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Fast Motion Estimation using Modified Unsymmetrical Cross MultiHexagon Grid Search Algorithms for Video Coding Techniques

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Abstract— Advanced digital video compression technologies have become an essential part of motion estimation strategy. The motion estimation of H.264/AVC is a tedious procedure. Numerous calculations were proposed for the video stream motion estimation, however they have a high computational multifaceted nature which altogether expands the encoder unpredictability. Video compression encoding computerized video to take up less storage space and transmission data transfer capacity. This paper proposes the Modified Unsymmetrical-Cross Multi Hexagon-Grid Search (MUMHexagonS) algorithm is utilized for motion estimation searching process .The conventional search patterns are replaced by the Asymmetrical Improved Cross Search Pattern, Minimized square search and Improved Diamond Search Pattern. The proposed motion estimation and video compression system lessen the movement estimation time, compression time, calculation cost and it accomplishes the better encoding effectiveness and great video quality.

Keywords— Video compression, Unsymmetrical Cross Multi Hexagon Search (UMHexagonS),Motion Estimation, Improved Diamond Search

I. INTRODUCTION

Computerized video comprises of arrangement of pictures which are shown in the brisk consistent rate. Video compression strategies diminish the bit rate of the recordings as far as redundancies and encode the arrangement of edges, in light of the fact that the constant succession of casing has huge document estimate than the typical archive record. It makes the video unacceptable for the application condition. Fundamentally, video compression is the consolidated issue of motion estimation and noise decrease. Various calculations are there to anticipate the movement in the video groupings. They are 2D-logarithm search algorithm[1], three step search algorithm[2], hexagon-based search algorithm[3] with the consistent inquiry design which decreases the video quality and precision . The following piece of motion estimation is video coding for example encoding the staying set of casings of the video grouping. Numerous target cost capacities are accessible for video compression. The video coding system like MPEG-2, MPEG-4and H.263 has high computational unpredictability and encoder multifaceted nature. The sequences of frames that area unit closely connected on the temporal and abstraction dimensions represent a video. In a video, two near frames area unit similar and generally the changes occur solely thanks to the displacements of objects or the camera or thanks to noise. Estimation of redundancy could be a should to reduce the information amount for the pictures that area unit to be transmitted and it may be used supported the shaping foreseeable properties. These foreseeable properties area unit used for creating the predictions of all data, and also the errors between and also the foretold data area unit transmitted throughout the transmission of real data [4]. Within the prediction of knowledge, there are a unit 2 techniques like with inter-frame prediction and while not inter-frame prediction [5]. So, it is necessary to code every frame severally with image coding techniques [6].The compression capability is also decreased if the inter-frame prediction is not used. This sort is often employed in mobile appliances due to its low process demand, broad compatibility and easy implementation [7].

II. RELATED WORK

Advanced digital information is rapidly growing because of the developing of video and multimedia technologies. The transmission capacity and capacity prerequisites of the video applications assume an imperative task in video compression. The digital image and video compression is a key empowering innovation for beating this issue. H.264/AVC is the most well known video coding norms which upgrade the compression execution of the video and it has a striking effectiveness in the rate bending improvement when contrasted with the current benchmarks. This video

