International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169
Volume: 4 Issue: 5 207 - 211

Hybrid Approach for Video Compression Using Block Matching Motion Estimation

Rohini K.Akotkar
Dept. of electronics & telecommunication Engg.
Sipna Colleg of Engineering & Technology
Amravati-444701, India
akotkar.rohini@gmail.com

Prof. sanket B. Kasturiwala
Dept. of electronics and communication Engg
sipna colleg of engineering & Technology
Amravati-444701,India
sanket.kasturiwala@gmail.com

***Abstract*—** To discard the redundancy present in video some video compression technique are involved .Basically video is a collection sequential frames in a sequence. video compression means reducing the size of video . In video sequence there are two types of technique are present that are temporal redundancy and spatial redundancy. In this paper we discuss about hybrid technique .Hybrid means combination of any two or more than two technique like efficient three step search algorithm(E3SS) and cross hexagonal search algorithm (CHS) .In today's date block matching algorithm for motion estimation is powerful technique for high compression ratio and to reduce computational complexity .The motion estimation calculate the position of pixel and It is a custom to calculate the pixel from current frame to reference frame .The main function of motion estimation is reducing the search point and redundancy present in video .The experiment result shows that the proposal algorithm performs better than previous proposed block matching algorithms and required less computation than other technique.

Keyword*:-Diomand search, motion vector video compression, motion compensation, cross hexagonal search, Efficient three step search.*

*****

I. INTRODUCTION

This paper introduce about hybrid approach for video compression using block matching motion estimation.Motion estimation is have an important role in interframe presaging coding system.When the frame rate is appropriately high, there is a great amount of similarity between consecutive frames. The main focus of motion estimations is to reduce s strong temporal redundancy present in video sequence. So that ,the most successful technique for motion estimation is perhaps the block matching algorithm (BMA) which accommodated by various video coding standards, such as ITU-T ,H.261, H.263, MPEG-1, MPEG-2 and MPEG-4. In order to reduce the computational complexity many fast block-matching algorithms have been developed such as three-step search(3SS),new three-step search (N3SS) , four-step search(4SS),and diamond search (DS) etc.

This paper introduce video compression interframe prediction is well exploited by motion estimation algorithm where temporal redundancy between successive frames is effectively removed to reduce computational complexity several block based fast motion estimation algorithm have been proposed. The aim of this project will be to evaluate in terms of two matching criteria that is sum of absolute difference (SAD) mean absolute difference(MAD)or peak signal to noise ratio(PSNR). Actually video Compression is a reversible conversion of data that contain fever bits and the inverse process is called decompress or decoding. The idea behind block matching is to divide the current frame into a matrix of macro block that are then compared with corresponding blocks and it's adjacent neighbors in the previous frame to create a vector that stipulates the movement of a macro block from one location to another in the previous frame. This movement calculated for all the macro blocks comprising a frame constitute the motion estimated in the current frame.

[1] Saurabh P. Asare , A.V.Gokhale , Chetankumar M. Selukar, S.D.Kamble proposed " Hybrid Algorithm for Block Matching MotionEstimation Technique" International Conference on Communicationand Signal Processing, April 2-4, 2015, India[1].

[2]In 2013, Ms. S. G. Farkade and Prof S.D. Kamble have proposed in their paper that a hybrid algorithm which is combination of efficient three step search & cross hexagon search. Cross Hexagonal Search gives the better result than DS & Hexagonal Search. This hybrid scheme is also motion estimation based technique. The main objective of this proposed work is to exhibit the number search points can be decreased to eliminate the computational complexity [2].

[3].In 2002 ,C. H. Cheung and L. M. Po have proposed in their paper that a novel algorithm using a cross-search pattern as the first step and large or small diamond search (DS) patterns as the subsequent steps for fast block motion estimation. The cross-diamond search (CDS) algorithm employs the halfway-stop technique and finds small motion vectors with minimum number of search points than DS algorithm while maintaining similar or even better search quality [3].

[4]In 2004,Xuan Jing and Chau Lap-Pui have proposed in their paper that a modification on the three-step search algorithm which gives a small diamond pattern in the first step and the unrestricted search step is used to search the center area. The final results show that the new efficient three-step search performs better than new three-step search in terms of MSE and requires less computation by up to 15% on average [4].

[5].In 2011, Yixin Yan and Shaoliang Meng have proposed in their paper that Hybrid motion compensation technique (H-MCT) based on Cross Diamond Search (CDS) and Efficient Three Step Search (E3SS) algorithms. The performance of the

proposed scheme is evaluated in terms of two matching factors, the first one is sum of absolute difference (SAD) and second one is mean absolute difference (MAD) as well as the fidelity measure and peak signal-to-noise ratio (PSNR). The desired results show that the proposed scheme performs better than state-of-the-art algorithms like Cross Hexagonal Search and Efficient three step search by utilizing less number of search points [5].

