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# An Improved Compound Morphological Transform Algorithm for Video P-frame Compression

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**Abstract:** DCT has block effect and the "mosquito noise" and become more obvious in the low transmission. It is difficult to meet the satisfaction of video transmission in narrow bandwidth and high quality requirements. Video image based on mathematical morphology inter-frame coding technique is the use of inter-frame motion compensation coding algorithm through complex morphological transformation, using the structural elements of the macro block irregular pieces for opening and closing operation, selecting and filtering the irregular pieces and then estimating and encoding the small irregular size for motion and motion vector and finding the matching block with absolute difference to achieve inter-frame prediction. The simulation can achieve relatively fine compensation to improve the coding efficiency and under the same compression ratio the video quality can be improved, the deficiencies of the DCT algorithm in image transmission are remedied to improve the effect of image transmission, to reduce the computational complexity, to improve signal noise ratio. It is of great significance in decoding and transmitting the network video.

**Key words:** Compound morphological transform, p-frame compression, motion estimation, structure elements, frame prediction

## INTRODUCTION

It is well known that human obtain information through visual sense about accounts for 70% of the total amount of information,it has intuition, reliability and a series of video information superiority, under the impetus of the technology progress and user needs, people demand for information communication and storage has not only confined to the traditional voice and text information, image and video image information storage and transmission have become all kinds of consumer electronics, communications and hotspot in the field of computer application. Due to the digital video in improving image clarity and quality, improving human-computer interaction function, analog video have not this advantages (Cen and Liu, 2001; Chen, 2006). So simulation video is gradually replaced by digital video. From the entertainment industry (such as DTV, Video-On-Demand) to commercial applications, such as Video phone, Video conference and now the booming each kind of telemedicine, distance education and training, digital Video has become more and more in-depth People's Daily lives, greatly changed the way of people using the computer for entertainment and education, in particular the rapidly development of Internet and the development of a new generation mobile communication network, there has been fundamental change for the predominantly traditional TV broadcast Video service (Cheng and Gong, 2010; Gao *et al*., 2009).

In the field of application of the image, as a result of the large image data quantity, the data compression technology is more pressing. In recent 10 years,the subject of image compression obtained by leaps and bounds the subject development and fruitful results, there are many new methods, new technology and entered the stage of practical application in many fields (Luo *et al*., 2000; Zhu and Ma, 2000). Data compression is expressed in bits for signals emitted from source, reduced data must be assigned to the specified information set or a set of data sampling signal space. Signal space, that is, the object of data compression, it can be physical space, such as memory, disks, disk data storage medium; The time intervals, such as the transmission of a given message set time; Electromagnetic spectrum band for the transmission of a given message set the bandwidth required. Visible, signal space refers to the given information of airspace, time domain and frequency domain space. These forms of signal space are interrelated, reduced information the means to enhance the efficiency of transmission or storage space in the decrease of the bandwidth. In what way, what kind of signal space compression, according to the needs and technical conditions to decide. In the

bandwidth restricted narrow-band transmission, bandwidth utilization ratio is more important (Xu and Wei, 1998; Yan and Liu, 2011).

Mathematical Morphology was born in 1964, morphological image processing is based on geometry.Research basic idea of Image morphology geometric structure is to use a structure element to detect an image for look to whether can put this structure elements well fill in inside the image and validate placing structural elements of the method is effective. Based on the image fit into the marked the location of the structural elements, you can get information about the structure of the image. This information is concerned with the size and shape of the structural elements. Therefore, the nature of the information depends on the selection of structural elements. That is to say, different structural elements can complete different image analysis through complex morphological transform, it can achieve structure analysis and feature extraction for target image to obtain the different analysis results.

## OVERVIEW OF MOTION ESTIMATION CODING ALGORITHM BASED ON MORPHOLOGICAL TRANSFORM

At present, some video compression standards such as h. 261 and MPEG-1/2, adopts the two-dimensional block DCT transform and motion compensation block matching algorithm, effectively eliminate the redundancy of the image sequence in space and time, but what the interframe prediction coding, motion compensation technique tend to have search the contradiction between computational cost and accuracy, limit the certain application of high-speed transmission occasions; And the adoption of block DCT transform and motion compensation block matching, make this kind of method to restore the image block effect (Zhao and Gui, 2005).