coding standard depends on encoding the recordings dependent on macro blocks. The video is isolated into video solid shapes and again separated into full scale hinders that are encoded utilizing outlines later on or recently encoded casings. This procedure of finding the movement vector in the casing to the equivalent or nearest movement vector in the reference or past edge is called as motion estimation. The motion estimation is a fundamental preface by which the successive video outlines are anticipated. It helps in decreasing the general size of the video by taking out the rehashed casings without development, consequently enhancing the storage space for recordings. The back to back video outlines with initiated development of the articles are anticipated utilizing a considerable lot of the motion estimation calculations. The motion estimation calculation utilizes scan focuses for the expectation. The inquiry focuses contain diverse example size and shape. It has critical impact on the contortion execution of the casing and the seeking speed. The movement misshaped squares video 3D shapes in the casing are isolated utilizing the pursuit focuses while anticipating. The calculation time and the multifaceted nature are two elements impressive in the motion estimation calculation. The presented low intricacy motion estimation. In any case, the video nature of the compression procedure is not possible enough for the better effectiveness as contrasted and the full pursuit calculation [8]. The motion estimation utilizing network based calculation presented [9] by depends on the vitality work which enhances the exactness of the motion calculation. Regardless of the way that the precision is getting enhanced, the looking velocity of the calculation is diminished in this way lessening the proficiency.The broke down the execution of Enhanced Predictive Zonal Search (EPZS)[10], Multi Hexagon-framework look (UMHexagonS) and Simplified estimation, Unsymmetrical-Cross Multi Hexagon-matrix seek (UMHexagonS).Video coding is the second introduce to consider in the video compression after motion estimation. The better methods are utilized to decrease the bitrates. To lessen the calculation time and unpredictability, 3D video signals are changed to 2D example to evacuate both the redundancies[11]. The neighboring squares with comparable highlights are dictated by the Euclidean distance measure and the picture encoding is done through the Huffman coding. In any case, the encoding multifaceted nature is higher. In a goal work, the duplication multifaceted nature is a basic factor to be considered close to with confinement of the coefficient grouping without decrease in information. The coordinating of the succession with the adjusting bitrates with the transfer speed coordinate is a critical task[12]. The rate control conspire uses a methodology with bitrate influencing the exhibitions. The misuse of simultaneous multi way exchange is utilized for information transmissions and for the re-transmission of turning questions to accomplish best video conveyance. These experiences with respect to the motion estimation and the vide coding are considered. The critical thinking affinities of the proposed commitment are talked about in the accompanying areas.

III. METHODOLOGY

In this paper, the proposed Modified Unsymmetrical Cross Multi Hexagon Grid search algorithm for motion vector calculation in video coding and 3-D DCT technique for bit rate decrease in video coding is introduced. Essentially, the video successions are changed over into the video 3D shapes. The video cube shapes are then recharged into the full scale squares comparing to the individual casing of the succession. The full scale squares of the edge are anticipated for the motion estimation. The movement expectation builds the effectiveness of the video compression systems. The motion estimation plot utilized here is Modified Unsymmetrical-Cross Multi Hexagon Grid Search Algorithm. In the motion estimation calculation, the pursuit point with the inside hunt territory is declared. At that crossroads the ideal movement vector is discovered utilizing the topsy-turvy enhanced cross pursuit design and furthermore, the hunt call attention to is completed utilizing the limited square inquiry design. In the past, utilizing the hexagon framework look, the square with the base rate mutilation cost is anticipated as the last movement vector. In the wake of identifying the movement, the recordings are packed utilizing three dimensional discrete cosine change pursued by the quantization and the entropy encoder to get the compacted bits for the capacity purposes. In the transmission side, the video is packed utilizing the proposed calculation. To recover the information, the decompression must be finished. The underlying advance includes interpreting the bits into the squares subsequent to scaling down the single quantum esteem. At that point the de-blocking is done, recovering the full scale hinders into the video 3D shapes lastly achieving the decompressed arrangement of the video in the genuine application level.

A. Modified Unsymmetrical Cross Multi Hexagon Grid Search Algorithm

The motion estimation is a very tedious and computationally savvy process when contrasted and the video compression process. The normal time utilization can be decreased by lessening the absolute number of inquiry focuses. The famous calculation utilized for the movement estimation is UMHexagonS calculation in the H.264 yet at the same time it is tedious because of various inquiry focuses. The proposed motion estimation calculation is an adjusted UMHexagonS calculation with decreased pursuit focuses. Thusly, the encoding proficiency is made strides. The proposed look calculation for the movement estimation comprises of the accompanying four stages.

They are 1) Initial Point search 2) Asymmetrical improved cross search pattern 3) Uneven transformed multi-level hexagon search 4) Improved Diamond search. The intention

of this algorithm is to find the optimal motion vector providing better applicability for the video compression technique

Step (i) Initial Search Point: The Initial search point method is used to set the initial search point as a search centre to the next search step. The initial search point selection is done making use of i) Median prediction method ii) Up layer prediction method iii) Neighbouring frame reference prediction method and iv) Corresponding block prediction method. The aim of the proposed work is to reduce the redundancies i.e. temporal and spatial redundancies. The median prediction reduces the spatial redundancy. Consider that the frames of macro block B are surrounded by the macro block A on the left, macro block C on the top and the macro block D on the right top. as depicted in the Figure 1**.** All these frame blocks are adapting the same motion feature.

