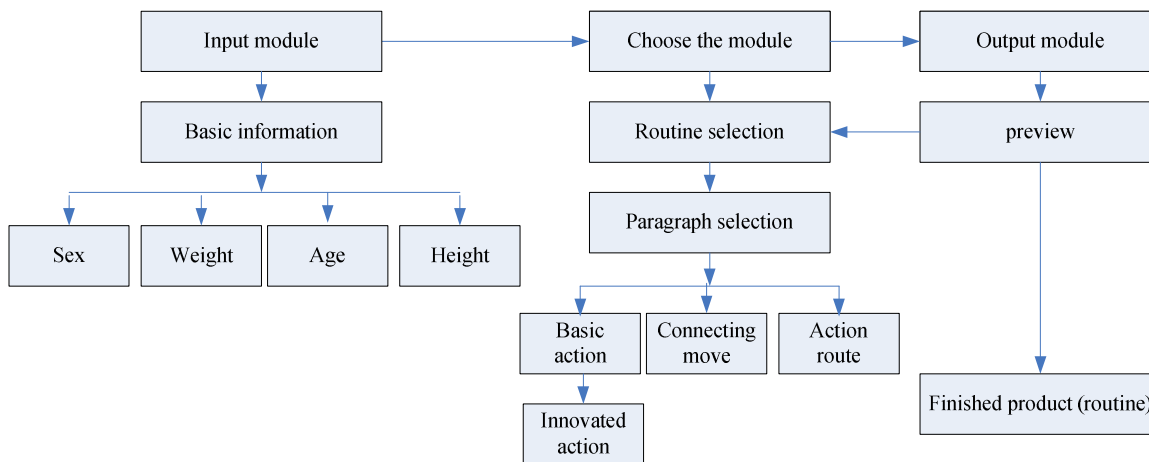


**Figure 5 : Structure of computer simulated routine design**

The assistant training is based on change trend of complete shooting data and data distributions, original basic quality attribute may become indifferent quality due to changes of time and environment, from research results of the customer's mind and conclusion validated, attractive quality, expected quality and basic quality are all provided with the characteristics of subsidence gradually with changes of time, that is to say the attractive quality will become expected quality gradually after a period of time, and finally changes gradually into the basic quality. The change law reflects the features of gradual progressiveness of students' demand and difficulty of satisfaction.

**Tacking and evaluation of the training process**

According to the statistics results of the historical training data sets $C = \{C_1, C_2, C_3 \cdots C_n\}$, single training data $C_i = \{C_1, 1, C_i, 2, \cdots i, 10\}$, the satisfaction coefficients of "the teacher has affinity ", "the teacher creates happy learning atmosphere" and "the teacher respects the students' opinions and communicates with the students" are very high, the data shows that the gym teacher can consider the students' interests, and concerns more to the students, and the students have very high degree of satisfaction for this. But the dissatisfaction coefficients of "site environment for class", "quantity and quality of equipment used in gym class" and "site space for class" are very high, this shows that the class environment and equipment in gym class in the college are in imperfect status, and the students are dissatisfactory with this.

Evaluation of the training process of the athletes in the training, original basic quality attribute may become indifferent quality due to changes of time and environment, from research results of the customer's mind and conclusion validated, attractive quality, expected quality and basic quality are all provided with the characteristics of subsidence gradually with changes of time, that is to say the attractive quality will become expected quality gradually after a period of time, and finally changes gradually into the basic quality. The change law reflects the features of gradual progressiveness of students' demand and difficulty of satisfaction. So tracking survey shall be made periodically to the same questionnaire, only in this way can the real demands of the students be met, and degree of satisfaction of the students to teaching quality in college can be improved accordingly.

Evaluation of training process of coach in the training, physical education evaluation system in this study is athlete-oriented, and the property weight of index shall reflect the degree of concern of the athletes. According to the above conclusion, improve the essential attribute first: for example, the coach introduces the course outline at the beginning of semester; the coach use different teaching methods to help students; the coach demonstrate correct sports skills to help students and so on, for these attributes, the athletes may take them for granted, when having the essential attributes, the degree of satisfaction of training quality cannot be increased, but when lacking of essential attributes, the degree of satisfaction of training quality may be decreased.

**CONCLUSION**

This study has narrated in detail the establishment of systems related to function of computer system based on machine vision and the principle design, built the computer system based on machine vision, and narrated the establishment process and principle design of the system in detail, and introduced the parameter method of machine vision and image

processing method, and discussed the collection and processing method of training data in detail, including the scientific data processing schemes from single shooting data collecting and processing to complete the training data analysis. In a word, the computer assistant training is provided with both scientific quantitative analysis and relevant factors of psychology and social cultures, even exactly, which is a complete expert system and is required to be studied further.

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