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Big Data Processing Technology in Film and Television Post Production

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Abstract. Nowadays, the wave of digitization, networking and informatization is sweeping the world, which makes the visual image become an important way of communication and transmission of global culture. The purpose of this paper is to analyze the application of big data processing technology in film and television post production. The distributed computing power of MapReduce is used to extract the content features of video images, construct corresponding indexes, and store and retrieve them in HBase database according to the indexes to form a big data processing platform for video images. This paper deeply discusses the framework related theory as the support of big data processing technology in film and television post production, analyzes the common algorithms in nonlinear editing system, discusses the mirror effect monorail and double track special effects in video special effects, and makes the realization effect of each kind of special effects in the space domain, and makes some special effects among them, The implementation of compressed domain is discussed. In this paper, through the application of experimental video big data processing technology to the film and television post production of various possibilities, and draw the following conclusions: in extreme cases, the stunt tree becomes a one-dimensional linear structure, using traditional parallel topology sorting, the device parallelism is 0, and using pipeline scheduling, because of breaking the sequence between frames, can play a relatively large parallelism.

Keywords: Big Data Technology, Post Film and Television, Video Production, Non-linear Editing

1. Introduction

With the rapid development of computer software technology, post production has run through the whole film and television production process, and has become an indispensable important element of film and television post production [1-2]. Digital technology covers important technical means and content, such as information technology, storage technology, communication technology, information management, processing technology and security management [3]. On this basis, it also includes integration technology, transmission, compression and streaming media technology, computer



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graphics technology and so on. The dependence of new media on digital technology makes the collection, processing, dissemination, management, storage and output, security and other contents of new media related theories, use methods, technologies and related system information become important objects of digital technology research [4-5].

At the same time, the large amount of computing required to serve millions of Internet or mobile users has a strong demand for cross media mining. Cloud based big data platform will make it feasible to access a large number of computing resources in a short time [6-7]. Athey s proposed a framework for cross media semantic understanding, including discriminative modeling, generative modeling and cognitive modeling [8]. Mei J studies the development status of big data processing technology, focusing on Hadoop technology which is widely used at present. According to the characteristics of video monitoring, forkan a proposes a Hadoop based big data video monitoring solution [9]. The architecture model of svsnscs is proposed by using Hadoop and big data processing platform, and the video processing flow is proposed according to the characteristics of cascade network [10].

In this paper, we use the distributed computing power of MapReduce to extract the content features of video images and construct the corresponding index, so as to store and retrieve them in HBase database according to the index, forming a big data processing platform for video images. Compared with the traditional parallel topology scheduling algorithm, the new improved hierarchical pipeline scheduling algorithm is discussed. The theoretical analysis and experimental results show that the hierarchical pipeline scheduling algorithm has the advantages in performance.

2. Research on the Application of Big Data Processing Technology in Film and Television Post Production

2.1. Big Data Processing Framework

As a mature distributed data processing framework, Hadoop has many features needed by distributed storage and computing system, and can quickly process massive data of TB level or even Pb level. In Hadoop architecture, the underlying Hadoop common library provides the common functions of the sub projects of Hadoop ecosystem framework, and the core component HDFS distributed file system provides the distributed data storage function with high fault tolerance required by computing services. MapReduce, another core component of Hadoop, is a distributed task computing framework, which is mainly composed of the runtime environment and editing model required by the actual task execution. The main programming contents for users using Hadoop computing framework are map function and reduce function. As a distributed service, zookeeper can coordinate other applications. The other components are optional components under Hadoop computing framework. They are aimed at different application scenarios and meet the personalized service requirements of different tasks.

2.2. Non Linear Editing

Nonlinear editing system plays an important role in the development of contemporary film and television. Because of the technology platform based on non-linear editing, editing, the key link of post production, has more possibilities of artistic creation. Because of the realization of digital technology, the digital material is edited on the computer.

(1) Drawing image

Image marking means that image B is gradually replaced by image a in the form of region. With the moving of the boundary, the content of image B is gradually replaced by the content of image a. the shape of this boundary can be simple straight line or other complex geometric shape. This conversion usually lasts for 20-30 frames. In the spatial domain, it can be expressed as follows:

$$S(x, y) = \left\{ \begin{array}{ll} f(x, y) & 0 \leq n \leq L_1 \\ P \otimes f(x, y) + \bar{P} \otimes g(x, y) & L_1 \leq n \leq (L_1 + L) \\ g(x, y) & (L_1 + L) < n \leq L_2 \end{array} \right\} \quad (1)$$

In the above formula, the value of P is 0 or 1, $\bar{P}$ is the complement of P , that is, one is 1, the other is 0, $\otimes$ is the pixel multiplication, $P \otimes f(x, y) + \bar{P} \otimes g(x, y)$ represents the process of image zooming from $F(x, y)$ to $G(x, y)$.

