Target Tracking Algorithm for Multi-channel Information Transmission in Large Data Environment

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Abstract. Because the traditional single-channel information transmission algorithm ignores the real-time control of the transmission data, the signal transmission tracking accuracy is low. For this reason, a target tracking algorithm for multi-channel information transmission in a big data environment is proposed. The algorithm solves the echo signal of each point, determines the transmission range of the multi-channel information, uses the interrupt mechanism to optimize the decoding algorithm, and obtains the position of the data of each point through the classification of the classifier, so as to realize the transmission target tracking of the multi-channel information. The traditional single-channel information transmission algorithm and the target tracking algorithm of multi-channel information transmission are compared and analyzed. The experimental results show that the information transmission and tracking accuracy of the multi-channel information transmission target tracking algorithm in the big data environment is better than that of the traditional single-channel information transmission algorithm The information transmission tracking accuracy is high, and it has a better information transmission tracking effect.

Keywords: Digital signal · Multi-channel · Synchronous transmission · Transmission rate

1 Introduction

Multichannel information transmission is a kind of long-distance integrated detection technology. Through network remote instruments, long-distance resources can be telemetered and controlled under non-contact conditions. Since the first laser came out in the 1960s, laser technology has been widely used in many fields, such as long-distance ranging, space military, atmospheric research, etc. because of its monochrome, good directivity and coherence. With the continuous progress and breakthrough of laser technology, laser is more and more used in the field of signal transmission in space network. The traditional optical passive network signal is transformed into an active network signal transmission, and the physical and spatial characteristics of the surface can be acquired more accurately and efficiently. Efficient transmission of network

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random digital signals is one of the main methods to obtain high-resolution three-dimensional images. Its measurement method is to transmit a set of long-distance, high-brightness laser beam pulse signals to the target object, and then detect the height information carried by the reflected pulse echo [1].

The traditional single-channel information transmission algorithm cannot process massive network random digital signals, and the information transmission efficiency is low. At the same time, the stability and accuracy of information transmission can not be guaranteed. A target tracking algorithm for multi-channel information transmission in large data environment is proposed. The target tracking algorithm for multi-channel information transmission is realized by determining the transmission range of multi-channel information and complementary gain power transmission mode. The algorithm can real-time control the sampled data, ensure the integrity and non-distortion of the data, and ultimately achieve efficient transmission of network random digital signals. Experimental results show that the proposed multi-channel information transmission target tracking algorithm has high information transmission efficiency, and has good performance in data transmission accuracy, method stability and comprehensive error control [2].

2 Target Tracking Algorithm for Multi-channel Information Transmission

2.1 Determine the Range of Multi-channel Information Transmission

After the user interface represented by Windows enters the host computer, it requires the ability of high-speed elevation detection and I/O processing. This requires different measurement methods to improve its performance, but puts forward new requirements for the range of multi-channel information transmission. In fact, the peripheral speed of laser beam pulse signal has been greatly improved, such as the data transmission rate between hard disk and controller has reached more than 10 MB/s, and the data transmission rate between controller and display has also reached 69 MB/s. It is generally believed that the speed of laser pulse signal should be 3–5 times that of peripheral device. Therefore, the range set in the past is far from meeting the requirements, and has become the main bottleneck of the whole system. Therefore, a higher performance requirement is put forward for laser technology. An advanced local bus is used to deal with a large number of network random digital signals. The problems of low efficiency, instability and poor accuracy of information transmission [3]. A local bus is a local bus that is not attached to a specific processor. Structurally, the local bus is the first-level bus inserted between the original system bus, which is managed by a bridge circuit, and the interface between the upper and lower is realized to coordinate data transmission. The manager provides signal buffering to support 10 peripherals and maintain high performance at high clock frequencies. Local bus also supports bus master control technology, allowing intelligent devices to acquire bus control when needed to speed up data transmission [4]. The main performance and characteristics of local bus are as follows.

The main performance of local bus: support 10 peripherals; bus clock frequency 33.3 MHz 166 MHz; maximum data transmission rate 133 MB/s; clock synchronization mode; independent of CPU and clock frequency; bus width 32 bits (5 V) 164 bits (3.3 V); can automatically identify peripherals; especially suitable for working with Intel CPU.

The characteristics of local bus are as follows: it has the ability to operate in full parallel with processor and memory subsystems; it has implicit central arbitration system; it reduces pin number by multiplexing (address line and data line); it supports 64-bit addressing and full multi-bus master control capability; it provides parity check of address and data; it can convert SV and 3.3 V signal environment. It can be seen that the local bus provides a wider and faster access to the microprocessor for peripheral devices, and effectively overcomes the bottleneck of data transmission. At present, local bus interface is the preferred interface for many adapters, such as network adapter, built-in modem card, voice adapter, etc. At present, most motherboards have PCI slots [5].

