Research on the Application of Computer Big Data Technology in the Visual Communication of Sports Tennis Live Broadcast

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Abstract. This article introduces the realization of visual communication of sports tennis live broadcast system based on video splicing technology. First, the image is pre-processed, and then the SURF algorithm is used for image registration and splicing of the video image and the spliced image is merged. This article proposes a method for determining hot spots in panoramic videos based on motion foreground extraction. This method can smoothly track hot spots for extraction to achieve real-time sports tennis live broadcast. The implementation of this system saves manpower and financial resources in the process of live video streaming.

Keywords: Computer, Big data technology, Tennis, Live broadcast, Visual communication.

1. Introduction

Modern Games Competition Information System (GIS) not only accurately provides various sports information and results during the game, but also provides more for on-site athletes, coaches, competition officials, staff, on-site spectators, news media and the general public., More detailed, more convenient and quick information services, supporting the efficient operation of on-site competition management and sports meeting organization [1]. Through a wealth of information release methods, the colourful and exciting process and results of sports competitions are displayed, so that athletes, media, and the public can interact around sports competitions, so that the athletes' competitive style can be widely displayed, and the media's publicity effect can be fully realized. Play, so that the public can enjoy watching sports competitions, and enable more people to participate in sports events. The current TV technology is developing rapidly in the direction of digitization and multimedia. The intelligentization of TV program production is currently a hot topic of research at home and abroad. [RT-SET's Larus virtual studio system and ORAD's BLUESET system are used in TV stations at home and abroad. It has been widely used. The virtual fusion system realizes the real-time fusion of virtual objects and videos and is applied to the live broadcast of TV programs. The edge area of high-definition TV images is the position where the gray level changes most sharply, and there is a very rich amount of information, so in the process of image processing, it is necessary to fully realize the importance of the edge of the TV digital image, enhance the accuracy of the image edge, and effectively improve the subsequent high-definition display level. It is necessary to quickly and effectively extract the edge contour of the TV digital image, which can effectively suppress the noise. In communicating specific things, visual communication expresses the visual form of active behaviour, and visual communication is more dependent on objective feelings and visual subjective feelings. Visual communication is also the process of transmitting information symbols [2]. The main purpose of this system is to meet such needs. It only needs to set up a few cameras on the scene to realize the automatic live broadcast of the tennis match.

2. System flow

This system is mainly realized through the following technical steps: video acquisition and pre-processing; then the feature points are extracted by the SURF method for video splicing; the morphological-based fusion method is used to merge the image overlapping area to generate a panoramic video; Panoramic video uses the designed hot spot tracking method to track, extract and

broadcast by hot spot. The flowchart is shown in Figure 1 (the picture is quoted from Design of cellular, satellite, and integrated systems for 5G and beyond):