(2) Mirror effect

In the monorail stunt, the mirror stunt is a relatively basic stunt. The double track stunt, such as page rolling and page turning, is composed of mirror stunt and portrait stunt. In a mirror trick, the axis of symmetry can be horizontal, vertical, or diagonal.

For horizontal mirror effect, it is represented by matrix:

$$S(x, y) = F(x, y - 7) = \begin{bmatrix} f_{07} & f_{06} & \dots & f_{00} \\ f_{17} & f_{16} & \dots & f_{10} \\ \dots & \dots & \dots & \dots \\ f_{77} & f_{76} & \dots & f_{70} \end{bmatrix} = F(x, y) \begin{bmatrix} 0 & 0 & \dots & 0 & 1 \\ 0 & 0 & \dots & 1 & 0 \\ \dots & \dots & \dots & \dots & \dots \\ 1 & 0 & \dots & 0 & 0 \end{bmatrix} \quad (2)$$

Where $f(x, y)$ is the original pixel value and $S(x, y)$ is the transformed pixel value.

$$S(x, y) = \begin{bmatrix} 0 & 0 & \dots & 0 & 1 \\ 0 & 0 & \dots & 1 & 0 \\ \dots & \dots & \dots & \dots & \dots \\ 1 & 0 & \dots & 0 & 0 \end{bmatrix} \times F(x, y) \times \begin{bmatrix} 0 & 0 & \dots & 0 & 1 \\ 0 & 0 & \dots & 1 & 0 \\ \dots & \dots & \dots & \dots & \dots \\ 1 & 0 & \dots & 0 & 0 \end{bmatrix} \quad (3)$$

Formula 3 is the spatial domain transformation form of diagonal mirror image.

3. Experimental Research on Big Data Processing Technology in Film and Television Post Production

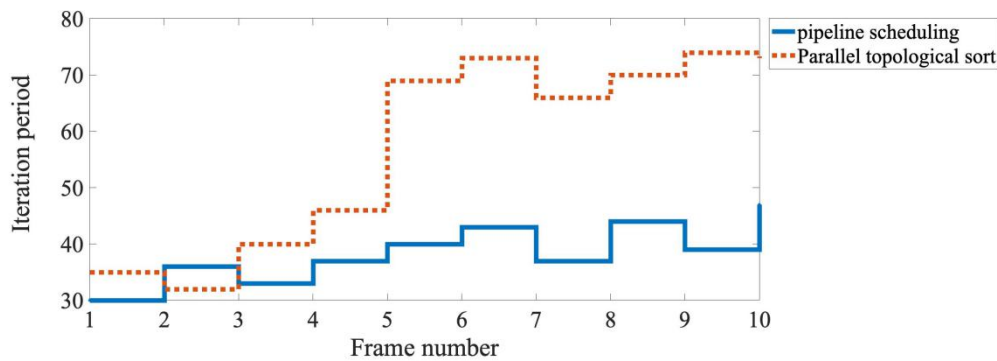
We take the application of big data processing technology in the film and television post production as the experimental content, and respectively adopt the two scheduling algorithms to achieve the film and television post effect. Here, the iteration period and memory consumption are taken as the test indicators. Since it is impossible to know the output completion time of each frame accurately, we take the callback execution time of each output completion as the completion time, and use the output time difference of adjacent frames as the iteration cycle. This will have certain error, but it will not affect the comparison of scheduling effect. YUV422 video data of 800K is the most frequently used memory in the board, so the usage of this part of memory is mainly monitored in the experiment.

For simple stunt tasks, both scheduling algorithms can ensure real-time processing of each frame. In order to fully compare the effects of the two algorithms, we mainly select several different types of more complex programs as the analysis target: type I: programs with more video layers but less stunts per layer (corresponding stunt tree width is large and depth is small). Type II: programs with fewer video layers but more special effects on each layer (corresponding to small width and large depth of stunt tree). Type 3: programs with multiple different stunt trees.

4. Experimental Analysis of Big Data Processing Technology in Film and Television Post Production

4.1. Comparison of Type I Experimental Results

This video program contains four layers of video. Each layer is added with a video stunt. The first layer and the third layer are added with transparency adjustment special effects (C once), the second layer with DVE special effects (r once, C once), and the fourth layer with mosaic special effects (r twice, C once). The experimental results show that the scheduling effect is shown in Figure 1 and the memory usage is shown in Table 1.

