Basketball Auxiliary Training Method based on Video Analysis Technology

Liu Wei

Chongqing University of Education, Chongqing 400067 China

Corresponding author's e-mail: liuwei54@126.com

Received 10 September 2013, www.cmnt.lv

Abstract

In order to improve basketball training in university, video analysis is adopted. System requirement analysis and system function module is investigated. Then the key technique referring to video analysis is given. The results of the experiment show that the testing methods of the system can objectively reflect students' understanding on basketball tactical and ability of observation, analysis, decision-making on the match situation, as well as improve tactical awareness. Therefore, the study results can be effective for physical education services, and is expected to provide new ideas and methods for selection of the sports talent and physical education in university.

Keywords: basketball auxiliary training; video analysis; JSP; Flash.

1 Introduction

Along with the rapid development of information technology, large number of advanced technology joined in the multimedia technology. This have made the combination of multimedia and education become more and more extensive in the increasingly broad space, and the exploration of this unknown space must promote the development of information technology education. At present, there are more researches combining video analysis and basketball tactical awareness in the college of Physical Education. However, the majority of studies in the exploratory stage, the results also difficult in practice promotion and application, the reason is that they do not master the intrinsic relationship between technical characteristics of video analysis and basketball tactical awareness. Using the computer multimedia technology to effecttively test tactical awareness and promoting the formation of tactical awareness is still unclear in the study field.

Rule-based video classification system for basketball video indexing was proposed by Zhou[1]. Study and development of multimedia database system of basketball techniques and tactics was proposed by Chen[2]. Automatic detection method of goal segments in basketball videos was proposed by NePal[3]. Development of a computerized dynamic assessment for basketball knowledge was given by Park[4]. Design of online basketball course based on WWW was given by Yinjie Z[5]. Development of a multimedia instructional program for leaming basketball games in eighth-grade physical education was given by Lee[6]. An empirically driven mathematical modelling analysis for play calling strategy in American football was given by Boronico[7]. Modeling and prediction of competitive performance in swimming upon neural networks was proposed by urgen Edelmann-Nusser[8]. A mid-level representation framework for semantic sports video analysis was proposed by Duan L[9]. Maximum entropy model based baseball highlight detection and classification was proposed by Y Gong[10]. Audio events detection method based highlights extraction from baseball, golf and soccer games in a unified framework was proposed by Z Xiong[11]. A fusion scheme of visual and auditory modalities for event detection in sports video was proposed by M Xu[12]. Structure analysis of soccer video with hidden Markov models was proposed by L Xie[13]. Event based indexing of broadcasted sports video by intermodal collaboration was proposed by N Babaguchi [14]. Robust player gesture spotting and recognition in low-resolution sports video was proposed by M. Roh [15]. Video annotation for content-based retrieval using human behavior analysis and domain knowledge was given by H. Miyamori [16]. Improving accuracy in behavior identification for content-based retrieval by using Audio and video information was given by H. Miyamori[17]. Human shape-motion analysis in athletics videos for coarse to fine action/activity recognition using transferable belief model was given by E. Ramasso[18]. Data mining and knowledge discovery in NBA data was proposed by I Bhandari[19]. My study is based on lots of references and experiences of basketball experts and athletes, together with my years of concerns and practice on basketball, in which I designed a multimedia training system for cultivating basketball tactical awareness in light of the theory and technique in my study field.

In the next section, system requirements analysis and system function module is investigated. In Section 3, the key technology is given. In section 4, in order to test the performance of video analysis technique, the experiment is carried out. Finally, section 5 gives some conclusions.

2 System requirements analysis and system function module

System chooses video as building movement situation information carrier and uses animation image text as auxiliary. Video footage is objective reflection of the real game and is the most reliable. It is easy to get and is easy to obtain sports video footage in Internet. Each sports sites, network TV and digital TV offer video game downloads, which have fairly rich resources. Current streaming media and the use of P2P technique make transmission speed of the video in the network greatly improved.

The main purpose of system has two points. One is to have the effect of effective auxiliary for the improvement of students' tactics consciousness. The second is convenient for teacher to intervene effectively. The system mainly realizes the following functions. One is learning of basic tactics, which can enhance students' understanding of some basic tactics. The second is function of strengthening training. The students can learn some tactical thinking through interaction with the system, thus promoting the improvement of consciousness. The third is function of evaluation. After the student interacts with the system, the system logs data, analyzes the data, feedback operation results of students and the operation can be used as a summative evaluation. Of course, the results can't reflect the students' level of consciousness. The fourth is management function. Teachers can set the system thorough background management module, including motion scenarios and classification, modification of testing question.