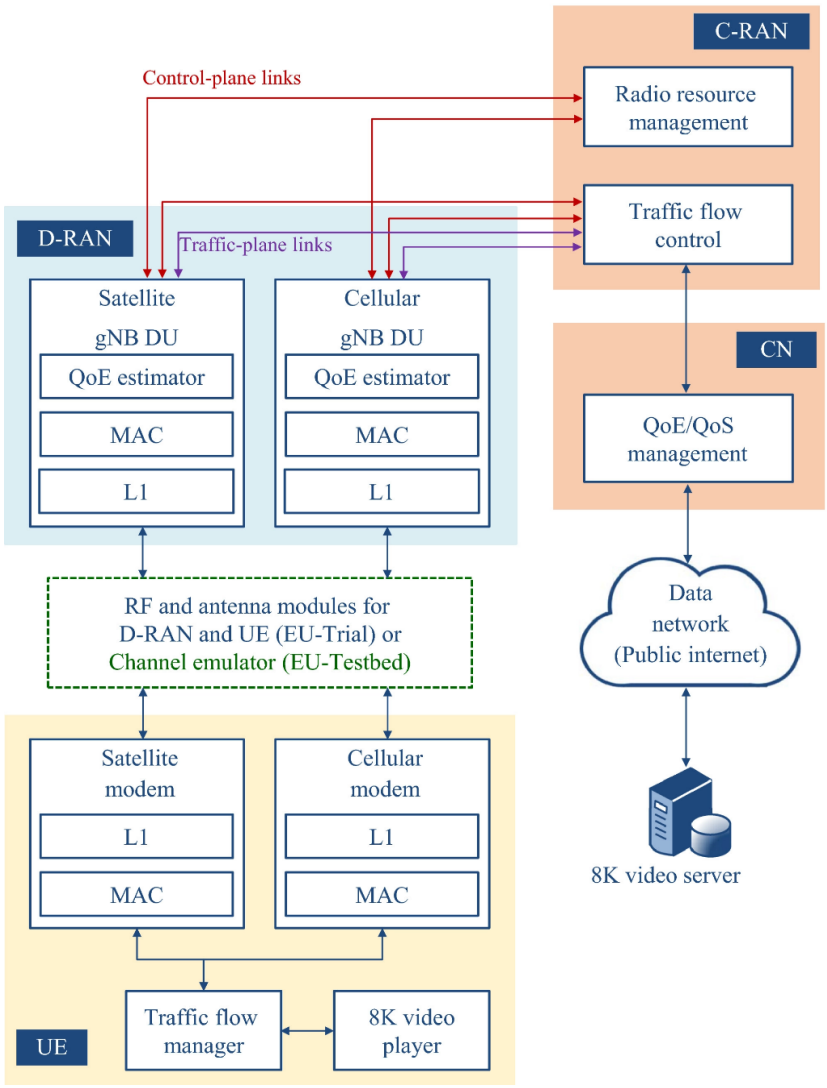

Figure 1. System implementation flow chart

3. Video capture

Before designing the data, it is necessary to save the memory. In the process of processing this part of the data, it is necessary to make full use of computer-related technology, and to design the drawings, and display the drawings through the drawing software [3]. This process is the graphic image technology. For visual communication design, under the full application of TV technology, TV image technology can create multi-element content including colours and text. Visual symbols are an important channel in the process of visual communication, which can realize the function of disseminating language and expressing vision. In the process of visual communication, the realization of effective artistic creation requires the application of basic elements including graphics, layout, text, and colours. Graphics actually belong to a kind of visual symbol, and the creation process is mostly conscious, but also contains rich connotations, and its intuitiveness is very obvious. In recent years, the development speed of visual communication has been accelerating, and it has been widely used in TV image design. The system uses multiple cameras of the same model, and the horizontal height and spacing are basically the same, and the overlapping range of the images captured by two adjacent machines is more than 1/5 of the width of the captured images. Synchronous triggers are used to start multiple cameras. to ensure the synchronization of the video stream time.

4. Design of visual communication algorithm for tennis sports video rebroadcasting

Template matching has nothing to do with the content of the image, and is the most commonly used in gray-scale registration [4]. The steps of template matching are: first set the template area, which can be selected in the overlapping part of the reference image; then select an area of the same size in the image to be matched, and compare the two; after traversing the entire image, according to the similarity relationship will finally determine the matching position. The selection of benchmark template, similarity measurement and search strategy are the key to matching. The schematic diagram of template matching is shown in Figure 2:

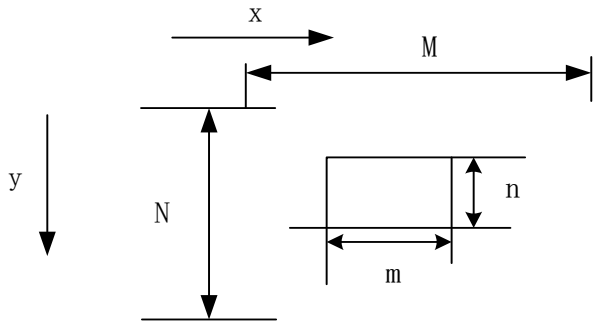

Figure 2. Schematic diagram of template matching

The degree of similarity can be measured by the normalized cross-correlation evaluation function, and the normalized cross-correlation algorithm is usually written as the NC algorithm [5]. Using this method to determine the matching similarity can be achieved by calculating the cross-correlation value. There are generally two forms of definition, see formulas (1) and (2):

$$NC(i,j)=\frac{\sum_{m=1}^{M}\sum_{n=1}^{N}T(m,n)S^{i,j}(m,n)}{\sqrt{\sum_{m=1}^{M}\sum_{n=1}^{N}T^2(m,n)\sum_{m=1}^{M}\sum_{n=1}^{N}\left[S^{i,j}(m,n)\right]^2}} \tag{1}$$

$$NC(i,j)=\frac{\sum_{m=1}^{M}\sum_{n=1}^{N}\left[T(m,n)S^{i,j}(m,n)-\overline{T}(m,n)\right]\left[S^{i,j}(m,n)-\overline{S}^{i,j}(m,n)\right]}{\sqrt{\sum_{m=1}^{M}\sum_{n=1}^{N}\left[T(m,n)-\overline{T}(m,n)\right]^2\sum_{m=1}^{M}\sum_{n=1}^{N}\left[S^{i,j}(m,n)-\overline{S}^{i,j}(m,n)\right]^2}} \tag{2}$$

Among the matching methods based on the transform domain, the Fourier transform method is the most typical. Its characteristic is that it has nothing to do with the specific scene, has a certain degree of noise resistance, and can adapt to the translation transformation and rotation transformation of the image [6]. The Fourier transform method searches for the peak value of the phase difference in the frequency domain after spatial transformation of the image, and then determines the overlap position based on this. The transformation of the image from the spatial domain to the frequency domain is achieved through Fourier transform, so that only simple spectrum multiplication calculations can be performed, without the need for complex cross-correlation calculations. First, there are two images f_1 and f_2, assuming that the translation relationship between the two is (x_0, y_0), then there is formula (3):

$$f_2(x,y)=f_1(x-x_0,y-y_0) \tag{3}$$

After the Fourier transform, the relationship F_1, F_2 between the two is shown in equation (4):

$$F_2(\varepsilon,\eta)=e^{-j2\pi(\varepsilon x_0+\eta y_0)}F_1(\varepsilon,\eta) \tag{4}$$