In summary, multi-channel recording system needs to transmit multi-media information at the same time, and it also requires high transmission capacity: large capacity, high bandwidth, low latency transmission; in order to meet the needs of system synchronization, it needs to support resource management requirements including acceptability testing and resource scheduling functions: to facilitate the system to achieve distributed voice acquisition through multiple channels. The local bus can deal with the above problems well, but it needs to determine the transmission range of multi-channel information according to the data of each point, and adjust the frequency of network random digital signal according to the change of curve slope [6]. If the sampling regression curve of network random digital signal is $y = f(x)$, the sampling set t can represent $t = [(x_1, y_1), (x_2, y_2), \ldots..(x_n, y_n)]$. The sampling time of each sampling point in the above formula is $t_1, t_2, \ldots\ldots, t_n$, and the relationship between sampling time of each point is $t_1 < t_2 < \ldots\ldots < t_n$. Using the nearest n information sampling points, a regression curve is fitted, and the regression equation of one-dimensional line is applied. The formula is as follows:

$$\left\{ \chi = \frac{\sum\limits_{k=i-1} i = n(t_n - t)}{\sum (t_n - t)} \right\} \tag{1}$$

In formula (1), χ represents the slope coefficient. n is the sampling value of sampling point. If χ is larger, the sampling time interval is smaller. If χ is smaller, the sampling time interval is larger. In the process of controlling each sampling point, in order to improve the transmission accuracy of the network random digital signal, it is necessary to consider the specific expression of the echo signal when discretizing the network signal. The corresponding series values of the network signal obtained after sampling are formula (2), as shown below:

$$y = f(x) = \sum_{i=1} \beta \left(\frac{n(t_n - t)}{t^2} \right) \tag{2}$$

Formula (2) denotes the corresponding series values of network signal echo signals. To achieve a precision level for information transmission, the echo signals of each point can be obtained by solving them. According to the above steps, the multi-channel synchronous and accurate transmission of network random digital signals can be completed, and the range of multi-channel information transmission can be determined [7].

2.2 Optimized Decoding Algorithms

Multichannel inevitably requires that the system has a higher processing efficiency, requiring that the system can process up to dozens of channels of media information in a unit time. On the one hand, the processor of the system should have a higher computing speed, or the system should choose a more efficient media decoding algorithm. On the other hand, we can decompose the processing operations into the main part of the system by constructing a distributed architecture. In order to reduce the operation pressure of the main processor, the processing efficiency can be improved in other parts besides the processor. In multimedia recording system, multimedia I/O and multimedia encoding and decoding process are responsible for processing media information. To improve the processing efficiency of the system, we must start from these two layers and analyze their functions, structures, and applicable methods. Similarly, the improvement of processing efficiency of the system will mainly be reflected in these two layers [8]. The multi-channel information transmission structure is as follows.

Figure 1 is a multi-channel information transmission structure. The “transport layer” includes multimedia real-time transmission and control protocols. It provides packages, sending and receiving functions, data transmission scheduling for compressed media streams, and abstracts application-level parameters such as data burst and average data rate, so as to make them correspond to communication-level parameters and maximize transmission capacity. This layer shields network resources downward, provides media transmission interface upward, and provides the function of system resource management and use. The transport layer can be divided into three parts: one is the interface and protocol with the multimedia processing layer, the other is the interface and protocol with the storage management layer, and the other is the data transmission scheduling and control. “Storage Management Layer” is responsible for storing, querying and managing all kinds of multimedia records. It is the core of multimedia recording system [9].

The traditional single-channel information transmission method cannot cope with the massive network random digital signals, and the information transmission efficiency is low. At the same time, the stability and accuracy of information transmission can not be effectively guaranteed. Furthermore, only one 12 ADCI converter is introduced into the multimedia processing layer. There are 18 input channels in the converter, including 16 external input channels and 2 internal input channels. Four external input channels are used to input four sensor acquisition signals and one internal input channel is used to input internal reference voltage signals. Before using ADC 1 conversion, configure ADC 1. ADC 1 uses regular channel conversion sequence and converts the mode to multi-channel single conversion mode. And enable DMA mode. The sampling time from channel 0 to channel 7 is 28.5 cycles. The shorter

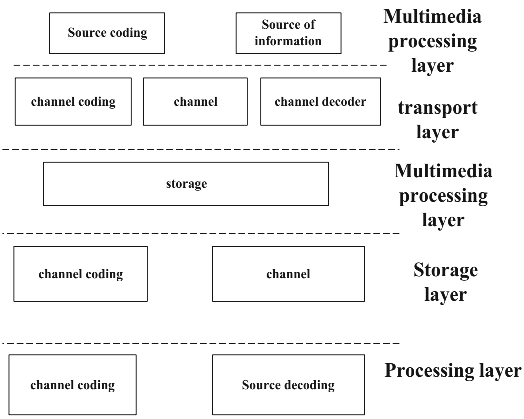

Fig. 1. Information transmission structure

the sampling time, the faster the sampling channel can be closed, the system can enter the sleep mode, reduce energy consumption, and prolong the battery life. However, the sampling time is too short, which may reduce the accuracy of sampling data. The final compromise is 28.5 cycles. Initialize the sampling value of 8 channels to ADC1 IN17, open 8 regular channels to SQ1–SQ8. The operation formula is as follows.