**Figure 1.** Comparison of dispatching effect**Table 1.** Comparison of memory usage

Frame number	Assembly line	Parallel topological sort
1	12	15
20	53	56
30	41	58
40	44	58
50	43	60
100	16	19

It can be seen that the iteration period of pipeline scheduling in stable phase is significantly lower than that of parallel topology sorting, but what is not shown here is that the delay of the first frame of pipeline is much larger than that of parallel topology sorting algorithm. It can also be seen that the memory consumption of pipeline scheduling is much larger than that of parallel topology scheduling. If the program is sufficiently complex and the memory demand exceeds the quantity provided by the board, the pipeline will not start up. In this case, the parallel topology sorting can not be used in real-time processing, but it can usually produce the processing results correctly.

To sum up, for this type of program, it is necessary to judge the memory requirement. If it can be met, pipeline scheduling is adopted; otherwise, parallel topological sorting is adopted. In addition, considering that the pipeline has pre filling time, if the program length is too short, pipeline scheduling is not suitable.

4.2. Comparison of Type II Experimental Results

This video program contains two layers of video, each layer has more than one video stunt. On the first layer, DVE special effects, mosaic special effects, tricolor matting like special effects, color brightness gain special effects. In the second layer, transparency and DVE are added. The experimental results show that the scheduling effect is shown in Fig. 2 and the memory usage is shown in Table 2

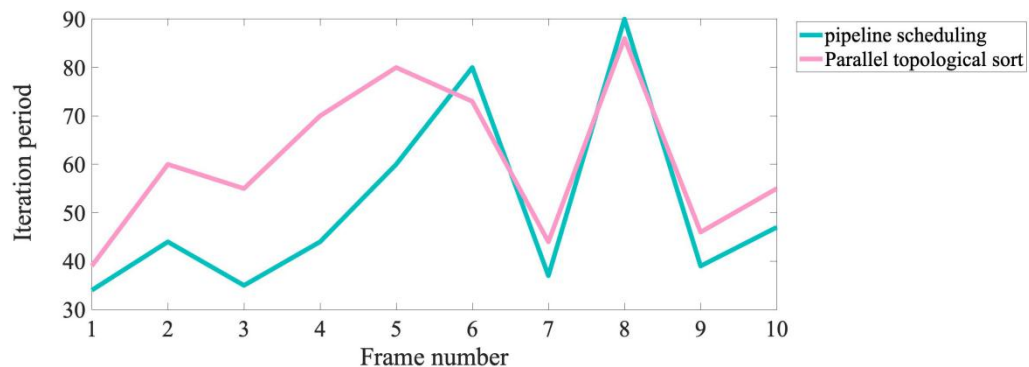


Figure 2. Comparison of dispatching effect

Table 2. Comparison of memory usage

Frame number	Assembly line	Parallel topological sort
1	32	37
20	57	50
30	48	55
40	42	50
50	47	46
100	19	17

It can be seen that the iteration period of pipeline scheduling is still significantly lower than that of parallel topology scheduling, and the memory consumption of pipelined scheduling is not much higher than that of parallel topology scheduling. For such programs, pipeline scheduling is obviously more advantageous. This type of program corresponding to the characteristics of the stunt tree is very deep, but the width is small. If parallel topology sorting is adopted, it is difficult to play parallelism because the set of nodes without precedence constraints is relatively small. Considering the extreme situation, the stunt tree becomes a one-dimensional linear structure. If the traditional parallel topology is used, the parallelism of the device will be 0. If the pipeline scheduling is used, the sequence between frames will be broken, so it can play a greater parallelism.

In terms of topology, the parallel scheduling algorithm is obviously better than the general iterative scheduling algorithm in terms of large cycle. Considering that reducing the iteration period is the ultimate goal of our scheduling, if the memory limit can be met, the hierarchical pipeline scheduling algorithm is obviously preferred; if the memory is not enough to start the pipeline, we can consider using parallel topology scheduling. Although the expected iteration period can not be achieved, at least each frame task can be handled correctly, which is also very important in the implementation system. Generally speaking, the pipeline scheduling algorithm still has some advantages. For the more complex video programs, we can consider mixing the two scheduling algorithms in order to give full play to their respective advantages and improve the system performance as much as possible.

5. Conclusions

With the development of film and television post production technology, the emergence of non-linear editing has become a revolution of film and television post production technology. The editing technology of "non-linear editing" can break the linear order and arrange the sequence randomly in the editing process. Instead of the traditional film storage method, the virtual digital storage mode is used, and the signal processing is carried out by computer, which can be randomly retrieved. In this paper, HDFS, HBase and MapReduce are combined to build a big data processing platform for video image. By analyzing the parallelism of video processing tasks and the weakness of traditional parallel topology scheduling algorithm, video real-time judgment, delay special effects, software special effects and other methods, the performance and scalability of the system are further improved. After

the actual verification, we can see that after the improvement of scheduling algorithm, the resources are optimized and the video post production processing capacity is greatly improved.

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