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MotionEstimation Technique forReal Time Compressed Video Transmission

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ABSTRACT:-
Motion Estimation is one of the most critical modules in a typical digital video encoder. many implementation tradeoffs should be considered while designing such a module. It candefine ME as a part of inter coding technique.Inter coding refers to a mechanism of finding co-relation between two frames (stillimages), which are not far away from each other as far as the order of occurrence is concerned, one frame is called the reference frameand the other frame called the current frame, and then encoding the information which is a function of this co-relation‟ instead of the frame itself. This paper focuses more on block matching algorithms which comes under feature/region matching. Block motion estimation algorithms are widely adopted by video coding standards, mainly due to their simplicity and good distortion performance In FS every candidate points will be evaluated and more time will be taken for predicting the suitable motion vectors. based on the above noted drawback, the above said adaptive pattern is proposed

Optimization is proposed at algorithm/code-level for both encoder and decoder to make it feasible to perform real-time H.264/AVC video encoding/decoding on mobile device for mobile multimedia applications. For encoder an improved motion estimation algorithm based on hexagonal pattern search is proposed exploiting the temporal redundancy of a video sequence. For decoder, at code level memory access minimization scheme is proposed and at algorithm level a fast interpolation scheme is proposed.

Keywords: Motion Estimation, Hexagonal Pattern Search, Diamond Pattern Search, Adaptive Pattern

I. INTRODUCTION

The motion search pattern is important in terms of search speed and correctness of the motion information, it consider various search patterns and Adaptivemotion search algorithm, where it exploit the correlation between blockdifference and motion magnitude. Important parameters in motion estimation are: size of block, search area, search pattern, search strategy, and matching criterion.[1]Various algorithms for fast block search have been developed to reduce the computational burden associated with thefull-search block matching algorithm (BMA).They mainly focus on the search strategy using heuristicmethods. Recently, it is known that the motion search pattern has an important influence on search speed and correctness of the motion information. Since the searchstrategy depends on search patterns for efficient motion estimation, it analyze search patterns for fast motion estimation.In a teleconferencing video, most image blocks are regarded as stationary or quasistationary.

Motion vectors for stationary image blocks are mostly around (0,0). In order to decide if a block is stationary. Block motion estimation algorithms are widely adopted by video coding standards, mainly due to their simplicity and good distortion performance. Using block motion estimation, a video search strategies. By analyzing the block matching algorithmas a function of the block size and distance in the search area, find analytic search patterns for initial motion estimation. it also propose an ad frame is divided into non-overlapping block of equal size and the best matched block is determined from reference frames to that block in the current frame within a predefined search window. Normally, thisis performed by minimizing a block distortion measure (BDM)between these two blocks such as the sum of absolute difference (SAD). The most straightforward BMA is the *full search* (FS), which exhaustively searches for the best matching block within the search window. However, FS yields very high computational complexity andmakesMEthe main bottleneck in real-time video coding applications. Thus, using a fast BMA is indispensable to reduce the computational cost. To reduce the number of search points, three classes of BMAs have been exploited:

1) Methods based on a set of fixed search patterns
2) methods exploiting inter-block correlation, and
3) methods applyinghierarchical or multiresolution framework.

a current frame into no overlapping rectangular blocks/macro blocks of equal size, a block-matching method attempts to find a block from a reference frame (past or future frame) that best matches a predefined block in the current frame. Matching is performed by minimizing a matching criterion, which in most cases is the mean absolute error/difference between this pair of blocks. The block in the reference frame moves inside a search window centered around the position of the block in the current frame.

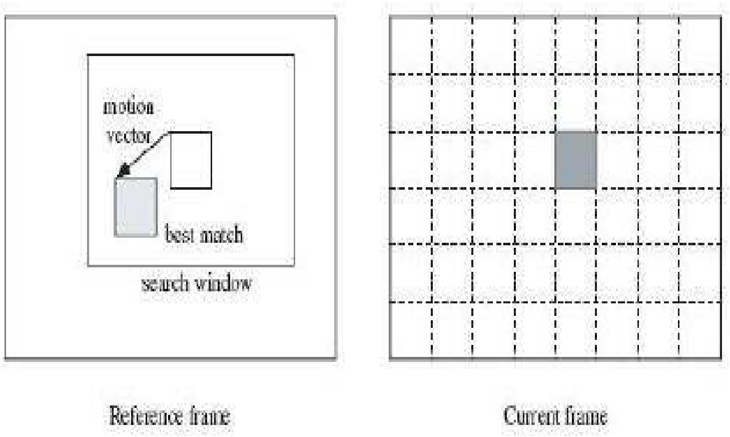


Figure 1[2]

