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Study and analysis of Various Parameters of Hybrid Video Coders for Optimal Bit Budget

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Abstract: In the current scenario main target of video compression technique to reduce the bit budget in such a way that resultantly maximum utilization of bandwidth. In this work we have discussed the various parameters that effect the bit budget in the video compression. Out of them quad tree partition, block matching algorithms, quantization parameters, are more suitable for achieving optimal bit budget. In this work we will discuss each one by one and finally concluded that which is most appropriate for bit budget control. In this work we also conclude that if we incorporate the two or more than two parameters changes in the hybrid video coder one can achieve total optimal bit budget and also achieve rate bit budget and distortion bit budget optimal separately.

Keywords: Bit-budget**,** Quad tree, Quantization, Video coder.

1. Introduction

Nowadays, every mobile is almost featured with high-resolution cameras. Capturing a small video of 5 minutes will use nearly 200 MB or more and sending these large video files for mobile communication will take large bandwidth and much time and some videos will not be even accepted by these applications. Thus, the size of video is needed to be reduced. It also becomes difficult to transmit the digital videos with high resolution and bit rate through their proposed channels. For transmitting the video from source to destination there are various video coders are developed [1]. In recent time High efficiency video coder (HEVC) is most appropriate video coder for high compression of multimedia data compression. It can handle the high definition (HD) video data and beyond the HD. This capability in the HEVC is due to some advance feature add on it as compare to the H.264/AVC. It provide the high compression efficiency and good quality of reconstructed video sequence as compare to previous standard. To achieve this high compression efficiency, a complexity of the system is increased. To reduce the size of video there are various parameters are used. Optimal bit budget in video coding depends upon information and static portion of the frame. In video coding advanced quad tree formation techniques are used for separate out the information and static portion of the frame. Advance quad tree decomposition

partition of the frame is done on the basis of information based, small size block represents the high information region and large size block represents the less information region [2][3].

To achieve optimal bit budget motion estimation algorithms, quantization parameter and quad tree decomposition strategy play important role. Selection of quantization parameter is most important task in video compression for achieving optimal bit budget. It is observed that information based quantization method and advance quad tree decomposition strategy is more beneficial for achieving most optimal bit budget [4] [5].

2. Related work

In [6] Y. Zhang et alproposeda machine learning approach for quad tree decomposition for finding out of low information and high information region in video frame. In [7][8] optimal bit budget is achieved using leaf merging strategy of quad tree, this technique non information portion of quad tree is merge and save a large number of bitbudget. S. Saponara in [9] present a work for reduction of bit budget using dynamic control of motion estimation and compensation. In [10] L. Prangnell proposed a soft threshold method for different types of information blocks and set the quantization parameter accordingly. In [11]using optimized value of quantization parameter high speed implementation of rate distortion is achieved. In [12] Yu et al on the basis of statisticalanalysis proposed a new quantization method on the basis of block information.

3. Parameters for optimal bit budget

3.1 Quad tree decomposition

Quad tree (QT) parameter is most suitable parameter for frame partitioning. There are so many techniques are developed by different researchers to separate out the information and non-information portion of video frame. It is also found that when non information portion is separate out one can easily compressed that portion. It is found that quad tree formation strategy is suitable for optimal bit budget in video compression. In high efficiency video coder now a days soft computing based quad tree formation techniques are used.

3.2 Quantization parameters

Quantization parameter selection is the best solution for finding out the optimal rate estimation motion estimation and compensation. Quantization parameters play big role in video compression and optimal bit budget control. There are various strategy developed by researchers for finding out optimal value of quantization parameters. The role of optimal value of quantization parameter is to maintain the good

value of PSNR at high compression. At the present time various research are going on using adaptive information based quantization method. In this quantization method quantization parameters are fixed on the basis of residual information of the frame. Using this strategy good video quality video frame is reconstructed with high compression.

4. Result and discussion:

In this case, we observe the results for the slow and fast motion video frameat 5 fps frame rate and ± 8 search range. Table 1 and Table2 shows the comparative analysis of different performance parameters for reconstruction of frame. It is found that variable quantization technique is more suitable than fixed quantization for achieve optimal bit budget with some degradation of PSNR value.