Module 1: tactical knowledge. Text is used to explain some basic tactics. Animation and video is used to deepen students understanding of tactics. It is noted that the correlation between words, animation, and video and the present methods of information. It is needed to communicate closely with expert teacher.

Module 2: thinking training. After students enter personal information, they enter the module. In this module, a large number of existing sports scenes in the form of basketball video games are provided. Students watch the game, let the students to make a choice corresponding to a certain action. After the completion of the training, system will store the choice in the database.

Module 3: thinking test. This module is similar to module two. In the training module, after the students make a choice, the video continues to play, the athlete's next action will verify whether the student's choice is correct and the students can get a timely feedback. In the testing module, after the students make a choice, the next section of video is directly called for the next topic test and students cannot get timely feedback. Testing data is kept by system for analysis.

Module 4: background management. Teaching, training, and testing of the system is carried out under the control of the teachers, so the system must support convenience simple setup and management for teachers. Firstly, the background support video upload. After the teacher upload a certain period of video of teaching value to the server, the system will automatically call format conversion program to compress video format and output the FLV format. Then the system calls FLV handler, so that you can drag and drop.

3 The key technology

System uses web browser as the platform, mainly realized by web technology, Flash streaming media technology and database technology. The development tools are JSP and Flash. Backend servers are Web server, Flash Video server, and database server. The corresponding server software is Tomcat, Macromedia Flash Media Server2 and MySQL.

As one of the mainstream technologies of the current Web development, JSP technology has many advantages. JSP based on Java can do any things that Java can do. There are many products supporting JSP, which have good scalability and fault tolerance and are suitable for all kinds of application server.

After the video is uploaded to the server, call ffmpeg through the background JSP program and input the corresponding command to realize video format conversion. Use ffmpeg coding to get high quality video.

ffmpeg.exe -I "D:\Video\Fearless\Fearless.avi" -target film -dvd -s 720x352. -padtop 64 –padbottom 64 –maxrate 7350000 –b 3700000 –sc_threshold 1000000000

-trellis –cgop –g 12 –bf 2 –qblur 0.3 -qcomp0.7 -me full

-dc 10 –mbd 2

-aspect 16:9 -pass 2 –passlogfile "D:\Video\ffmpegencode"-an –f mpeg2 video "D:\Fearless.m2v"

Convert specified format file to FLV format is as follows.

ffmpeg.exe –i test.mp3 –ab 56 –ar 22050 –b 500 –r 15 –s 320x240 f:\test.FLV

ffmpeg.exe –i test.wmv –ab 56 –ar 22050 –b 500 –r 15 -s 320x240f:\test.FLV

A part of Actionscript code realizing the function of player is as follows.

```
stop();
var soundl:Sound=newSound();
var vedio_num=l;
_root.FLVPath=   "video/   "+vedio_num+".
FLV";
_root.PlayTime=0;
_root.Drag=false;
_root.One=false;
VideoPlayer.isRTMP=false;
VideoPlayer.isLive=false;
VideoPlayer.idleTimeout=500;
Load._width=0;
Now._widih=0;
VNow._width=VMax._width*0.7;
VTip._x=VNow._width+VNow._x;
VideoPlayer.autoSize=true;
VideoPlayer.contentPath=FLVPath;
VideoPlayer.PlayheadUpdateInterval=30;
VideoPlayer.complete=funetion(){
vedio_num++;
_root.FLVPath="video/"+vedio_num+".FLV";
VideoPlayer.contentPath=FLVPath;
trace(FLVPath);
};
```

```
VideoPlayer.Progress=function(){
Load._width=VideoPlayer.bytesLoaded/Vide
oPlayer.bytesTotal*Max._width;
};
VideoPlayer.ready=funetion(){
VideoPlayer.Pause();
Ctu_play=0
trace(ctu_play)
xmlObj=newXML();
xmlObj.ignoreWhite=true;
xmlObj.load("pt_data.xml");
//address of XML file
xmlObj.onLoad=function(success){
if(sueeess){
trace("XML loading success!");
parseXML();
// function analysing XML text
}else{
trace("XML loading failure!");
     }
}
arr_ime=newArray();
function parse XML(){
list=xmlObj.firstChild.childNodes[vedio_
num-l].childNodes;
for(var i=0; i<list.length; i++){
arr_time[i]=list[i].attributes.time;
arr_time[i]=Number(arr_time[i]);}
trace(arr_time[2]);
}
//VideoPlayer.seek(PlayTime);
//VideoPlayer.play();
}
Load.onPress=function(){
_root.DragBarInterval=setInterval(DragBa
r,10);
}
Load.onRelease=function(){
clearInterval(_root.DragBarInterval);
Drag=false;
VideoPlayer.seek(Now._width/Max._width*V
ideoPlayer.totalTime);
}
Load.onReleaseOutside=Load.onRelease;
functionDragBar(){
Drag=true;
Var temp=_xmouse;
if(temp<Load._x){
temp=Load._x;
}else if(temp>Load._x+Load._width){
temp=Load._x+Load._width;}
Now._width=temp-Load._x;
}
```