Diamond Search Motion Estimation

The DS algorithm [1] comprises two search patterns. The first pattern, called large diamond search pattern(LDSP) shown in Figure 2(a), comprises nine checking points from which eight points surround the center oneto compose a diamond shape. The second pattern consisting of five checking points forms a small diamondshape, called small diamond search pattern (SDSP) shown in Figure. 2(b). In the searching procedure of the DSalgorithm, LDSP is repeatedly used until the minimum block distortion (MBD) occurs at the center point. DSalgorithm consistently performs well for the image sequence with wide range of motion content

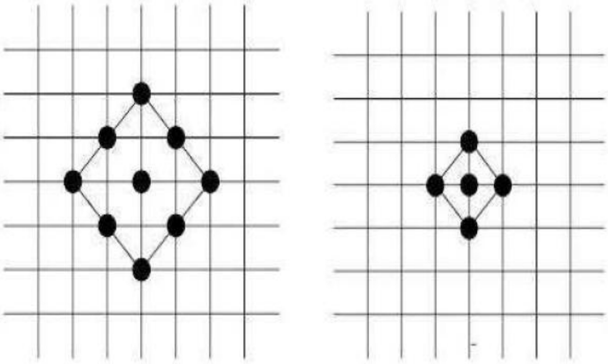


Figure 2[4]

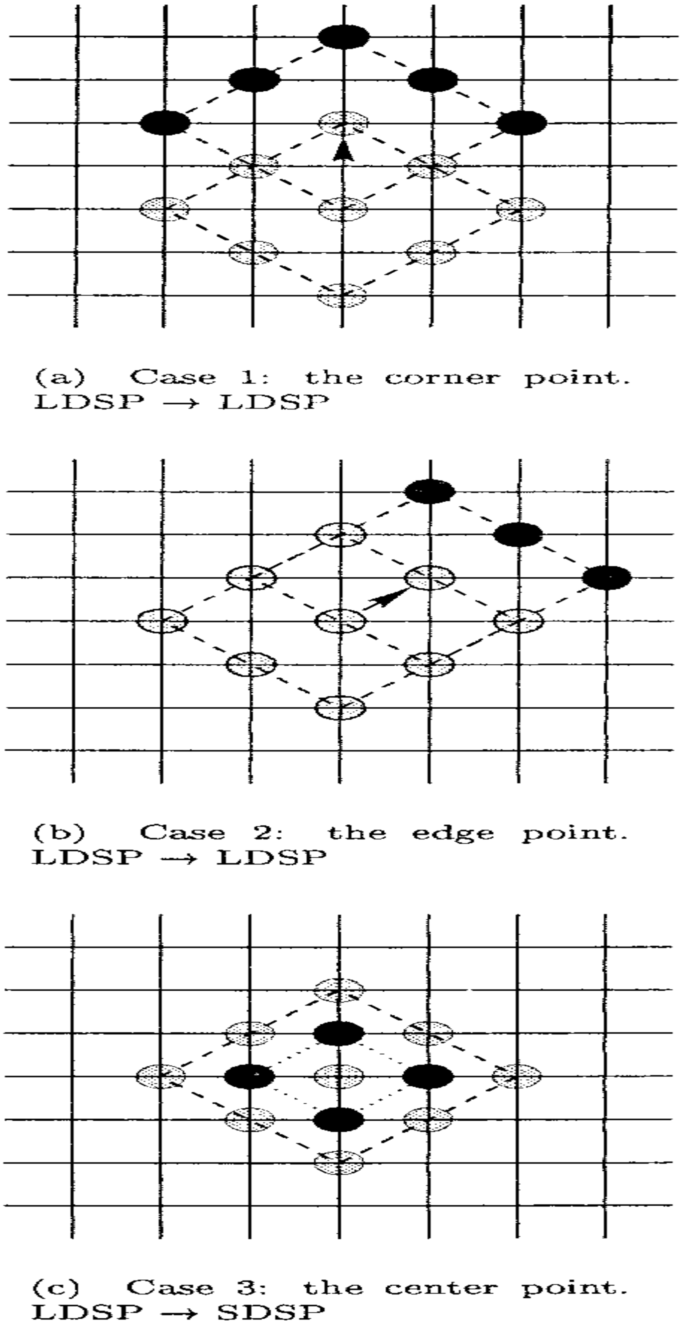
(a) Large Diamond Search Pattern (LDSP), (b) Small Diamond Search Pattern (SDSP)

DS by 538% at average search points and FS by 405 times and the average PSNR quality is slightly better (0.10–0.19 dB) than all the other algorithms including FS. This may be due to the fact that our scheme often prefers a smaller value MV, which requires fewer bits in coding. And a few additional bits are available for texture (DCT coefficients) coding, which results in better overall PSNR.

the search pattern (LDSP or SDSP) is near to or at the search window boundary, the checking points outside the search window are truncated. That is, the search is confined within the search window boundary. Note that this is a necessary constraint in MPEG standards since the variable-length codebook size for encoding motion vectors is limited.