Table 1: Comparative analysis of bit budget using Fix QP and variable QP with FR = 5 fps for slow motion video frame.

P	R_{FQP}	R_V	D_{FQP}	D_v	TB_{FQP}	TB_v	T_{FQP}	T_v	$PSNR_{FQP}$	$PSNR_v$
1	988	518	4619	2656	5607	3174	89.06	88.66	30.12	29.20
2	1054	536	4553	2641	5607	3177	101.44	97.55	30.13	29.20
3	1114	548	4503	2635	5617	3183	105.26	100.39	30.13	29.25
4	1123	554	4496	2633	5619	3187	108.25	103.48	30.15	29.30
5	1141	578	4486	2629	5627	3207	108.56	106.11	30.17	29.30
Avg	1084	547	4531	2639	5615	3186	102.5	99.23	30.14	29.25

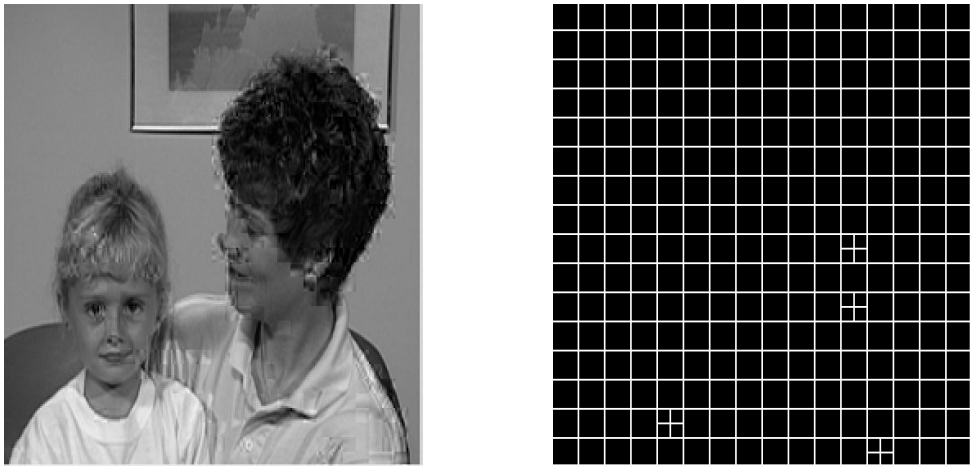

Fig.1. Reconstructed of slow motion video frame with Frame Rate 5 fps, at Fix Quantization Parameter and advance quad tree decomposition technique.

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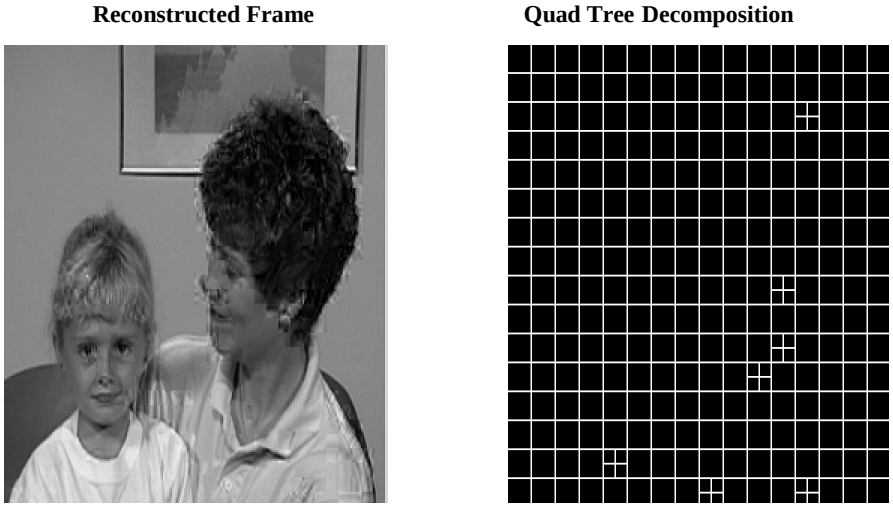

Fig.2. Reconstructed of slow motion video frame with Frame Rate 5 fps, at variable quantization Parameter and advance quad tree decomposition technique.

