

On-line Sprite Encoding with Large Global Motion Estimation

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A sprite which is an image composed of pixels belonging to a video object visible throughout a video segment is a very important concept proposed by MPEG4. Because of the search region limitation in the global motion estimation, the performance of traditional sprite coding technology is not satisfactory in the case of fast camera motion. Only enlarging search region is difficult to ensure the right motion estimation. In this paper, an improved algorithm is proposed with enlarging the search region, predicting the motion of current VOP(Video Object Plane)and shortening iterative time. Three main techniques are adopted in the new algorithm.

(1) Enlarging search region

An Accepted Quality(ACQ) is defined as criterion to evaluate the search result. If ACQ is one, search center is updated relying on the previous final motion vector and then the same process will repeat until the optimal global motion vector is found.

(2) Weighting SAD

It is very difficult for the global motion estimation to obtain the accurate motion vector in the large distance of the current and reference VOPs. While camera does large motion, the current VOP will move toward the same direction of a previous frame at the most probability. So the previous frame motion parameters can be exploited to predict the current VOP motion. The detail method is that SAD (Sum of Absolute Difference) of motion estimation is weighted by the previous frame transformation parameters.

(3) Shortening iteration

The Levenberg-Marquardt iterative algorithm can rapidly solves the precise motion parameters with suitable initialization. While the modifications achieve the preciseness demand of the motion vector, the iteration is obliged to exit. The simplification does not significantly modify the results while sensibly decreasing the computing time.

Two group experiments present a comparison between original algorithm and improved algorithm. The first group experiment shows the improved algorithm gets the same performance as the original algorithm in coding the general motion sequences. In the second group experiment, the Stefan background sequences which frame rate is 15HZ, 10HZ, 7.5Hz and 6HZ are encoded in various transformations. The results given by below table show the coding performances of the our algorithm are significantly improved.

Sequences	Transform	Frame rate (HZ)	Quantizer	Original algorithm		Improved algorithm	
				Y-PNS (db)	Bits rate (kb/s)	Y-PNS (db)	Bits rate (kb/s)
Stefan	translation	15	10	35.71	168.77	36.03	63.30
Stefan	affine	10	10	35.39	166.42	35.95	56.81
Stefan	perspective	7.5	10	35.19	163.07	35.85	52.68
Stefan	perspective	6	10	35.14	146.04	35.80	52.59

[1]MingChieh Lee, "A Layered Video Object Coding System Using Sprite and Affine Motion Model", IEEE Trans in Circuits and Systems for Video Technology, Vol7, No1,1997.

[2]Frederic Dufaux, "Core Experiment N3:Dynamic Sprite and Global Motion Compensation," Description of Core Experiments on Efficient Coding in MPEG4 video, DEC.