DS algorithm doesn't restrict the number of search steps essentially. The MBD point found in each step has less or equal matching comparison of the average number of search points applying DS, 4SS, and NTSS to

"Caltrain" sequence individually when (a) frame distance = 1 and (b) frame distance = 2.error compared with all the other checking points in the search pattern, which includes the MBD point found in the previous step, thusthe MBD values found along the search path are in a non increasing order If the center point of LDSP produces the MBD, the search pattern is changed from LDSP to SDSP in the final search. In this case, only four new points are required to betested, as shown in Fig. 3(c).the compact shape of the search patternsused in the DS algorithm increases the possibility of finding the global minimum point located inside the search pattern



(a) Case 1: the corner point.
LDSP → LDSP

(b) Case 2: the edge point.
LDSP → LDSP

(c) Case 3: the center point.
LDSP → SDSP

[4]Figure 3(a)the corner point(b)the edge point
(c) the center point

HEXAGONAL PATTERN BASED MOTION SEARCH

Motion estimation in H.264 follows hexagon-based search pattern which is depicted in Fig.4. It consists of seven checking points (shaded dots) with the center surrounded by six endpoints of the hexagon with the two edge points (up and down) being excluded. Of the six endpoints in the hexagon, two horizontal points are away from the center with distance 2 and the remaining four points have a distance of √5 from the center point, respectivelythat the hexagonal search pattern also contains seven checking points at the beginning. Then the search process, the hexagon-based search pattern keeps advancing with the centermoving to any of the six endpoints. Whichever endpoint the center of the search pattern moves to, there are always three new endpoints emerging, and the other three endpoints are being overlapped

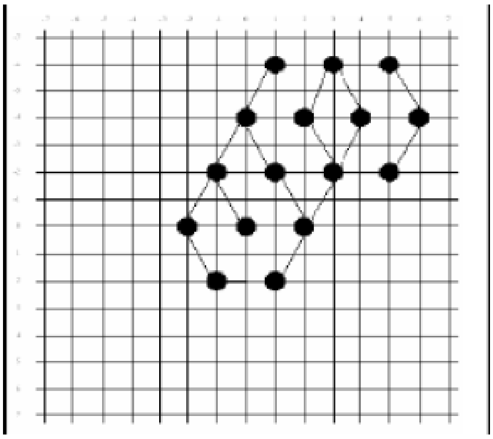


Figure 4[5]

In order to speed up the motion estimation process, it divide the motion estimation process into two parts

1) Dynamic motion detection

A motion detection method is suggested to separate out moving and stationary blocks within a frame. A frame is segmented in to blocks (7 modes for H.264).Each selected block is then identified as moving or stationary. The stationary block is assumed with zero motion vectors. And for the motion vector estimation of moving block temporal redundancies of video sequence are exploited to minimize the search points using standard motion estimation techniques

2) Motion estimation for moving block

For a moving block motion estimation is carried out by exploiting the temporal correlation between the frames in a video sequence. When matching a block from the current frame with a block from the previous frame, the matching criterion is usually evaluated using all samples within the block. Block matching is based on the assumption that all samples in a block move according to the same motion vector.

[6]A hexagonal search pattern is depicted in Fig. 1 and the inner search for the HEXBS algorithm is carried out using the shrunk hexagonal pattern covering the points 2, 4, 5, and 7. In [10], a one-more-step HEXBS is also presented to cover an additional pair of points of the four other points inside the hexagonal searchpattern, i.e., points 1 and 3 if point 2 wins in the last step of the HEXBS algorithm, points 1 and 6 if point 4 wins, points 3 and 8 if point 5 wins, and points 6 and 8 if point 7 wins. Note that a complete inner search within the large hexagon would requirethe evaluation of all the eight patterned points inside, excluding the center point. Hence, a more efficient inner search is desired to speed up the search process

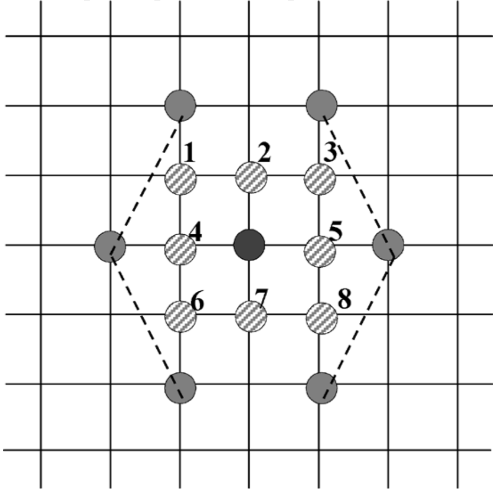


Figure 5[6]

