WEIGHT LIFTING TECHNOLOGY BIOMECHANICS RAPID FEED BACK SYSTEM STUDY

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Weightlifting is one of the important part of the Olympic. For a variety of reasons, the coach is by observation and experience qualitative methods on, the athletes technical action guide to further reveal the characteristics of technical action. The hope to be able to the test the qualitative and quantitative test of real combination more looking forward to the kinematics and dynamics of the key indicators. So after consulting a large number of literature and coaches discussion, we make the sports biomechanics research weight lifting technology rapid diagnosis system, the use of 3rd load station acquisition lower limb legal date, combining synchronous acquisition. Barbell center kinematics parameters to rapid analysis weightlifting action techniques. Help improve weightlifting athletes technical effect.

KEY WORDS: weightlifting, feed back

PREFACE: Weightlifting is one of the important part of the Olympic, in the competition at home and abroad for our project training and many other sports, due to various reasons, the coach is by observation and experience qualitative methods on the athletes technical movement for guidance. A senior qualitative analysis mainly uses the motion image rapid feedback test system of athletes training in the field test. There are some commercial test system, such as a computer cameras and special motion image of rapid analysis software Dartfish, training assistant , can rapid feed back some kinematic date. Direction research and simple kinematics date has the advantage of simple operation of simple operation, feedback speed, feedback material image intuitive practical strong coaches and athletes easy to understand. Defect is qualitative and simple kinematics analysis of the data of comprehensive index, different to further reveal the characteristics of technical action. Comprehensive quantitative research is more scientific test method, the test parameter is more, can reveal the internal characteristics of technical action. Defect is feedback speed is slow, and the testing result is usually need a few days after the shooting back to the coach. Along with the weight lifting technology service work through, the coaches on the scientific research put forward higher request. They hope to be able to test the qualitative and quantitative test really more looking forward to combine the kinematics and dynamics index combined, it can fast feedback test result, and can get a more comprehensive quantitative analysis of the key indicators. So after consulting a large number of literature and coaches discussion, we make the R&D weightlifting extreme sports biomechanics rapid feedback system, the use 3D load station acquisition lower limb legal date, combining synchronous analysis weightlifting action techniques. Help improve weightlifting athletes technical training effect.

METHODS: As is known to us, and test object without contact camera analytical system diagnosis technology required parameters feedback action it take time. While the traditional motion capture and analysis method is to take a maker point way to capture athletes action to carry on the analysis, such as based on the marker of capture system, Qualisys, Motion, Optitrack, New Oriental, but Motion Capture system is through the tracking posted on the human body articulation point on the marker to catch peoples movement, this kind of method for athletes have many influence or limit, e.g. need to be in a specific environment shooting data stick on athletes marker will affect the accuracy of the action, the system complex operation. And shall be the use of special equipment, the price is expensive, and marker to athletes cause psychological burden may outweigh effects on the body. So, non-touch unhampered motion parameter acquisition and analysis method is of practical value.

Through many times of coaches and communication and consult relevant material consensus that the barbell end, the kinematics parameters is the most important technical index. Due to the location of the center of barbell and leverage point position is basically the same point, so, we can through the tracking lever endpoint movement to determine the barbell center movement. There is a very important problem, now scholars mostly research are focus on kinematics index, produce the kinematics and the reason for the variation of kinetic parameters, little attention, so this system into 3D load station force platform for dynamic parameter combination kinemation parameter analysis.

This research according to the MATLAB based on video to methods, based on the characteristics of weightlifting us the photos of the lifter positive side video, the barbell center to carry on the track. The system tracking to the barbell center trajectory calculation speed, power and son each key notion parameters. The system don't need complicated equipment, ordinary camera can complete tracking task. Do not accept the restriction of environment condition, also don't interfere with the action of athletes, can be in any time, place to carry on the track.

When shooting in the barbell end point paste as tracking target color piece, use ordinary camera in the athletes are side to shoot. At the same time, in the sport range place good load platform (Kistler) motion date acquisition. Using MATLAB as a development Kistler, the input of the video image after the shooting athletes. Software automatic identification tracking barbell end point color piece, record the corresponding coordinates then through the coordinate calculation barbell trajectory of displacement, velocity and date. Kistler through the cabin Bioware software with pressure date and storage for .TXT format. MATLAB can be obtained through programming .TXT format load Kastler's date, and tracking get barbell trajectory kinematics data synchronization analysis athletes technical action action.