To solve above problems, in between the frames in video coding morphological transform based on mathematical morphology is introduced. To encode sequence images between frames in image processing, through morphological transform in macro block can be irregular small filter out with different motion vector and then the nature of the application framework for coding, in order to achieve more sophisticated compensation, in order to achieve the purpose of improving the efficiency of compression.

The core of the method for the correct selection of motion vectors of the motion vector and where inconsistent irregular small pieces. Assume that A macro block contains an irregular small pieces and their projected image and the actual image in the irregular position, there will be a large error The interframe displacement error in the macro block is not very big but in irregular small block is quite big. By the same token, if the interframe displacement error within a small piece is bigger, has reason to suspect that the small and the macro block with different motion vector, if the motion vector, the small pieces and motion vector coding alone, can better is forecasted to motion sequence images, reduced the interframe displacement error, so as to improve the compression effect and improve the signal-to-noise ratio of the effect. As shown in Fig. 2. 1, based on estimates of the number of irregular small morphological transform and motion diagram of the image coding algorithm

## THE IMPROVED INTERFRAME CODING PROCESS

**Extraction of irregular small pieces:** Through the study found that simple composite morphological transform which can achieve the goal of leach irregular small pieces. The concrete can adopt the following algorithm:

$$DFD(i,j)_{\lambda} = \begin{cases} 0, DFD(i,j) < \lambda \\ 1, DFD(i,j) \geq \lambda \end{cases} \quad (1)$$

Set DFD lambda to DFD after the threshold value of binary image, B is 3×3 structural elements:

$$DFDM = DFD_{\lambda} \circ B \bullet B \quad (2)$$

There is irregular small filtering results, For ease of irregular small pieces, can extract these small pieces of the skeleton:

$$DFDS = S(DFDM) \quad (3)$$

if $DFDS(i,j) > 0$, represents DFDM skeleton radius in (i, j), in fact these irregular small piece of has broken into a series of block length range.

If change the type (2) the morphological transform, such as filter out smaller pieces, can control the number of blocks needed to be encoded, can achieve the corresponding control code rate, etc.

**Motion estimation:** Similar to traditional motion estimation algorithm, still take "and absolute difference (SAD) as a measuring criterion. In DFDS is greater than zero points,

