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DYNAMIC VIDEO COMPRESSION USING IDLE SCENE SKIPPER

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ABSTRACT: High quality video requirements and application is becoming one of the most demanded services in the era of high speed digital communication. Quad full High Definition (QFHD) video compression has many level of challenges due to its large bandwidth requirements (1024 * 4 pixels). Both criteria of reserving the bandwidth and providing HQ video service need a balancing technological approach. This work explores various available video motion estimation algorithms and proposes an efficient video motion estimation technique with added advantage of increased estimation speed and with moderate PSNR ratios. Existing ME approaches follows cycling the video frame to meet the complete circle of starting search block point mechanism. In the proposed Enhance predictive zonal search method, searching macro blocks can be terminated early by employing threshold based rate distortion predictors, instead of calculating all the distortion predictors. A proposed approach of predicting the motion vector of a searching area before the actual termination of the MV, this will be known as multiple early termination of motion vectors and skipping the idle scene from the original video will increase the compression size. A performance comparison between full search, diamond search with MET EPZS for a test case video shows that proposed EPZS MET method can save to 82% of estimation time than full search and can save 22% estimation time than diamond search algorithm. The PSNR is degraded than full search for less than 1%, and better than diamond search by 1%.

INTRODUCTION

HEVC adopts a flexible Coding Unit (CU) quad tree structure. With more flexible CU size selection, the coding efficiency of HEVC increases significantly but its complexity is much higher than that of H.264/MPEG-4 AVC. To reduce computational complexity, we propose a fast algorithm, which consists of splitting decision and termination decision, in constructing the CU quad tree. This scheme is designed to be complementary to the current three fast tools included in HEVC TM5.0. In other words, when it is combined with the existing fast CU tools, it still provides additional time savings. The time reduction of our scheme is most noticeable on HD pictures. In comparison with the original HM5.0, our proposed method averagely saves about 43% encoding time and the BD rate increases by about 2.2% for the HD test sequences. [1]

High Efficiency Video Coding (HEVC) is currently being prepared as the newest video coding standard of the ITU-T Video Coding Experts Group and the ISO/IEC Moving Picture Experts Group. The main goal of the HEVC standardization effort is to enable significantly improved compression performance relative to existing standards—in the range of 50% bit-rate reduction for equal perceptual video quality. This paper provides an overview of the technical features and characteristics of the HEVC standard. *Index Terms*—Advanced video coding (AVC), H.264, High Efficiency Video Coding (HEVC), Joint Collaborative Team on Video Coding (JCT-VC), Moving Picture Experts Group (MPEG), MPEG-4, standards, Video Coding Experts Group (VCEG), video compression.[2]

Large coding unit which is also known as super macro block, has already been adopted in the test model of next generation coding standard called high efficiency video coding. The coding unit which is larger than 16x16 and less than or equal to 64x64 provides great bit rate saving while the coding complexity increases dramatically. In this paper, we propose a fast coding unit decision algorithm in either frame level or coding unit level to accelerate encoding procedure.

In frame level, by analysing the utilization rate of coding unit in all depth, we skip several rarely used coding units in specified depth. In coding unit level, the neighbour and co-located coding unit information are referred for further skipping coding unit in unnecessary depth. Results show our proposed algorithm provides averagely 45% total encoding time reduction and negligible drop of rate distortion performance. [3]

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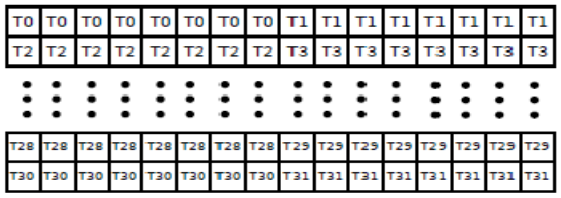
The H.264 video coding standard provides considerably higher coding efficiency than previous standards do, whereas its complexity is significantly increased at the same time. In an H.264 encoder, the most time-consuming component is variable block-size motion estimation. To reduce the complexity of motion estimation, an early termination algorithm is proposed in this paper. It predicts the best motion vector by examining only one search point. With the proposed method, some of the motion searches can be stopped early, and then a large number of search points can be skipped. The proposed method can work with any fast motion estimation algorithm. Experiments are carried out with a fast motion estimation algorithm that has been adopted by H.264. Results show that significant complexity reduction is achieved while the degradation in video quality is negligible. [5].