Table 2: Comparative analysis of bit budget using Fix QP and variable QP with FR = 5 fps for fast motion video frame.

P	R_{FQP}	R_v	D_{FQP}	D_v	TB_{FQP}	TB_v	T_{FQP}	T_v	$PSNR_{FQP}$	$PSNR_v$
1	1714	716	9048	8436	10762	9152	71.28	71.07	30.15	29.03
2	1816	788	8946	8352	10762	9140	73.68	73.19	30.15	29.12
3	1898	862	8879	8278	10776	9140	76.00	75.17	30.15	29.18
4	1952	934	8842	8219	10792	9153	78.79	77.18	30.15	29.27
5	1968	1012	8832	8167	10800	9179	80.78	79.17	30.15	29.39
Avg.	1869	862	8909	8290	10778	9153	76.10	75.15	30.15	29.19

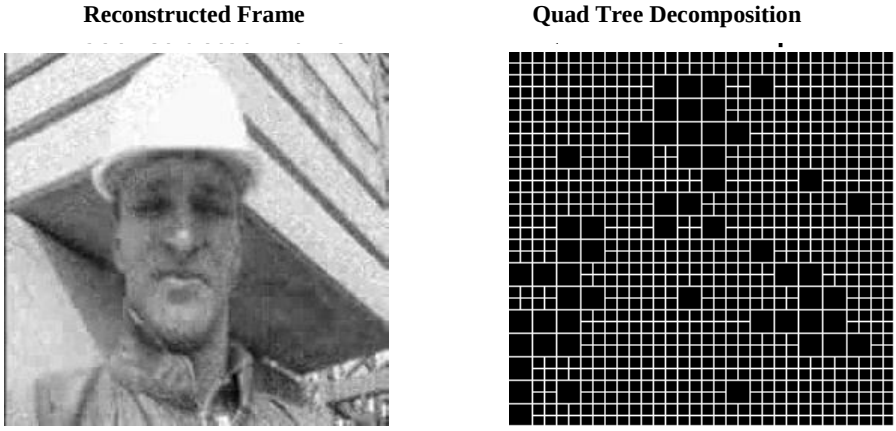

Figure 3: Reconstructed of fast motion video frame with Frame Rate 5 fps, at fix quantization Parameter and advance quad tree decomposition technique

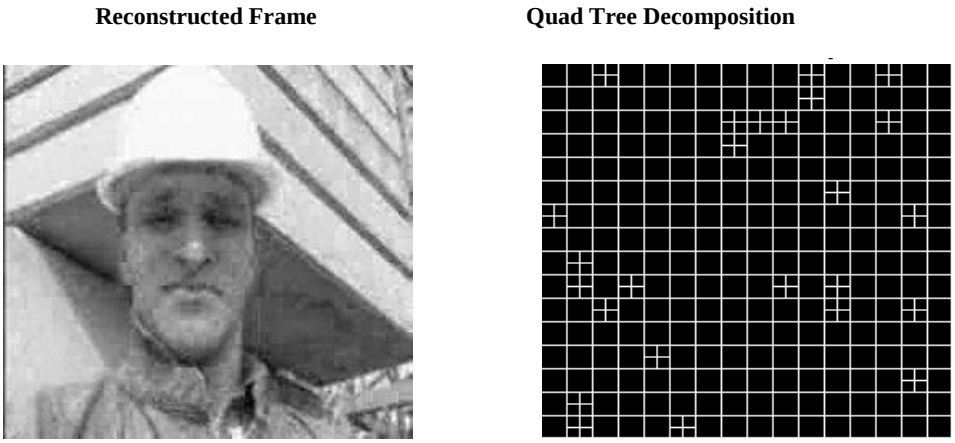

Figure: 4 Reconstructed of fast motion video frame with Frame Rate 5 fps, at variable quantization Parameter and advance quad tree decomposition technique

5. Conclusion

Results shows that comparative analysis between the various quantization parameter with advance quad tree decomposition technique for slow motion and fast motion video sequences in terms of bit budget, complexity and PSNR. It is concluded that using information based quantization method and advance quad tree formation strategy better bit budget is achieved. On the other side if we compare the different quantization parameter technique with advance quad tree strategy in terms of total bit budget saving and complexity, gives the outperforming results.

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