

Digital human technology and its application in the field of sports medicine and Prospect

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Abstract. This paper reviewed and prospected the application of digital human technology in the discipline of sports medicine. Through using the combining method of retrospective research and prospective analysis, the author summarized the basic theory and method of digital human technology, current condition in recent years, developing trend and application in sports medicine discipline. The result showed that the digital human technology has broad application prospect in the are as of human motion simulation model design, the construction of virtual organ, sports injury prevention and non-invasive deign, digital human body technology and combining with the research of traditional Chinese medicine, etc.

Introduction

Digital human technology is based on human system as the prototype, with human body coordinate system, to life science, information science, artificial intelligence, system science and computer science as the theoretical basis, the establishment of a series of different levels of the system prototype, field, physical model, mechanical model, digital model, information model and computer model and integration, based on human observation and network technology as the support to establish a multi-resolution fusion mass data, and various data, and multidimensional dynamic expression with multimedia simulation and virtual technology, technology system with space, digital, networking, intelligent and visualization[1]. Digital human body is a virtual human body information, digital, to go through the "virtual", "virtual physical human", "virtual physiological human" and "intelligent people" of the 4 stage, the cells in the body, protein, gene level mock, "virtual human" is the morphological structure, physical properties, physiological functions and smart thinking [2].

The basic principle and method of digital human technology is the main fault plane using human CT or MRI imaging technology, every body is constructed into a 3D database, and then use the computer drawing method to make three-dimensional graphics mode of human anatomy. Modeling of digitized virtual human, the first step is to build the digital human body 3D geometric model of Chinese characters. Human body model data access to a variety of technical methods and acquisition scheme. Great development instrument and technical equipment for modern medical imaging, but between body image faultage is lack of precision the current imaging instrument that can be collected. Section spacing is small, the stronger the authenticity of the reconstruction of structure. Secondly, is the image processing and analysis of virtual human. It is a cross science and computer technology, signal processing technology, anatomical technique, neural science and

technology, nuclear technology, radiation science and psychology and other disciplines, fields. At present, there are a lot of imaging methods, Such as PET (positron emission tomography), SPECT (single photon emission tomography), FMRI (functional magnetic resonance imaging) and OII (Optical Intrinsic Imaging), etc. In the image processing and analysis of virtual human, image registration is by finding the spatial transform, the corresponding points of the two images to achieve spatial location and the anatomical structure of the same [3]. Registration results should enable two images of all anatomical points, or at least of all with diagnostic, measurement and evaluation of significance of the point match. No matching function, visible human (virtual human) data is just an isolated model, the precise registration of visible human data can be fully used, comparison of standard data and the normal people and patients. This work is similar with bioinformatics gene homologous sequence alignment analysis. Due to anatomical differences between human individuals, study the registration method requires complex deformation. The processing method has been formed a new science, namely computational medicine. Therefore, digital human technology involves the plastination and human body structure reconstruction technique, data acquisition processing, application model of image processing and segmentation, 3D reconstruction and visualization, establish the scientific issues and key technologies.

Application and Prospect of digital human technology in the field of Sports Medicine

Human motion model of simulation. Because the body of the complexity of the structure, the diversity of human motion, the body's own biological characteristics and measuring instrument limitations, some motion parameters or indicators cannot be measured directly, for some destructive or special conditions of the experiment cannot live test, all of these limit the exploration of the rules of human movement. Therefore, the establishment of a similar to real human motion system of the human motion simulation model of digital human body technology, combined with the related experimental and computer simulation technology, through the research on the model to reveal and grasp the characteristics of real human motion system and the rule of law, human motion analysis of this science will have a significant impact on sports technology.

Study on the rules of human movement after the comprehensive model of the spring-damper-mass mechanics model, multi-body biomechanical model, the neuro-musculo-skeletal system 3 stages [4]. Introduce the method of system simulation, opened up a new research field of sports exercise system. This method is no longer rigid model in general, is a comprehensive model neuro-musculo-skeletal system. Research on human motion is more close to the real condition of human body with this method, the motion law of human body, has the significant theory value. Although there are some problems in the technology, but has become one of the rules of human movement trend. Research on human motion model of human VHP data set can be better based on the "virtual human", can be used to simulate the human body motion such as walking, running, jumping, punch, tumble, inverted, push-ups. In sports, the digitized virtual human model can also be used in the field of sports technique diagnosis, high difficulty movement innovation, helps athletes to improve the technical level of [5].

Research on virtual organ. With the higher requirement of the research and practice of sports, a full range of digital human model including internal organs, the brain, will become the research object, because it has extensive application prospects in medical, health care, the kinematic fields. The simulation model of the United States of America at Penn State University by using the computer program and nuclear magnetic resonance image can make a virtual stomach, various factors with color and motion to reproduce the effects of gastric activity, including pressure, gastric

activity, into the stomach of objects (such as tablets) movement [6]. Han Xiaopeng SPM is used to extract the ROI of PET brain functional images and visualization research, internal and external side shows the central front, back and paracentral lobule, appear excited enhancement, fMRI examination can show the relationship between regional changes of function and body part motor and Sensory specific brain, provides a reliable method acupuncture research [7]. Fang Chihua reported a preliminary study on the three-dimensional reconstruction of digitized virtual liver image, realized the automatic judgment of liver and hepatic duct location entity, and by the different colors to show [8]. Graph system of Japan Jikei University developed a virtual 3D human anatomy, the system uses real 3D data of human body (including dynamic image data 4D heart) to establish virtual 3D human environment, can anatomical information interactive extraction of organs from the 3D structure of the human body, such as the organ of the position, shape, size, etc [9]. F J using the computer 3D images of human heart anatomy diagram system, build a "virtual organ". The "virtual organ" can respond to various stimuli, has the growth function, physiological and pathological process can simulate the actual human organ, is actually a digital cloning of human organs[10]. At present, the whole brain atlas some international and VHP can provide the human brain structure data [11].