RESULTS:

Barbell center identification and collection: In the barbell endpoint labeled for computer identification index point (red, green, blue any color piece), through the MATLAB programming can be identification point of recognition. Because is the true side of shooting, the movement of index point can be considered to be in the center of the barbell plane motion. From the input feature out of the first image (figure 1), minus the image index point color tonal(index point for blue), again form the map to find the minus the color image (figure 2). Will get image through the median filtering the noise transfer binary digital image (figure 3). Through the in advance with the default good pixel value contrast, remove ratio index point big or small interference point.
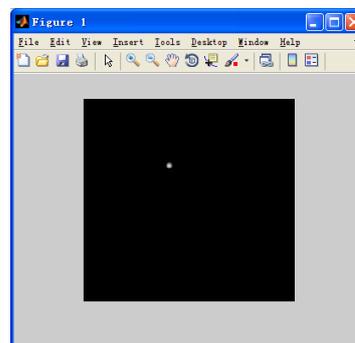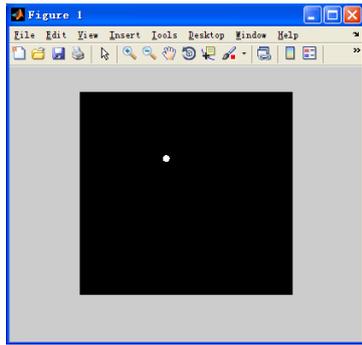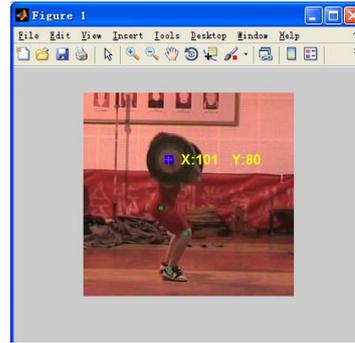

figure 1

figure 2

figure 3

figure 4

Using MATLAB image processing toolbox (IPT) to processed image spot analysis, find out the index point image center and rectangular to color piece for mark, intrturn to mark the image center coordinates.

Reading the next frame image repetitive operation until the video end can record every frame index point coordinate (figure 4), so that each frame index point coordinates, then be recorded in order to achieve, the purpose of the classification and tracking. And the acquisition to the barbell center running track.

Force plat and video synchronization: Through the video and the time synchronization to load force plat and video synchronous effect the capture of the video the synchronization is program set up a "synchronization signal window" in the video. Through the man-computer cooperation users use the mouse in the video in a box to represent force plat lamp position. Range of square window is used to capture force plat synchronization signal. When the force plat began to work signal lights come on, camera will also be the image into the video capture in MATLAB for each frame image "synchronizing signal window" gray scale processing if the signal light is come up, gray scale will change, the computer may perceive the signal and returns the signal in the time, and the force plat synchronization.

Data processing: Barbell center identification tracking collection after a few beam for each frame of the barbell center coordinates, and through the calculation data can get kinematics index: such as complete weightlifting action process barbell center displacement, speed and time; Dynamics index: three direction of pedal force work, work ratio effective power, average power; Athletes and the relation. Between the positions of barbell. Parameter calculation, the system formation including the key technical parameter form, barbell center path, diagram vertical direction of the barbell center displacement. Velocity diagram, the technical test report.

Kistler force plat through the Bioware software acquisition data in later can use .TXT format data output. MATLAB read .TXT format of data from chart.

Coaches and weightlifting training can not observe the actual effect of action but with this system, and after the action. Can quickly understand athletes execution of the actual effect. To the athlete's action technology improvements, guide athletes action technical training, improve the sports results.

Conclusion: Research and development of this system is in weight lifting movement technical training presences practice produce. The characteristics of the system is simple, quick data collection and analysis. This system mainly by ordinary camera equipment and 3D force plat composition, can fast given weight lifting action a practice of kinematics and dynamitic parameter combination technology feed back report for faculty and athletes reference for athletes in the daily action technical training to provide basis of improving and improve the weight lifting action technology training to effect an level.

REFERENCES:

Xie Wei, Li Jian, Zhou Jihe. Swimming the technical detection an application [J]. sport science,2008,(03)

http://www.dartfish.com/en/index.htm

http://www.smx2008.com/product/CoachNote_R2.asp

http://www.qualisys.com/

http://www.motionanalysis.com/

http://www.naturalpoint.com/optitrack/

http://www.dorealsoft.com/

Wang Zhengzhi. China outstanding female weightlifting athletes snatch technology sports biomechanics analysis and research [D]. Capital sport university journal, 2009

Chen Yu, Wang Jun. A woman catch weight lifting the barbell trajectory analysis and research [J]. An Hui sports science and technology, 1999, 04

Zhu Xianchen. National weightlifting snatch technology outstanding men 2D biomechanical study [D]. Capital sport university journal, 2008

Dan Xinhai, Han Wenliang. A technology on the biomechanical jerk [J]. Xi an sports university journal, 2005(02)