DIGITAL ANALYSIS OF PLAYER'S POSITIONING AND MOVEMENT DURING A BASKETBALL OFFICIAL GAME USING VIDEO ANALYSIS

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Abstract

The information used for preparing one single basketball game is coming from different sources, one of the most important being the analysis of the opponent team. The big challenge for analytics is designing a better accuracy on spatial tracking coordinates, to adopt more and different statistic information and to use all these new type of information for helping the coaching staff to use their own team's advantages better by exploiting the opponent's general mistakes.

By using the available technology of new-generation video cameras we could be able to obtain information about players' position during a basketball game. Using this information, the program DIGITAL ANALYSIS OF PLAYER'S POSITIONING DURING A BASKETBALL GAME will generate, during the game and at the end of the game, pdf files of each player and average digits for teams and compare these results, offering us a clear analysis between the teams and the players.

In order to offer adequate parameters the program imply generating over 2000 different indexes on players positioning, speed movement and direction during a basketball game, all these by using a laptop that will save the images captured by a high-tech video camera and a software program that will analyze the images.

Key words: video; analysis; tracking; tactics.

1. Introduction

The game of basketball has become one of the most popular games in the world precisely due to its peculiarities in terms of technical and tactical performances, the effectiveness of these performances being determined by the accuracy and decision-making capacity of players. High performance basketball is an accomplished athlete who has exceptional physical and morphological qualities and is adapted to the conditions of competitiveness in sport, by developing teamwork abilities, spirit of sacrifice, and mental strength under pressure. The rapidity with which the two stages of the game follow, offense and defense, are the main features that have made basketball be the second most watched game in the world.

In Romania, basketball is on the second place, after football, in the games ranking having the most legitimated sportsmen, seniors and juniors, according to data provided by the Romanian Basketball Federation. For these reasons, and in terms of increasingly higher interest regarding this sport, all aspects related to the organization of high performance basketball, the management, technical and tactical aspects are worth analyzing and it is necessary to use as many available resources as possible which can provide important data used by specialists in the field, to allow the development of the performance capacity of sportsmen who are practicing this sport.

2. Methods

The main goal of the project is to offer basketball coaches the facility of viewing and analyzing in real-time all the movement of the players on the court during a basketball game. The actual technology of video cameras are making possible to locate the sportsmen and the object of the game and by using a software dedicated to this main goal, they can generate data about their location and positioning in real time. By using this analysis during one season and comparing the results on long-term, will improve the performance capacity of the players, will develop their decisions in particular tactical situations, but it will also bring a high contribution to the professional development of the coaches.

3. Results and Discussions

Movement analysis in sports is an important issue that all the professional teams are focusing on, but in the basketball game, due to the complexity of the game, at this moment, there is no program that should provide precise information from the analysis of a software program.

Visual memory is, nowadays, one of the main qualities need for a professional basketball coach, in order to take the best decisions during the official game. Basketball coaches are often needed to memorize situations during the game, so they can adjust the tactical plan to the necessities of his team, especially while the game is being played.

By creating a software like that we can facilitate the motor skills analysis of basketball players, during basketball games and during the practices, simplifying the work of basketball coaches. All the coaches are using video analysis and can state it is one of the most effective methods in high performance sports, but this method is limited to a video recording and depending on its interpretation of the technical staff after the game ends, so that an intervention while the game is on the run, when it is more important, it is impossible to make, especially in those situations when some aspects of the game do not comply with the requirements of the initial tactical plan. The biggest disadvantage of this method is that the time required to create an accurate analysis is too long, sometimes until getting the conclusions, a game is viewed several times and the data obtained is not a result of standardized analysis with a reference system, but they rely on a highly subjective interpretation of a human being.

Also, designing such a program can offer some important statistics for the game that can analyze the efficiency of team's game based on individual performances of the players..

Every coach builds his own philosophy by operating in the spirit of his thinking about how his team should play and practice and by following up the answers to "why will I do it?" and "how will I do it?" as Steve Merglesberg (2012) believes.

Regarding the activity of the basketball coach,. T.Predescu and Ghițescu G. (2001) list the following aspects:

• The first problem is to establish their offensive system that he and the players want; to analyse and be convinced that the envisaged offensive and defensive systems can help the team win against its opponents.

• The coach must think about the arrangement of players on their post in the game system so that each player is as effective.

The same authors believe that the main task which the coach has in terms of game management is studying the opponent they are going to meet in the next stage and this is reflected in the so-called observation report. This report is drawn up on the basis of objective (preferably) and subjective information, as complete as possible, regarding the offensive and defensive game of the opponent. The basketball game is very complex that is why even its observation through a specialist eye is very different.

The responsibility of the coaches regarding the analysis in terms of the tactics of the game, in order to allow objective prediction of the team potential and creating a system suitable to the characteristics of players that are available, is a topical issue and the complexity of the basketball game which is practiced today makes it increasingly more difficult to fulfil these tasks. Whether we refer to the analysis corresponding to the game of the own team or the opponent team, whether it comes to play offensive or defensive, individual or collective tactics (relations between 2, 3, 4 or 5 players), the game model is demanding and hides many variables, difficult to control without the help of advanced systems that provide real and accurate information regarding the position and movement of players on the field during a basketball game.

The complexity of dynamic, tactical or theoretical aspects emerges from the features of competitive basketball game mentioned by (Ghițescu I.,and.Moanță A., 2013):

After each game, the technical and tactical analysis of the game is done following the comparison, on the one hand, between the expected tactical plan and the adjustments made as a result of indications received by players during the match or the break, and, on the other hand, between the individual or collective achievements or failures sustained by as objective data as possible.