FAST HEXAGONAL INNER SEARCH

In the original hexagonal search (HEXBS) algorithm two search procedures are involved. The coarse search procedurefirst locates a region where the optimal motion vector is expectedto lie, using the large hexagon search pattern consisting of six endpoints in Fig. 6 The coarse search continues basedon a gradient scheme until the center point of the hexagon hasthe current smallest distortion. After a hexagonal area is locatedin the coarse search, then the following fine-resolution searchlooks into the small area enclosed by the large hexagon for focusedinner search using the shrunk hexagon pattern, which isnot a full inner search.if full search is requiredfor the inner search, eight search points inside the large hexagon will be evaluated, which is computationally inefficient.Interestingly, it find that strong correlation exists between theinner search points to be checked (i.e., the eight labelled pointsin Fig. 6) and their surrounding checked points (here the sixendpoints of the hexagon in Fig. 6). Based on the monotonicdistortion characteristic in the localized area around the globalminimum, propose to check only a portion of the inner search points that are nearer to the checked points with smallerdistortions, which can save more than half of the eight search points inside it will present such an efficient innersearch scheme by exploiting the distortion information of the sixchecked endpoints of the large hexagon. There can be severaldifferent ways to exploit the distortion information. By trial anderror it find the most efficient inner search method in terms ofminimizing both number of search points evaluated and the correspondingdistortion. The method is referred to as 6-side-basedfast inner search, which is found to be most reliable and robustamong some other variants tried in maintaining almost thesame distortion as the full inner search.

Adaptive Pattern

ME is highly scene dependent, and, no one technique can be fully relied to generate good visual quality for all kinds of video scenes. Instead, it is the quintessence of a variety of techniques, such as motion starting point, motion search patterns, and adaptive control to curb the search, avoidance of search stationary regions, etc., that makes an ME algorithm robust and efficient across the board.*[3]* *For the Initial Search:* The shape ofour rood pattern is symmetrical, with four search points locatingat the four vertices, as depicted in Fig 7. The main structure of ARP has a rood shape, and its *size* refers to the distance between any vertex point and the center point. (Since symmetrical, four vertex points have equal distance to the center point.) As a special case, when the *size* of ARP is zero, the ARP will be shrunk from its normal rood shape to the center point itself.

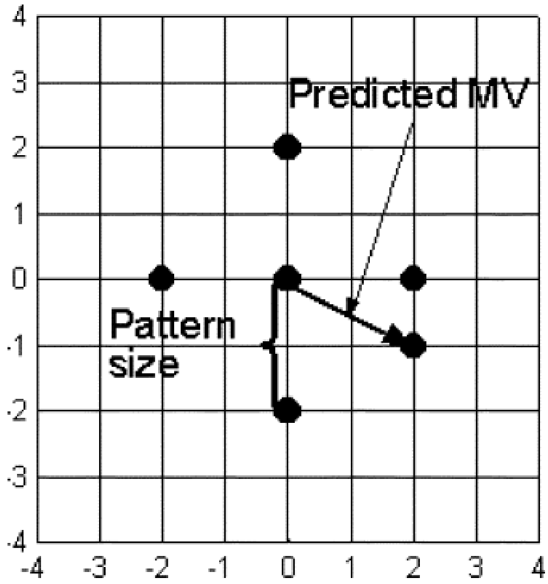


Figure 6[7]

adjacent MBs belong to the same moving object have the similar motions. Therefore, the current block’s motion behavior can be reasonably predictedby referring to its neighbouring blocks’ MVs in the spatial and/or temporal domains. As for the second issue, it use two types ofsearch patterns. One is the *adaptive rood pattern* (ARP) with adjustablerood arm (thus, the pattern size), which is dynamicallydetermined for each MB according to its predicted motion behavior.Note that ARP will be exploited only *once* at the beginningof each MB search. The objective is to find a good startingpoint for the remaining local search so as to avoid unnecessaryintermediate search and reduce the risk of being trappedinto local minimum in the case of long search path.

CONCLUSION

A video compression process is and how it can implement the ME techniques. Furthermore it briefly introduced BMA in video coding. The ME is the quite computationally intensive and expensive step in the video compression process. It can consume up to 75-80% of the computational power of the encoder if the FS is used by exhaustively evaluating all the possible candidate blocks within the search window As a consequence, the computation of video coding is greatly reduced with pattern based block motion estimation. The proposed HEXBS algorithm employs two different sizes of hexagonal search patterns. The proposed HEXBS consistently has a faster search performance than DS, regardless of no-, small-, medium-, or large-motion. Strikingly, for large motion image sequences, the new method may use much fewer search points than the DS algorithm. analysis shows that a speed improvement of up to 83% overDS algorithm can be obtained for locating some motion vectors in certain scenarios. The video coding achieves higher data compression rates and also it eliminates the need of high bandwidth requirements. The important aspect in the video coding is that without any significant loss of subjective picture quality, the video coding achieves higher data compression rates.

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