The making process of the team line-up visualization is shown in figure 1. The visualization of shooting area is shown in figure 2 and route map of tactical action is shown in figure 3. Design of basketball and athletes is shown in figure 4. Sudden acceleration of athletes is shown in figure 5.

FIGURE 1 The making process of the team line-up visualization

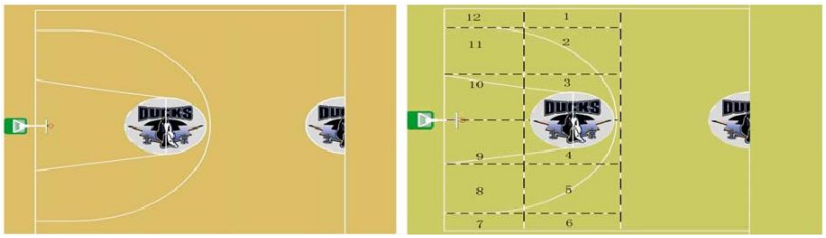

FIGURE 2 The visualization of shooting area

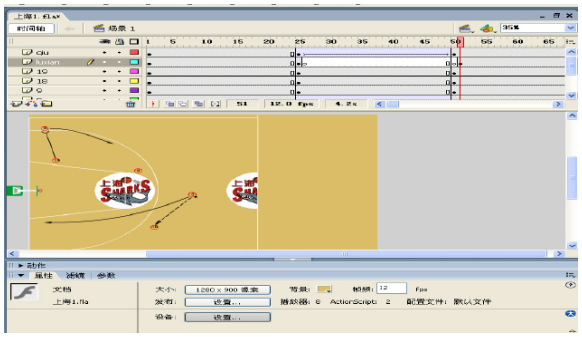

FIGURE 3 Route map of tactical action

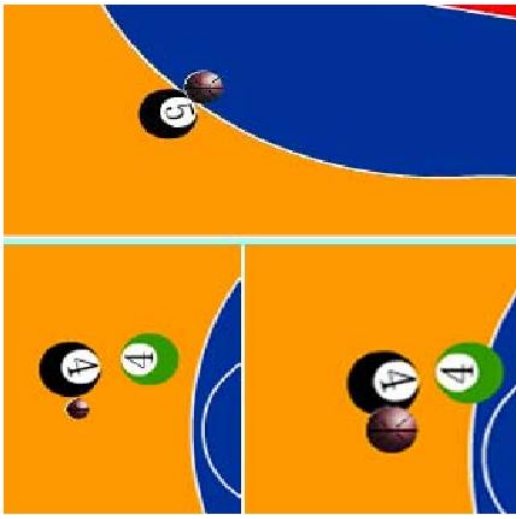

FIGURE 4 Design of basketball and athletes

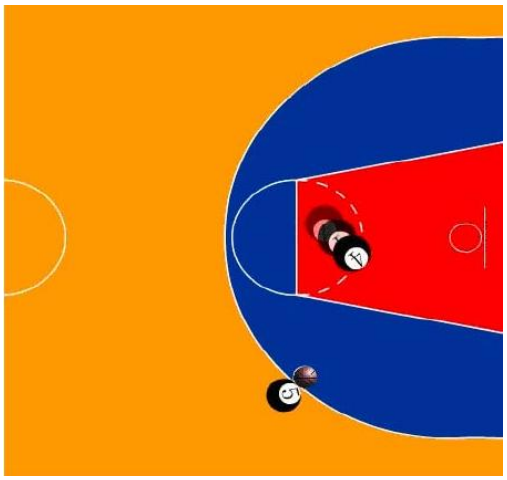

FIGURE 5 Sudden acceleration of athletes

4 Experimental study

30 number of students are chosen from major of physical education of some university in China and 30 number of volunteers are chosen from computer and information science college of the same university. They are labelled as group 1 and group 2. 30 numbers of students are trained using this system. Then compare the experimental data before and after using this system.

NBA 2011 to 2012 video games are collected, fragments of tactical teaching value are selected and further 60 fragments are selected for testing. 100 fragments are used for training. Set up expert scoring library. Video content, basketball teachers and expert advice is integrated to evaluate rationality of all testing option. Option rationality is divided into four levels, the most reasonable, reasonable, more reasonable and less reasonable. The corresponding score is 3, 2, l and 0. Then give score to each option. The most reasonable behave of player in the video is selected as the training video. Testing result of group 1 and group 2 are shown in table 1 and table 2 respectively. Score represents the score according to expert scoring criteria. Testing score comparison of two groups is shown in figure 6 and the average response time is shown in figure 7. In figure 6 and figure 7, the blue line represents group 1 and the yellow line represents group 2.