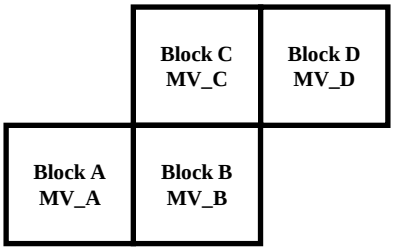

Figure 1. Median Prediction Method

Step (ii) Asymmetrical Improved Cross Search Pattern: The ideal motion vector search is not done in a careful way in the modified search patterns. For the optimal search, the search must be done in a long range else it will result in irregular pursuit process.The proposed asymmetrical improved cross search pattern consolidates the custom vertical and even way into a solitary motion vector search. This starts the expectation in the moderate just as the quick movement. The joining of the enhanced cross search pattern builds the proficiency by diminishing the absolute search focuses.

The direction of the motion vectors in the improved cross pattern is represented by an angle which can be computed as,

$$\gamma = \frac{MV_V}{MV_H} \quad (1)$$

Where $\boldsymbol{MV_V}$ and $\boldsymbol{MV_H}$ are the horizontal and vertical motion vectors.

Step (iii) Minimized Square Search Pattern: The reason for the minimum square search pattern in the proposed calculation is to decrease the complete number of search points. When asymmetrical search is finished, a small rectangular full search is directed with 25 look focuses thus the calculation is quick. The movement vector search of around 80 % is accomplished in the natural pictures utilizing 5 × 5 grid portion. In the event that the rectangular grid shape is diminished, the seeking time can be enhanced with decrease in the search focuses achieving level of about 90%.

Step(iv) Unsymmetrical MultiHexagonS Search Algorithm: The search point from the enhanced modified square search pattern is used here. The new search is performed in which the search region is divided into 32 regions less than three layer. The layers considered here are Layer 1,2,3,4. The movement vectors generally happen in the inside or limit of the search window. The layer 1 consolidates 16 districts of 18 search focuses. Layer 2 join 4 areas of 18 search focuses. Layer 3 joins 4 districts of 30 search focuses. The altered framework look just uses 26 areas in the network contrasted with the current calculation. By utilizing the conventional technique, the match point is resolved utilizing 32 districts in typical.

Step (v) Improved Diamond Search Pattern: The improved diamond search is the last search pattern in the proposed algorithm.. The diamond search pattern is used to find the motion vector more precisely in the small range areas. This search pattern is the modified form of the UMHexagonS algorithm.

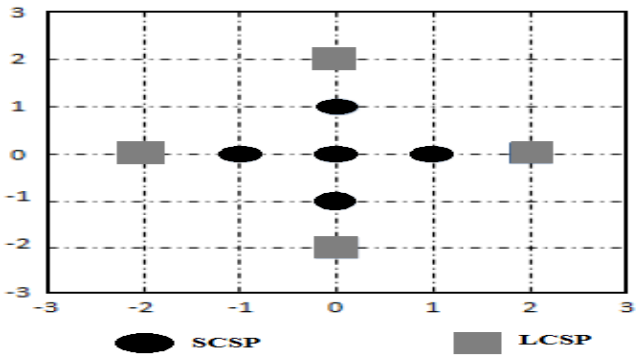

Figure 2. Improved Diamond Search Pattern

The Diamond search (DS) calculation utilizes two distinct sorts of settled pursuit designs. The primary example called substantial large diamond shaped search (LDSP) and the second example called small diamond shaped search (SDSP) appeared in Figure 2. The LDSP comprising of nine checking focuses from which eight points encompass the middle one to create a precious diamond shape. The SDSP comprising of five checking focuses and it frames a small diamond shape. The upside of DS is expansive movement content, ideal least esteem can be discovered utilizing less number of pursuit focuses. It is quicker than the conventional strategy for 4SS for small motion substance. As far as pursuit mode, it is profoundly delicate in all inquiry headings. It is more diligently to fall into the neighbourhood least, when contrasted with different BMAs. This pursuit calculation can take there is no restriction on the quantity of search steps, an unhindered focus one-sided inquiry design. In Figure 2, the improved diamond search algorithm is shown. The diamond

search pattern is applied repetitively to find the minimum rate distortion cost. It is classified into Small Diamond Shaped When it is find out, the point with minimum rate distortion cost will become the centre of the next diamond search.