PROPOSED APPROACH

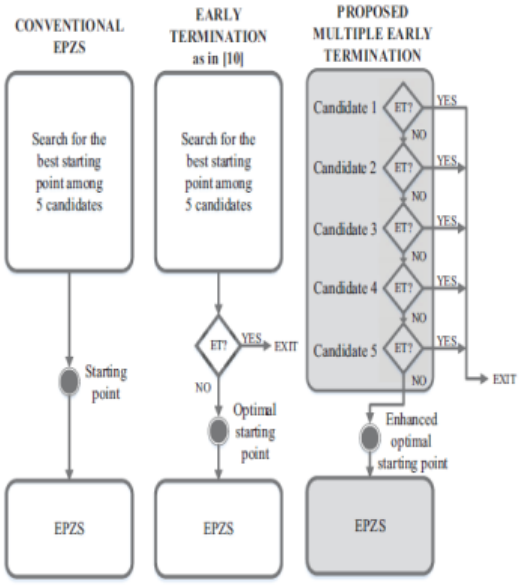
Predictive methods, such as EPZS use different vectors to find the best point for starting a directional search. It is usual to take LEFT, UP, and UP-RIGHT neighbours in the current frame, as well as the median of these three. Of course, these neighbours are not available in a parallel context because they are often being computed concurrently with the current block.

To search for motion vector candidates we exploit the fact that, for physical limitations, not every block is computing the ME at the same time, only as many as the hardware can handle. Since we compute the ME row-wise for efficiency reason, at the time of computing a row, the upper row has already finished its execution since a row can give work to thousands of threads. This allows us to effectively use the TOP vector in the current frame, instead of the one in the previous frame of other parallel approaches, to compute the vector predictor. Moreover, as motion vectors are read and written in the same memory space, in the worst case (top vector still has not been computed, it may happen in corner cases) the value of the previous frame will be used. Various literature work shows that using a greater set of motion vector predictors can improve PSNR. We use this not only for PSNR, but for compensating the lack of neighbour motion vectors. The predictors used in our implementation are LEFT, RIGHT, DOWN and COLLOCATED in the previous frame, TOP and TOPRIGHT in the current frame and ZERO.

4×4 and 8×8 are other used ME block sizes. Since these sizes may have less parallel operations than a 16×16 block, a problem arises when the minimum parallel granularity is 32, especially in the 4×4 size. However,



when taking into consideration the ME technique, there is no step of the process when only one block is processed simultaneously: at the selection of the best starting point, several predictors are tested independently of the results of the others; at the first step of the small diamond pattern search, 4 blocks can be checked simultaneously, and in each successive step of the search, 3 blocks can be checked. If other patterns are used, such as the square pattern suggested in, these numbers increase. This makes the number of operations that can be performed simultaneously greater than 32. When the number of operations is not a multiple of the granularity size, we suggest simply increasing the number of candidate vectors
that can be checked simultaneously. At the motion vector predictor stage, this can be achieved by increasing the size of the motion vector predictor set (adding DOWNRIGHT and/or DOWNLEFT). At the directional search stage, the search pattern can be extended by adding extra checking points.



While EPZS is already considerably less complex than full search ME, it still involves testing of a relatively large number of MVs. Each MV is typically examined in a Rate-Distortion (RD) sense. The distortion between

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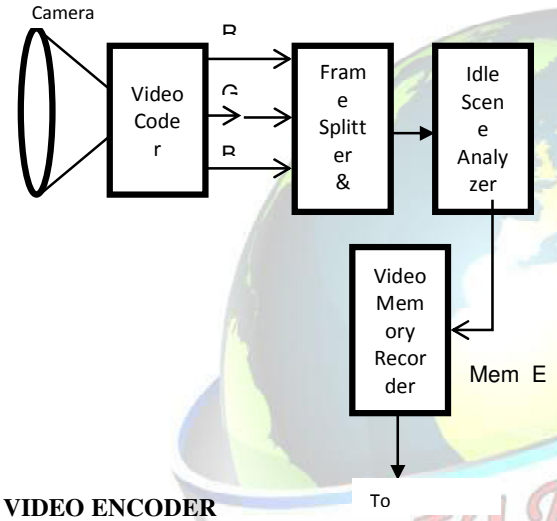
original block and prediction block obtained by means of such MV is computed. In conventional HEVC, this happens by means of the Sum of Absolute Differences (SAD) metric. Formally denote as X[h;w] and P[h;w] the samples in the original block X and prediction block P respectively, where h = 0; :::;H - 1, w = 0; :::;
W - 1 and where H and W are the blocks height and width respectively.