$$v_{ref\ln t} = \frac{v_{ref\ln t}}{4096} \times vdd \tag{3}$$

In formula (3), $ref\ln t$ denotes the reference value, $v_{ref\ln t}$ denotes the theoretical value, vdd denotes the theoretical value. According to formula (3), it can be calculated that $ref\ln t$ enlarges 100 times and retains decimal places. Compensation factor is the ratio of theoretical sampling value to actual sampling value. When the sensor data is sampled, the compensation factor is calculated firstly, then multiplied by the actual sampling value of the sensor, divided by 100, the theoretical sampling value of the sensor after compensation can be obtained. The value of rule channel conversion is stored in a single data storage management layer. Once the conversion is started, the converted data will be stored in the storage management layer. For eight consecutive conversions, set the queues of the eight regular conversions to the same value, and then average the results of the eight conversions to obtain the final result [10]. The structure of multi-channel internal analog-to-digital conversion is shown below.

Figure 2 is a multi-channel internal analog-to-digital conversion structure. When the lower computer receives the data sent by the coordinator, it first checks the data frames to prevent errors caused by data transmission. If the check fails, the frame command is dropped directly. If the check passes, the target address of the frame command is judged to be itself or not, and if not, it is returned directly. If the target address is itself, the command is executed and the data collected by the corresponding sensor is returned. The timeout count is cleared and data is sent. Channel 1 sends the first frame of data, and activates the sending interrupt. The interrupt function completes the sending of the remaining data frames. The serial port baud rate designed in this paper is 115 200 bit/s. It takes about 1/115 200 = 10 us to send 1 bit data, and about 100 us to send 1 b data. When a large amount of data is sent, the time consumed increases and the power consumption increases. Interruption mechanism is used to send data, check data frames, optimize decoding algorithm, improve efficiency, reduce power consumption and prolong battery life [11].

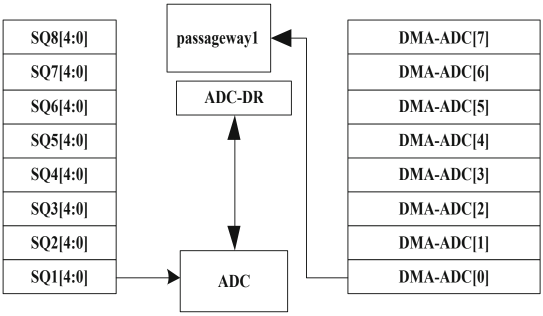

Fig. 2. Multichannel internal A/D conversion architecture

2.3 Implementation of Multi-channel Information Transmission Target Tracking

In large data environment, multi-channel information transmission target tracking algorithm finally transforms the tracking problem into the binary classification of samples. Through classifier classification, the sample location with the greatest similarity is the approximate location of each point data. Then, the location of each point data is optimized and the location of each point data is finally obtained. Sample collection in the algorithm is divided into two parts. In the first part, positive and negative samples for classifier updating are collected, which are carried out in the nth data frame of the known target location; in the second part, samples that need to be classified by the classifier are collected, which is carried out in the nth data frame of the tracking task. The two parts of sampling are carried out in different data frames, but the sampling process is consistent. In the process of sampling, the first step is to determine the location of the sampling area. In the algorithm, the sampling area is a square area centered on vertex (x, y) in the upper left corner of the target position, and the edge length of the square is twice the radius of the outer boundary of the sampling area. Sampling grids are generated in the region, and then appropriate samples are selected according to the sampling conditions. Sampling conditions can be expressed as $ind = (rd < prod) \cap (dist < inrad)$, which are mainly determined by two conditions in the process of sampling. First, samples must be selected in the sampling area. When the positive sample is taken, the radius *inrad* of the outer boundary of the sample area is smaller.

In order to collect positive samples near the target location. When negative samples are sampled, the samples will be sampled in the annular region where the radius of the inner boundary is larger than that of the outer boundary, and the radius of the inner boundary is larger than that of the outer boundary when positive samples are sampled. When acquiring the samples to be classified, the samples are sampled near the same position in the current frame according to the target position obtained in the previous frame. The radius of the outer boundary of the sampling area is between the range of the radius of the outer boundary when the positive and negative samples are collected.