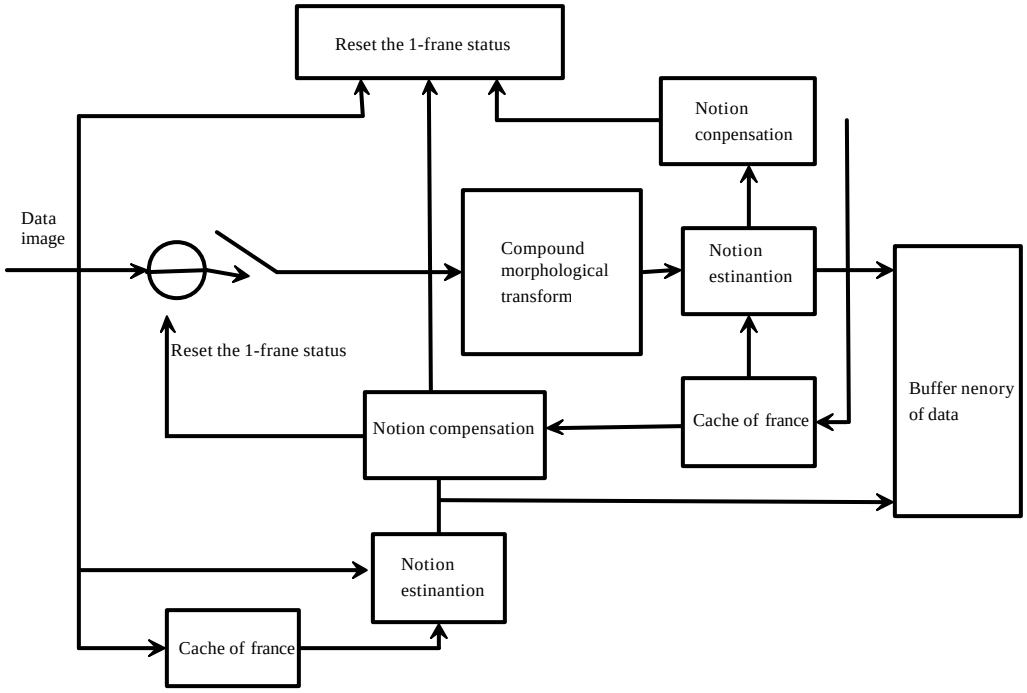


Fig.1: Based on The Morphological Transform the Irregular Small Estimation and Motion Image Coding Algorithm Block Diagram

each point of irregular represents a piece of the small squares, the small motion matching, the absolute difference and as follows:

$$SAD_N(x,y)=\sum_{m=i-w}^{i+w}\sum_{n=j-w}^{j+w}\left|S_k(m,n)-S_{k-1}(m+x,n+y)\right| \quad (4)$$

The block size motion estimation using and its somewhat randomly selected, can also be w will set as function of DFDS (i, j), the irregular block in the square, the greater the matching the bigger the piece also, the general value range of x and y is $-15\le x,y\le 15$, this is the same as ordinary block matching motion estimation range, with $SAD_N$ minimum of (x, y) is the matching block. Motion vector of square is:

$$M_v(i,j)=(x-i,y-j) \quad (5)$$

**The code for Irregular small pieces:** After calculate the size of the irregular blocks and motion vector, The sender to its position, size, motion vector coding, the terminal recovery solution accordingly them again, or get these small squares and the corresponding motion vector. Because of a certain point (i, j) in the DFDM may, respectively belong to two (or more) different squares, it take the principle of closest commonly, set (i, j) subordinate to the squares, respectively are $(x_n,y_n),n=1,2,...$, take minimum point $(x_q, y_q)$ in the area , if $\{|(i,j)-(x_n,y_n)|,n=1,2,...\}$ Motion compensation, motion vector of point (i, j) is $(x_q, y_q)$.

## SOFTWARE IMPLEMENTATION AND SIMULATION RESULTS

**Software implementation process:** Video image acquisition and storage process is like this video image source data get from CCD camera, input file of video can be yuv video file (Y:Cb:Cr is 4:1:1) and it can also be a continuous BMP format file for the single frame sequence image, Will be collected in the video image sequence on temporary into memory or cache, can also be collected images sequence data stored in the hard disk, easy to read when compression processing.

Video image compression coding process is it read from the memory or hard disk image data frames and P frame coding, mainly for P frame coding by software vc + + 6.0 programming to achieve compression. Compression process is shown in Fig. 2.

Video decoding and images displaying is that reading the compressed code stream, Unpacking the video image data, Real-time displaying the decoded image, Unziping the coding process as shown in Fig. 3.

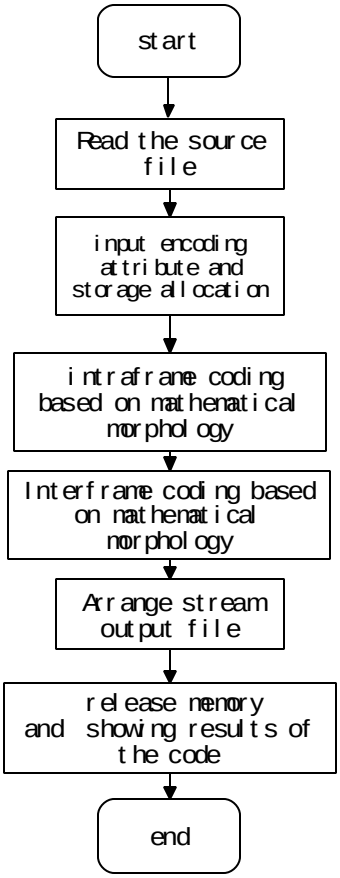


Fig.2: Encoding Process

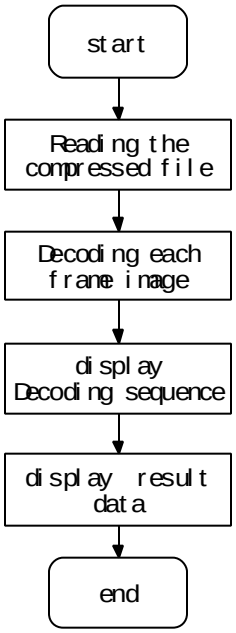


Fig.3: Decoding process


Fig. 4(a-c): Reconstruction result in the figure (a) is the original image by collected; (b) after the simulation, rebuilt after interframe compression results figure; (c) for the use of DCT algorithm of compression standard h. 263