IV. RESULTS AND DISCUSSION

The experimental setup needed a personal computer with windows 7 os platform,intel I3-32310M@2.10GHZ_CPU and 4GB RAM,display 800x600.The software tool used for the simulations is MATLAB 7.12.0.The proposed algorithm is tested on three different videos. The three videos are listed as Foreman, Mobile, and News. The videos taken for the experimentation are from different bitrates. Each video are tested with three different compression rates (bit/sec).In this section, the results and discussion of the proposed modified unsymmetrical multi hexagon diamond search algorithm is analyzed. The performance of the proposed system is analysed by comparing the UMHexagonS algorithm. The performance analysis is based on the searching time, motion estimation. The performance metrics which are taken into account for proving the efficiency of the proposed system is discussed below. The searching time is the time utilized for the estimation of the motion vector in the video frame. The search parameter has the direct effect on the searching time of the motion vectors. Motion prediction time is the time at which the motion in the macro blocks happens and predicted. Estimating the motion with the increased speed helps in the efficient video coding.

V. EXPERIMENTAL RESULTS

The experimental results of the proposed system in comparison with the UMHexagonS algorithm are discussed in this section. The performance curve is plotted for the individual metrics based on the comparison. The search time of each block achieved by both the MUMHexagonS and UMHexagonS algorithm is depicted in the Figure 3. The performance curve is plotted between the search points and time (in ms). For a better efficient block matching algorithm, reduced search point must search with increased speed. The proposed system has reduced number of the search points compared to the UMHexagonS algorithm. In Figure 3, shows that the proposed algorithm searches with reduced search point and increased speed. In general case, the proposed system increases largely when the search points are increased in the large image area. The motion estimation time of both the algorithm is depicted in the Figure 4. The performance curve for the motion prediction analysis is drawn between the size of the video taken for the compression and the motion prediction time. The proposed MUMHexagon search algorithm quickly predicts the motion of the moving objects in the video sequence than the UMHexagonS algorithm. From the Figure 4, it is clear that for the videos of greater size the time required for the prediction also exceeds in both the algorithm.

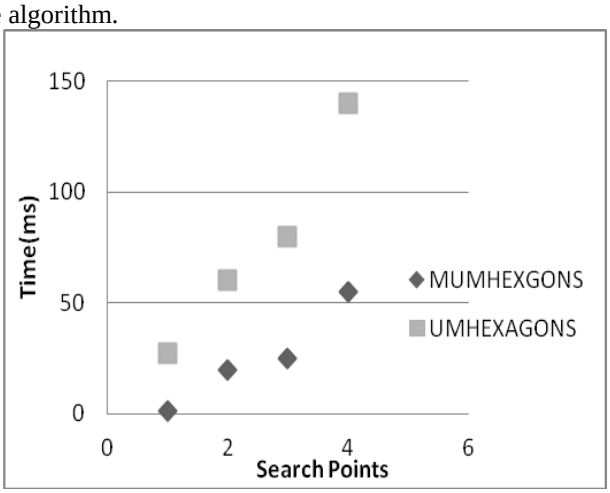

Figure 3. Performance analysis based on search time

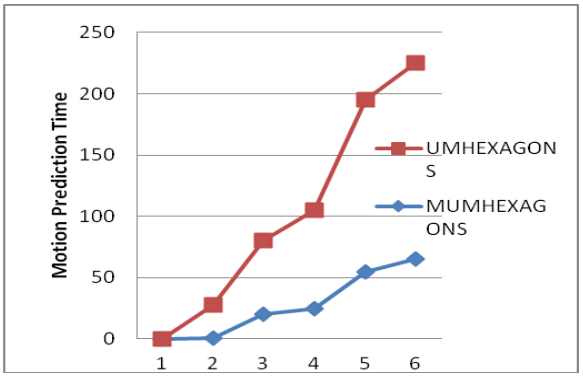

Figure 4. Performance analysis based on motion prediction time

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VI. CONCLUSION AND FUTURE SCOPE