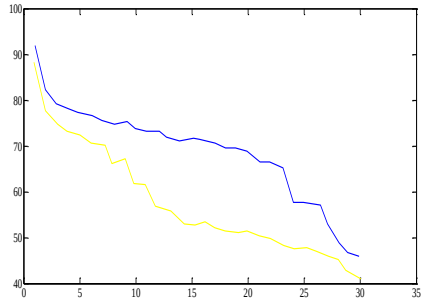

FIGURE 6 Testing score comparison of two groups

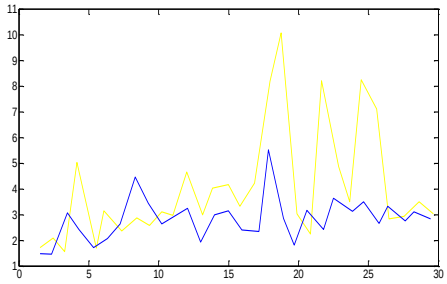

FIGURE 7 Average response time

TABLE 1 Testing result of group 1

serial number	score	testing score
1	78	88
2	69	77
3	65	75
4	73	73
5	62	72
6	69	71
7	64	70
8	65	67
9	61	67
10	60	62
11	59	61
12	57	57
13	52	56
14	55	55
15	54	54
16	52	54
17	53	53
18	52	52
19	52	52
20	48	52
21	44	52
22	51	51
23	49	49
24	48	48
25	48	48
26	47	47
27	43	47
28	42	46
29	44	44
30	40	42

TABLE 1 Testing result of group 2

serial number	score	testing score
1	82	97
2	72	95
3	78	93
4	72	98
5	67	96
6	69	91
7	75	96
8	75	70
9	70	82
10	71	80
11	73	89
12	62	80
13	64	83
14	68	75
15	70	90
16	72	78
17	63	70
18	71	82
19	66	85
20	59	80
21	61	75
22	65	78
23	66	85
24	52	80
25	56	85
26	58	87
27	54	65
28	43	70
29	45	88
30	42	65

The results of the experiment show that the testing methods of the system can objectively reflect students' understanding on basketball tactical and ability of observation, analysis, decision-making on the match situation, as well as improve tactical awareness. Therefore, the study results can be effective for physical education services, and is expected to provide new ideas and methods for selection of the sports talent and physical education in university.

5 Conclusions

With the rapid development of the computer technology, our life is changing rapidly by the revolution of information. Basketball auxiliary training is a very broad field, which involves the computer vision, artificial intelligence, pattern recognition and so on. It is a cross strong discipline. Due to its high application value, so the basketball auxiliary training has always been the hot researching. This paper introduces video analysis technique into basketball auxiliary training. Firstly, system requirements analysis and system function module is investigated. Then the key technology is given. The results of the experiment show that the testing methods of the system can objectively reflect students' understanding on basketball tactical.