[6]In 2011, Faizul hadi jamil, Rosalyne R. Porle, Ali Chekima , Razak Ali Lee, Hayder Ali and Sukhairi Mat Rasat have proposed in their paper seven types of Block Matching Algorithm technique like Exhaustive Search, Three Step Search, New Three Step Search, Simple and Efficient Three Step Search, Four Step Search, Adaptive Rood Pattern Search and Diamond Search have been used to analyze the video frames quality with change in block size and change in sequence of *I* and *P* frame[6].

[7] In 2006, August, M. Manikandan , P. Vijayakumar , N. Ramadass, have proposed in this paper about "Motion Estimation Method for Video Compression – An Overview" in the IFIP International Conference which is on Wireless and Optical Communications Networks. They said the importance of video compression by using motion estimation[7].

The paper is organized as follows: Previous work done for block matching motion estimation is briefly given in Section II. Section III shows the proposed work while the experimental results are given in a Section IV while Section V deals with the conclusion of the paper followed by the references

II. PREVIOUS WORK FOR BLOCK MATCHING MOTION ESTIMATION

Since last two Decades various Block Matching Algorithm are proposed for achieving higher quality video. Initial block search technique was full search which used for getting the best match in the reference frame and checks the current block with whole candidate block. It takes several times so that it is not feasible for large sequences video [1]. The Koga et al invents the three step search (TSS) [2]. In TSS checking point pattern in the 1st step is consistently allocated which is not realistic for small motion estimation. New three step search algorithm is proposed in 1993 which is having center biased characteristics which is efficiently used for small motion estimation [3]. In this N3SS half way stop techniques is used for stationary & quasi-stationary block. It is more robust than the TSS which gives the more accurate smaller motion estimation. Four step search method is proposed in 1996 by Lai-man Po et al, this algorithm also works on the center biased technique and half way search technique. This algorithm also provides better result than the TSS and gives the similar performance with the N3SS in terms of Mean square error with minimum computational cost [4]. Unrestricted center biased diamond search (UCBDS) is proposed by Jo Yew Thamb et al. UCBDS is more robust & efficient than the TSS, 4SS, FSS,DS.

III. PROPOSED WORK

This paper analyze that previous technique are not giving satisfactory result for block matching motion estimation for video compression . so we proposed a new method that is hybrid technique which is consist of ETSS AND CHS. This paper proposes a hybrid algorithm which is combination of efficient three step search and cross hexagonal search. This algorithm is based on motion estimation technique. Main objective of this proposed work is to eliminate computational complexity by decreasing the number of search points. Performance of the Hybrid algorithm evaluated with some parameters like mean absolute difference (MAD) and Sum of absolute difference (SAD). The search pattern
for hybrid algorithm shown in following fig 1.

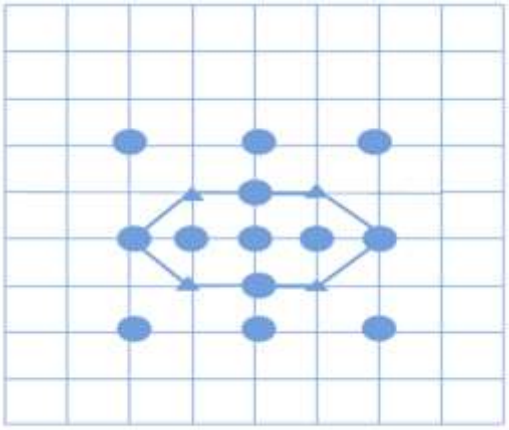


Fig. 1. Search pattern for Hybrid Algorithm

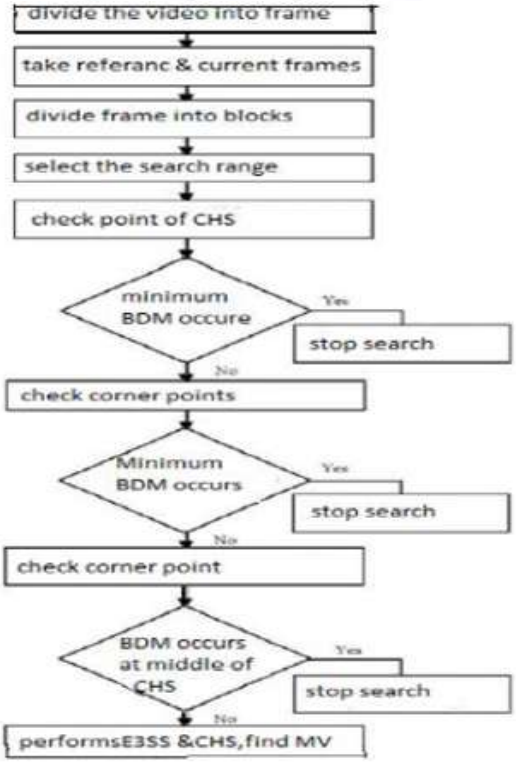


Fig. 2. Hybrid Algorithm Flowchart

Fig 1 explains search patterns for hybrid (ETSS+CHS) block matching motion estimation algorithm while Fig.2 explains Flow chart has been used to explain the hybrid algorithm. In this some terminologies are used that is MV (Motion Vector) BDM (Block Distortion Measure), CSP (Cross Search Pattern). Before applying the Hybrid Algorithm some techniques has to be carried out.