With the in-depth research, if digital human organ is established after exercise, the digitized virtual reconstruction of different intensity exercise of human organs, such as heart, liver, brain and vital organs, kidney, skeletal muscle of the human body, resulting in a large amount of data movement after the human body each organ, on the basis of comparative analysis of sports and normal human digital imaging, a large number of different exercise intensity and normal people get from the macro function characteristics of data to micro, will have the huge promotion effect of basic research on sports.

Sports injury prevention and non-invasive diagnostic research. In sports training especially process of athletic training and competition, sports injury is inevitable. Injuries occurred often have certain regularity, it is inseparable with the sports project. Therefore, only summarize between sports and sports injury of the law, to take effective methods to prevent. How to realize the sports injury of the non-invasive diagnosis is always the research focus in sports medicine workers, digital human body will bring a good opportunity for this field. Make a bold attempt to many domestic and foreign scholars in this field. Zhou to analyze and simulate the process of people encounter obstacles fall while walking with 12 degree of freedom rigid body model of 6, in search of a strategy to reduce the harm caused by falling [12]. Ayoub used the 5 rigid body simulation model of snatch weight, manual evaluation and research of the human pain [13]. This method can also be used for rehabilitation training weightlifters, effect on pain of weightlifting case. Ergonomic engineering program of CAD RAMSIS, can be used to simulate the geometry and dynamics model of the human body [14]. When the digital human body reached the third stage of digital virtual human, can simulate human motion in the 3D state, directly see the virtual human in the movement of the muscle and bone changes with motion, force characteristics of the vulnerable parts in motion situation, analysis the advantages and disadvantages of different technical style, and then summarize the prevention method sports injury is effective.

After the realization of virtual human in first stages, the visualization model of further physical simulation, to the second stage in the construction of "virtual physical human" goal. For example, the finite element numerical analysis is to simulate the physical simulation of mature human body mechanics behavior. Will be based on the slice data set 3D reconstruction image, after free modeling and finite element analysis software CAD processing, can be carried out structural mechanics simulation, stress, strain distribution [18] simulation of the relevant parts of the. Thus

speculated that competitive sports, study on the injury mechanism, fracture characteristics and protective measures will be used to simulate virtual human, to review the damaged tissue observation and qualitative analysis of human use of Department of Internal Medicine Department of internal medicine imaging and virtual reality technology in digital human body, or even any part will be possible [15]. This study further, on sports injury of non-invasive diagnosis and treatment have a major impact on.

Combined with the digital human technology and traditional Chinese Medicine. The input of some "syndrome" in human form after computer processing, can display the variation in vivo data. The screening of digitized virtual human can compound component fatigue. In the screening of anti fatigue herbal ingredients, is the first quantitative on fatigue characteristics, using exogenous method of fatigue "syndrome" based on the virtual people, virtual human model establishment of sports fatigue. Taking drugs known composition and its role as a foundation, input medicine information, then we can get a series of pharmacokinetic data. In the aspect of property theory of traditional Chinese medicine research, virtual human can also use experimental methods cannot achieve the function. The traditional Chinese medicine related data such as effective component and the main function of input computer, role in establishing fatigue virtual human model is good, the drug in the virtual human body's metabolism and pharmacokinetic data can be simulated, according to the physiological and biochemical data of sports fatigue virtual physiological human change, can analyze the component of Chinese traditional medicine to improve the situation of fatigue. Such of use in digitized virtual human can eliminate the screening of effective components of fatigue in traditional Chinese medicine.

Digital medicine is an emerging interdisciplinary field, compared with all the old knowledge structure, connotation, research content, research methods, explore the development regularity of range, academic system, and other aspects of its origin, has many differences, once born, has the new direction of development and its the characteristics of. Born in the new subject, often is a breakthrough from the interdisciplinary field. Digital human body as a branch of digital medicine, quantitative research relates to the dynamics of imaging processing and precision analysis, both the exact reconstruction of human body system structure, or the human organ, tissue and the surrounding organs of the relationship, involves a lot of data and complicated calculation, although there are still a lot of problems and difficulty in certain aspects of science and technology, but can not stop the process of digital human body, we will share the data of human resources, to promote the great development of sports science. China Digital Medicine early research work carried out at the same time, because of the demand for traction, and cultivate a batch, combined with engineering, medicine, information technology with multi-disciplinary knowledge structure and interdisciplinary research ability of the compound talents or research team. It can be predicted, and the use of digital medical research in the near term will climax.

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