It is necessary that as many objective data as possible are provided with regard to the performance of the players during the game so that basketball coaches can better control all duties and responsibilities they have concerning the team they lead, related to the rigors of modern basketball. The means currently used (video analysis, statistics recording, observation sheets) prove insufficient to keep up with the tactical-technical rigors of modern basketball practiced and emerging from the players' mastery, from the capacity to decide in a very short time, from the developed speed of the game, the motric qualities of players who develop very high game speed and numerous theoretical resources

Moanță A. (1998) finds that changes in the Regulation have permanently directed the development of the basketball game, the change of rules occurring every 4 years takes into account the stage of the game and its trends.

Thus, this has led to the current game practiced at full speed with spectacular counterattack conclusions, unexpected combinations of 2-3 players, concluded with underhand throws or remote throws, elaborated positional attacks, aggressive defence held on half or the whole court, tactical schemes for special situations, efficiency in shots.

Practicing competitive game implies a good physical, technical and tactical training of the whole team.

It is well known that basketball evolution has a certain cyclicality, namely the development of the attack at the expense of defence, so that after a while, under the influence of changes of regulation and orientation of the training, to reverse roles.

Tong, T. (2013) finds that the trends of the basketball game are directed to a completely tacticalised game, but draws attention to the need to devise game strategies and tactical plans as close as possible to the actual requirements of the game itself. In the process of training, tactical training is designed to reduce vulnerability of the game system, both in the offensive and in the defensive phase, and the solution is to study the variables that occur during the game.

Trninic, S. (2010) considers that the concept of knowledge in the basketball game can be presented as a binary tree hierarchically structured, with the following substructures: game strategy; game tactics; game tasks; as well as individual technique and tactics that are found in all the game details. Also Trninic, claims the need for modern tools that can process data regarding the general variation at the level of technical and tactical skills of the players in order to facilitate, on the one hand, establishing their roles within the team, and on the other hand, anticipating performance capacity, referring to the player, individually or to team potential, in general. Without this data, there can be no objective analysis in professional sports, since it is not possible to assess correctly the actual quality of players and teams.

The main goal of our research is to optimize the tactical behaviour of the male basketball players participating in the First League by using the information of the program Analysis of position and movement of players during a basketball game, while the program provides average numbers and comparing players of the opponent teams and comparing them with the team mates, at the end of the game being created individual and collective documents that can be stored and archived.

This program will also provide regarding the tactical decisions made by the technical staff during one or more seasons (tactical plans, game systems, tactics design).

Figure 1 Model of tactical interpretation of an offensive game situation

4. Conclusions

In order to achieve the objectives, the program will generate a very large amount of data required for the actual analysis, about 2.500 indices collected every second, regarding the positioning, speed, and the direction of movement of all the players that are on the court during an official basketball game.

The information that we will obtain using the high-technology video-recording cameras, will be transmitted through a wireless Internet connection and will be sorted and then stored in the HDD of the computer.

The interpretation of the information obtained is not possible without a software program that will analyse the data by offering intuitive images that can be represented either by a video file or by frame by frame analysis. The images will be represented by a basketball court figure and the projection of the players, the playing object and will be using signs and symbols for the players' movement with or without ball, on the defence or on offense and the movement of the ball accepted in the language specific to basketball (*Figure 2, Figure 3*).

Figure 3 Dynamic analysis of playing surface   Figure 4 Dynamic analysis of distances

Ștefănescu, C. (2016)was using GPS systems to obtain the data obtained can provide valuable information on the physical efficiency of the players. All this information and other that are regarding the ball

(when a team scores a basket, when the ball gets out of bounds) can be obtained with a bigger precision by using High-Tech cameras. Any coach records in the training plan the indices measured at training regarding the physical capacity of each player. Often, this data cannot be found exactly during the evolution of the player in the game. For example: Player A, at the tests during training, for the distance of 10 meters manages to get the time "t". During the game, for the same distance, under similar conditions, the time usually obtained will be higher because of several factors. The differences between "t1" (time during the game) and "t" can provide relevant information about the ability of each player to use in the game the skills acquired during training. Another important indicator will be the distance travelled throughout the game, compared to the time spent in the court. These data, compared with the variation of heart rate and successes or mistakes (data obtained with the means specific to statistical analysis) can give us valuable information with respect to the player and team efficiency. All these things can be possible by synchronizing the programwith thestatistical recording systems.

References

1. Ghițescu, I. G., Moanță, A. D. (2013).*BaschetFundamenteȘtiințifice.* Bucharest: Bren Publishing House;
2. Merglsberg, S., (2010).*Developing a coaching phylosophy.* http://www.worldofbasketball.org/developing-a-coaching-philosophy.htm;
3. Moanță, A. (1999). *Evoluțiaregulamentuluijocului de baschet, cu implicațiiînpregătireatehnico-tacticăaechipelor,* Bucharest:Annual Session of scientific communications, A.N.E.F.S., „Actualitățiși perspective îneducațiefizică, sport șikinetologie, 5 – 6 March, 123;
4. Ștefănescu C.(2016).*Digital analzsis of player'spostioning and movement during a basketball official game.*Constanța: Science Movement and Health, vol. XVI, ISSUE 2 Supplement, 674-679;
5. Teodorescu, L. (1979).*Baschet – Teorie, Practică. Probleme de metodică.* Bucharest: Sport-Turism Publishing House;
6. Tong,, T. (2013), *Basketball Tactical System and Reform Orientation Research based on Mathematical Statistics.* J. Cheng Du Phys. Educ. Inst., 27:63-65;
7. Trninić, S., 2010, *Hierarchical structuring of knowledge in basketball game.* Acta Kinesiologica 4 1: 37-44.