The cross-power spectrum between them is:

$$\frac{F_1^*(\varepsilon,\eta)F_2(\varepsilon,\eta)}{\left|F_1^*(\varepsilon,\eta)F_2(\varepsilon,\eta)\right|}=e^{-j2\pi(\varepsilon x_0+\eta y_0)} \tag{5}$$

Among them, F_1^* represents the complex conjugate of F_1 . The inverse Fourier transform of the above formula is:

$$\sigma(x-x_0,y-y_0)=F^{-1}\left[e^{-j2\pi(\varepsilon x_0+\eta y_0)}\right] \tag{6}$$

After obtaining the position of the peak of the above formula, the translation value (x_0,y_0) can be obtained, which is the position of the translation vector between the two. This method requires him to want to see a large overlap range. Although the calculation speed is fast, its application scenarios and registration accuracy are both limited. Among them $\overline{T}(m,n)=\frac{1}{M\times N}\sum_{m=1}^{M}\sum_{n=1}^{N}T(m,n)$, $\overline{S}(m,n)=\frac{1}{M\times N}\sum_{m=1}^{M}\sum_{n=1}^{N}S^{i,j}(m,n)$. The $NC(i,\ j)$The bigger the description template in the above formula is more similar to the pixels of $(i,\ j)$Location on the search map. When $NC(i,\ j)$The value is1 is, the matching position is determined. In practical applications, due to different shooting time or equipment, the pixel gray value between the reference image and the reference image cannot be absolutely the same [7]. At this time, for the determination of the best matching position, it can be considered that the position with the largest NC value is the best Match location.

5. Experimental analysis

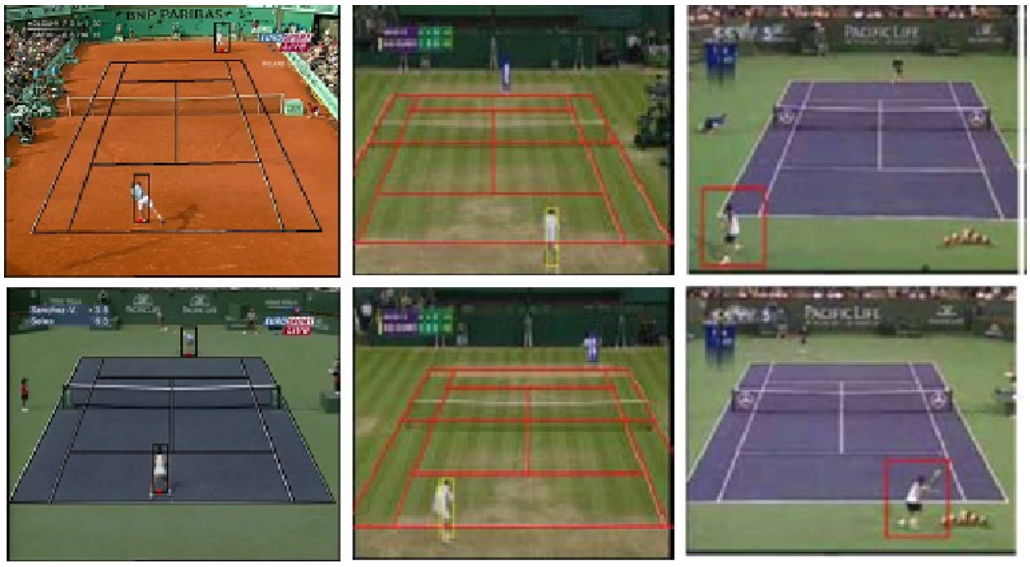

Figure 3. Hot spot area detection and extraction rebroadcast effect diagram

The hotspots of interest in tennis matches are often in the area with the most sports targets, so the hotspot area defined in this system is: the hotspot area is a sub-area in the video in which the sports foreground objects are the most; this sub-area The height of the video is equal to the stitched video, and the width is determined according to the aspect ratio of the specified broadcast standard (the specified broadcast standard in this article is 640*480, that is, the aspect ratio is 4:3). Technical steps for extracting hot spots for rebroadcasting There are: determining the main area, using the background frame difference method to extract the foreground, denoising, determining the location of the hot spot, smooth tracking of the hot spot, and extracting the hot spot for rebroadcasting [8]. The camera's acquisition resolution is 640*480, and the overlapping area of two adjacent frames the percentage is

39.8%. A total of 5 video streams are collected and spliced. It takes 31ms to stitch each frame of the 5 video streams to obtain a panoramic video frame. The average time to detect the location of the hot spot area of each frame of the panoramic video after splicing is 11ms.The experimental effect is shown in Figure 3.

6. Conclusion

The new edge detection method developed in this research achieves the purpose of better retaining the details of the edge of the image, good suppression of noise, and comparing the similarities and differences of different types of edge detection methods, and finally found that this method has more advantages. After the implementation of this system, the tennis match was successfully broadcasted. The system satisfies the real-time broadcast at a resolution of 640*480. Now it is seeking cooperation with local TV stations for further performance improvement and function expansion.

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