Since the classifier is updated frame by frame according to the position of the target, and does not retain any prior knowledge, if similar objects suddenly appear in the data sequence, it may lead to the classifier can not classify the samples accurately, which may lead to the failure of tracking. Once the target is lost in the tracking process, the classifier will update according to the wrong location, which will cause the subsequent tracking process to fail. Aiming at the problem of target tracking, the proposed algorithm is improved on the basis of the traditional target tracking algorithm, which adds the process of target location optimization and achieves multi-channel information transmission. At the same time, the weighted sequence tracking window is used to solve the target problem, correct the error in the centroid recalculation process, and improve the tracking efficiency and robustness of the algorithm. The formula for calculating the centroid weight is as follows.

$$\delta_{rd} = \sum_{i=1} w\left(\frac{n\left(t_n - \bar{t}\right)}{t^2}\right) \tag{4}$$

In formula (4), the discriminant weight of a data frame on w can be adaptively adjusted by the learning of discriminant weight, and the two features can be organically combined to improve the discriminant ability of the tracking algorithm. When the target information is similar, the discriminant ability of the internal analog-to-digital conversion structure becomes weak, and the corresponding weight decreases accordingly. When the sparse feature of the target is similar, the discriminant ability of the sparse representation coefficient feature becomes weak, and the weight of the discriminant weight updating strategy reduces its weight. It can be seen that the update strategy increases the accuracy and robustness of the tracking algorithm and reduces the occlusion of the target. So far, target tracking algorithm for multi-channel information transmission is realized [12–15].

3 Experimental Conclusion

In order to verify the effectiveness of the proposed multi-channel information transmission target tracking algorithm in large data environment, 14 common data sequences are selected from a large number of data sets provided in the database for estimation. The attributes of these 16 common data sequences are as follows.

Table 1 is the attributes of 16 general data sequences. According to the attributes of 16 general data sequences, the traditional single-channel information transmission algorithm and the multi-channel information transmission target tracking algorithm proposed in this paper are used to carry out information transmission tracking on the data. The transmission tracking accuracy of the two algorithms is compared. The comparison results are shown in Fig. 3 Show.

Table 1. Attributes for 14 common data sequences

Sequence name	Frame number	Challenge
Basketball	#725	IV. OCC. DEF. OPR. BC
Bolt	#350	OCC. DEF. IPR. OPR
Cardark	#393	IV, BC
David	#462	IV, SV, OCC, DEF, MB, IPR, OPR—
David3	#252	OCC. DEF. OPR. BC
Deer	#71	MB, FM. IPR. BC, LR
Doll	#74	IV. SV. OCC, IPR. OPR
Faceoccl	#128	OCC
Footballl	#900	IPR. OPR. BC
Human8	#1336	IV. SV. DEF
Lemming	#1000	IV. SV. OCC, FM. OPR. 0 V
Panda	#351	S V. OCC, DEF. IPR. OPR. 0 V. LR
Singed	#200	IV. OPR. SV. OCC
Skating 1	#500	IV. OCC. DEF. MB, FM. IPR. OPR. O V

Analysis of the data in Fig. 3 shows that the target tracking accuracy of the multi-channel information transmission proposed in this paper increases with the number of experiments, up to 98%, while the target tracking accuracy of the traditional single-channel information transmission algorithm The number of experiments continues to

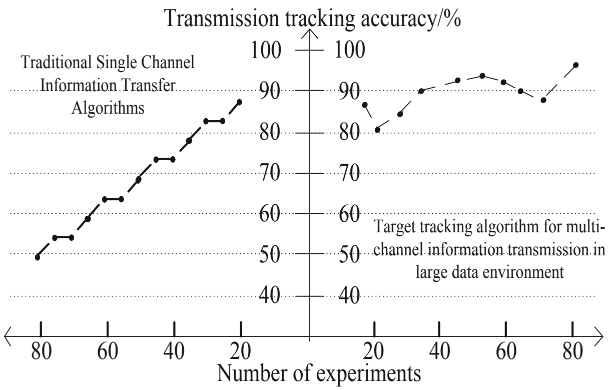

Fig. 3. Comparing the experimental results

increase, showing a downward trend, and the highest is only 88%. The target tracking accuracy of the multi-channel information transmission proposed in this paper is higher than that of the traditional single-channel information transmission algorithm, which shows that the target tracking of the multi-channel information transmission proposed in this paper The algorithm can track the target more robustly and accurately.

4 Concluding Remarks

There is a huge amount of information in the field of signal transmission in space network. The information extracted by traditional transmission methods is limited, and the accuracy can not be effectively guaranteed. A target tracking algorithm for multi-channel information transmission in large data environment is proposed, which can improve the efficiency of information transmission and ensure the accuracy of information acquisition. The experimental data prove the effectiveness of the multi-channel information transmission target tracking algorithm in large data environment.

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