References

[1] Zhou W, Vellaikal A, Kuo CCJ 2000 Rule-based video Classification system for basketball video indexing *Proeeedings of the 2000 ACM workshops on multimedia* 213-16

[2] Chen J, Yao S 2007 Study and development of multimedia database system of basketball techniques andtactics *Journal Shanghai Physical Education Institute* **31**(3) 59

[3] Ne Pal S, Srinivasan U, Reynolds G 2001 Automatic detection of Goal'segments inbasketball videos *Proeeedings of the ninth ACM international conference on Multimedia* 261-69

[4] Park J H, Kang M, Lee H J, Kim H, Kang S J 2008 Development of a computerized dynamic assessment for basketball knowledge *European Sport Management Quarterly* **6**(1) 60-7

[5] Yinjie Z, Bin Z, Bo L, Xibin H 2002 Design of online basketball course based on WWW *ComPuters in Education 2002 Proeeedings International Conference on* 1212-13

[6] Lee T K, Lee H, Moon J 2005 Development of a multimedia instructional program forleaming basketball games *eighth-grade physical edueation*.

[7] Boronico J S, Newbert S L 2001 An empirically driven mathematical modelling analysis for play calling strategy in American football *European Sport Management Quarterly* **1**(1) 21-38

[8] Urgen Edelmann-Nusser, Andreas Hohmann, Bernd Henneberg 2002 Modeling and Prediction of Competitive Performance in Swimming Upon Neural Networks *European Journal of Sport Science* **1**(2) 1-10

[9] Duan L, Xu M, Chua T, T ian Q, Xu C 2003 A mid-level representation framework for semantic sports video analysis *Proceedings of the ACM Multimedia Berkeley CA USA* 33-44

[10] Gong Y, Han M, Hua W, Xu W 2004 Maximum entropy model based baseball highlight detection and classification *Computer Vision and Image Understanding* **96**(2) 181-99

[11] Xiong Z, Radhakrishnan R, Divakaran A, Huang T 2003 Audio events detection based highlights extraction from baseball, golf and soccer games in a unified framework *Pro. IEEE Int. Conf. Acoustics Speech And Signal Processing* **5** 632-5

[12] Xu M, Duan L, Xu C, Tiall Q 2000 A fusion scheme of visual and auditory modalities for event detection in sports video *Proc Int Conf Acoustic Speech and Sigllal Processing* 189-92

[13] Xie L, Chang S, Divakaran A, Sun H 2002 Structure analysis of soccer video with hidden Markov models *Proc tat Conf Acoustic Speech and Signal Processing Orlando FL*

[14] Babaguchi N, Kawai Y, Kitahashi T 2002 Event based indexing of broadcasted sports video by intermodal collaboration *IEEE Trans OH Multimedia* **4**(1) 68-75

[15] Roh M, Christmas B, J Kittler, et al 2006 Robust Player Gesture Spotting and Recognition in Low-resolution Sports Video *European Conference on Computer Vision. Graz Springer* 347-58

[16] Miyamori H, Iisaku S 2000 Video Annotation for Content-based Retrieval Using Human Behavior Analysis and Domain Knowledge *IEEE International Conference on Automatic Face and Gesture Recognition Grenoble IEEE* 320-5

[17] Miyamori H 2002 Improving Accuracy in Behavior Identification Information *IEEE International Conference on Pattern Recognition* **2** 826-30

[18] Ramasso E, Panagiotakis C, Rombaut M, et al 2009 Human shape-motion analysis in athletics videos for coarse to fine action/activity recognition using transferable belief model *Electronic Letters on Computer Vision and Image Analysis* **7**(4) 32-50

[19] Bhandari I, Colet E, Parker J, etc 1997 Advanced Scout: Data mining and Knowledge Discovery in NBA data *Data Mining and Knowledge Discovery* **1**(1) 121-5

Authors

Liu Wei, born in May,1977, Chong qing City, County, China

Current position, grades: lecture of School of Teacher Education, Chongqing University of Education, China
University studies: BA in 1999, Chengdu Sport University; MA in 2007, Southwest University;
Scientific interest: His research interest fields inlude PE teaching and sport training
Publications: More than 9 papers
Experience: From 1999 to present, teach basketball and volleyball for Chongqing University of Education, working as the coach for the school's men and women basketball teams and gaining the honors of Champion and the second place; being skilled in PE teaching and training of sports team