We have exhibited a MUMHexagonS calculation and 3-D DCT strategy for the motion calculation and video coding. The proposed calculation incorporates three step searches. They are Cross search, Square search, and improved diamond search. The video coding is finished by making utilization of the three dimensional cosine change. The execution parameters of the video coding like visual quality and the compression are very much kept up by the adjustment of the proposed calculation. The execution of the proposed calculation is contrasted with the conventional UMHexagonS calculation with demonstrate its effectiveness. The examination is done as far as the search time of motion vectors and motion time estimation. The MUMHexagonS calculation has the PSNR esteem more noteworthy than that of the video coding standard, UMHexagonS. It demonstrates that the proposed calculation considerably diminishes the search points and henceforth decreases the calculation fundamentally while the video characteristics are kept up paying little respect to quick or moderate motion video

arrangements. The proposed algorithm demonstrates that it performs productively in the ongoing movement estimation and video coding applications.

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REFERENCES

[1] Koga, T, Iinuma, K, Hirano, A, Iijima, Y & Ishiguro, T 1981, 'Motion compensated inter frame coding for video conferencing', In proceedings of National Tele communication Conference, New Orleans, LA, pp. G5.3.1–G5.3.5.

[2] R. Li, B. Zeng, and M. L. Liou, "A new three-step search algorithm for block motion estimation," *IEEE Trans. Circuits Syst. Video Technol.*, vol. 4, pp. 438–443, Aug. 1994.

[3] Akash Ambulkar, Shailesh Wankhede, Sujit Kautkar, Mukesh Angrakh & Vidya N More 2012, 'Enhanced Directional Hexagonal Search Algorithm', in proceedings of 2012 IEEE International Conference on Circuits and Systems (ICCAS), pp. 143-146.

[4] Jonathan Fabrizio, Severine Dubuisson & Dominique Bereziat 2012, 'Motion compensation based on Tangent Distance prediction for video compression', Signal Processing: Image Communication, vol. 27, no. 2, pp. 153-171.

[5] Anmin Liu, Weisi Lin, Manoranjan Paul, Fan Zhang & Chenwei Deng 2011, 'Optimal Compression Plane for Efficient Video Coding', IEEE Transactions on Image Processing, vol. 20, no. 10, pp. 2788-2799.

[6] Vo, DT & Nguyen, TQ 2008, 'Quality Enhancement for Motion JPEG Using Temporal Redundancies', IEEE Trans. Circuits Syst. Video Technol., vol. 18, no. 5, pp. 609-619.

[7] Wei Chena, Yonghong Tiana, Yaowei Wang & Tiejun Huang 2016, 'Fixed-point Gaussian Mixture Model for analysis-friendly surveillance video coding', Computer Vision and Image Understanding, vol. 142, pp. 65-79.

[8] Hossein Bisjerdi Mohammad & Alireza Behrad 2012, 'Video Compression using a New Active Mesh Based Motion Compensation Algorithm in Wavelet Sub-Bands', Journal of Signal and Information Processing, vol. 3, pp. 368-376.

[9] Hossein Bisjerdi Mohammad & Alireza Behrad 2012, 'Video Compression using a New Active Mesh Based Motion Compensation Algorithm in Wavelet Sub-Bands', Journal of Signal and Information Processing, vol. 3, pp. 368-376.

[10] Ashwin, S, Jayanthi Sree, S & Aravind Kumar, S 2013, 'Study of the Contemporary Motion Estimation Techniques for Video Coding', International Journal of Recent Technology and Engineering (IJRTE), vol. 2, no. 1, pp. 2277-3878.

[11] Pengyu Liu & Kebin Jia 2013, 'A Motion Characteristics Based Unsymmetrical Cross Multihexagon Grid Search Algorithm for Fast Motion Estimation', Information Technology, vol. 12, no. 15.

[12] Dengyin,Yang,2018, 'Distributed Compressive Video Sensing with Adaptive Reconstruction Based on Temporal Corellation', In proceedings of IEEE Third International conference on Image, Vision and Computing,June-2018.

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