Then the SAD is computed as:

$$SAD = \sum_{h=0}^{H-1} \sum_{w=0}^{W-1} |X[h,w] - P[h,w]|, \qquad (1)$$

IDLE SCENE SKIPPING



VIDEO ENCODER

Camera is an optical instrument that records images that can be stored directly, transmitted to another location, or both. These images may be still photographs or moving images such as videos or movies. Video compression uses modern coding techniques to reduce redundancy in video data. Most video compression algorithms and codecs combine spatial image compression and temporal motion compensation. Christo Ananth et al. [6] proposed a system in which the cross-diamond search algorithm employs two diamond search patterns (a large and small) and a halfway-stop technique. It finds small motion vectors with fewer search points than the DS algorithm while maintaining similar or even better search quality. The efficient Three Step Search (E3SS) algorithm requires less computation and performs better in terms of PSNR. Modified objected block-base vector search algorithm (MOBS) fully utilizes the correlations existing in motion vectors to reduce the computations. Fast Objected - Base Efficient (FOBE) Three Step Search algorithm combines E3SS and MOBS. By combining these two existing algorithms CDS and MOBS, a new algorithm is proposed with reduced computational complexity without degradation in quality. MATLAB Tool M-script is used to extract the image frames from an AVI format Video.

STORAGE

A data storage device is a device for recording information or data. Recording can be done using virtually any form of energy, spanning from manual muscle power in handwriting, to acoustic vibrations in phonographic recording, to electromagnetic energy modulating magnetic tape and optical discs.A storage device may hold information, process information, or both. A device that only holds information is a recording medium. Devices that process information may either access a separate portable (removable) recording medium or a permanent component to store and retrieve information.

IDLE SCENE SKIPPER

Idle scene skipper is novel method that compares the video frames from the encoder before it get stored in the storage device. The dynamic algorithm which used in the idle scene skipper it prevent identical frames get storing in the storage device. So it avoid usage of vast amount of memory usage.

RESULTS AND CONCLUSION

IDLE SCENE RECOGNITION

Fig A.1 Before Idle Scene Recognition

Fig A.2 After Idle Scene Recognition

A successful design of multiple early termination enhanced predictive zonal search algorithm is developed and implemented in MATLAB GUI tool. EPZS MET has the unique advantage of balancing the

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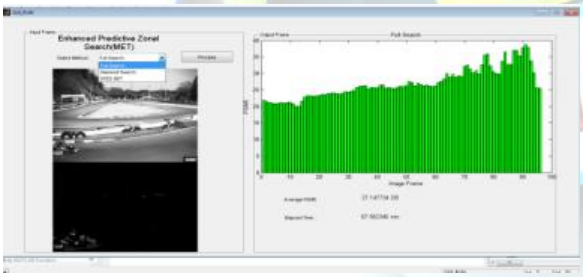
bandwidth and high speed digital demands of a HQ video broadcasting. Existing approaches of full and diamond searches are following a technique of expensive motion vector search delay for achieving high quality video estimation. But our proposed approach has the capability to terminate the searching points before its arbitrary iteration, when the threshold based predicative descriptors are used to bypass the arbitrary detour for processing the entire motion vector patterns.A grey scale 2d test video of racing car with a size 240*320 consists of 98 frames is used as an input video. Test video is chosen based on the criteria that it should have both larger and minimal motion occurrence as its content.

Motion estimation of EPZS MET is proven to be better by performing its latency and accuracy ratio comparison with existing full and diamond search algorithms.ME delay time is measured by means of the delay taken for software encoding and the accuracy of the ME will be calculated by again reconstructing the motion vectors to an decoded video and the differences between the original video frame and decoded video frame will be predicted through PSNR calculations.

A performance comparison between full search, diamond search with MET EPZS for a test case video shows that proposed EPZS MET method can save to 82% of estimation time than full search and can save 22% estimation time than diamond search algorithm. The PSNR is degraded than full search for less than 1%, and better than diamond search by 1%.That shows that the proposed algorithm has great improvement in processing time without affecting the accuracy performance.



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