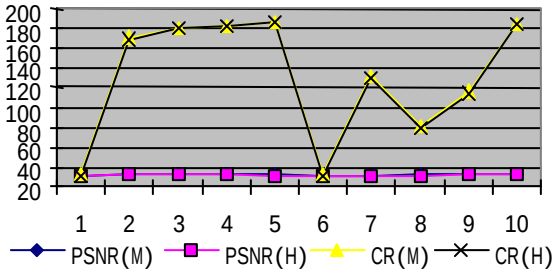


Fig. 5: Effect of the parameters for mathematical morphology and h. 263 interframe compression

**The contrast for simulation results:** Due to the sensitivity of the human eye of luminance signal is much higher than on the sensitivity of the colour, so the experiment selects the luminance signal motion estimation, the displacement between frames in video image error of image processing. Through the morphological transform in macro block irregular small filter out with different motion vector and then to encode the application skeleton nature, reached with the human eye to identify, enhance the compression ratio.

The following little-boy video images for testing, Test time setting between 20 to 200 s, To illustrate the program, Interception of intermediate 5 frames used were compared, The simulation results are shown in (a), (b) and (c) of Fig. 4.

Through the simulation, using the result of the reconstruction of luminance component PSNR image

Table 1: Mathematical morphology algorithm for video compression data

| No. of the frame | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Enctype | I-F | P-F | P-F | P-F | P-F |
| PSNR | 30.3 | 33.6 | 34.2 | 33.9 | 32.9 |
| CR | 32.6 | 170.4 | 180.6 | 183.5 | 187.1 |

Table 2: h.263 algorithm for video compression data

| No. of the frame | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Enctype | I | P | P | P | P |
| PSNR | 30.1 | 32.8 | 33.1 | 32.9 | 31.5 |
| CR | 31.9 | 168.9 | 179.2 | 182.3 | 186.7 |

coding quality evaluation, as shown in Table 1 and 2. effect of the parameters for mathematical morphology and h. 263 interframe compression as followed Fig. 5.

## CONCLUSION

The experimental results show that the above simple interframe compression for background, character was in a local movement, irregular small quantity is less, when doing interframe motion estimation joined the mathematical morphology method to motion compensation of irregular small pieces, can effectively improve the signal-to-noise ratio and compression ratio, greatly improve the effect of the motion compensation, under the same compression ratio can improve image quality. So on the premise of meet the human visual, makes every effort to at the time of coding, the frame image to keep the good quality, improve the accuracy of interframe prediction; Between the frame image to increase the compression ratio of the image, to improve the coding efficiency of video image, the network video image codec and transmission application field have great economic benefit and practical value.

Mathematical morphology is an science of image processing and analysis,the basic ideas and methods of image processing theory and technology has a significant influence, a lot of very successful theory model and visual inspection system of mathematical morphology algorithm has been adopted as its theoretical basis or component. Although the wavelet analysis is one of the important means of image compression category, However, we deeply understand mathematical morphology will be found that the basic ideas and methods of mathematical morphology can also be applied to all aspects related to image processing, such as target recognition based on hit strike transform, image segmentation based on watershed concept, skeleton extraction and image compression based on the corrosion and open operation, image reconstruction based on geodesic distance, particles analysis based on the morphological filter, etc. At present, the technical and application about morphology is constantly developing and expanding, including visual detection, robot vision, medical image analysis

processing, character recognition, image coding compression, materials science, etc.,in addition,visual inspection, robot visual, biomedical image analysis, image compression, texture analysis and many other fields have achieved successful application, created a huge economic benefits.

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