A.Give uncompressed color video and convert it into YCbCr then to gray

Videos can be in any format like mp3, avi, mpeg. Generally videos are in the RGB format but RGB models require more space than the other color modals. First convert it into number of frames. To reduce the space & transfer time we have to convert these frames into YCbCr color space. YCbCr color space is used for digital video component. YCbCr is scaled and offset version of YUV color space. In YCbCr color space Y is the luminance (brightness) component and CbCr are the chrominance component. Whenever we are converting it into the gray shade at the time luminance component is fully consider and from chrominance blue component consider fully & from chrominance red only first component is consider.

B.Apply Quad tree partitioning on gray frames.

Quad tree partitioning is applied to partition the gray frames. This partitioning makes partition of frames or images into big ranges of blocks and converts the gray frames into 4 parts. In this transformation are to be find out for each block. These transformations are compared with the original block which uses the distance metric concept. If the transformation is accepted that means the distance between the block lower than the specified threshold and if the transformation is rejected means the range of block is further divided into four quadratic sub blocks. This partitioning is continued till the blocks covered with an acceptable transformation or still meet the certain conditions and this quad-tree decomposition is actually a top to down approach [11].

C.Apply a mechanism for block matching motion estimation algorithm

Three step search, four step search, efficient three step search, diamond search, cross diamond search , hexagonal search, cross hexagonal search are all search techniques have been proposed earlier. Any one of them or hybrid combination of them will be applied but here we apply the combination ETSS and CHS is called as hybrid technique.

D. Applying Hybrid and ETSS Block matching motion estimation algorithm

Proposed Hybrid block matching motion estimation algorithm is applied on standard Database. And the results of ETSS and Hybrid (ETSS+CHS) is shown and compared on SAD and MAD matching criteria

$$SAD(i,j)=\sum_{n_1=1}^{N}\sum_{n_2=1}^{N}\left|f_k(n_1,n_2)-f_{k-1}(n_1+i,n_2+j)\right|$$

$$MAD(i,j)=\frac{1}{N^2}\sum_{n_1=1}^{N}\sum_{n_2=1}^{N}\left|f_k(n_1,n_2)-f_{k-1}(n_1+i,n_2+j)\right|$$

VI. EXPERIMENTAL RESULT ANALYSIS

For experiment purposes consider standard input video KIYO.

A. Importing input video

Input video Akiyo_cif.avi

A. Frames of original video

Frame1 Frame2 Frame 3 Frame4

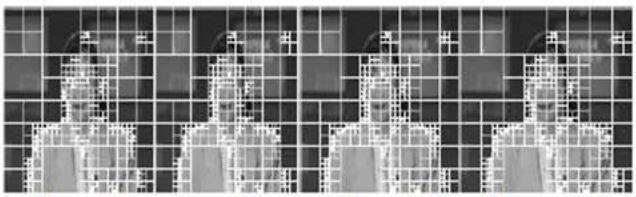
B. Converted into YCbCr

img_ycbcr1 img_ycbcr2 img_ycbcr3 img_ycbcr4

C. Converted into Gray

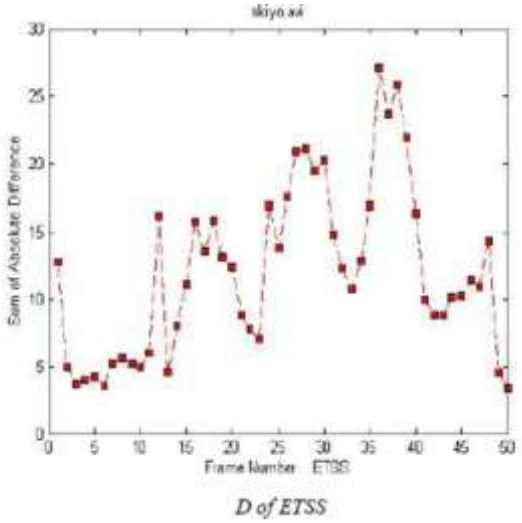
img_gray1 img_gray2 img_gray3 img_gray4

D. Quad tree decomposition of gray frame

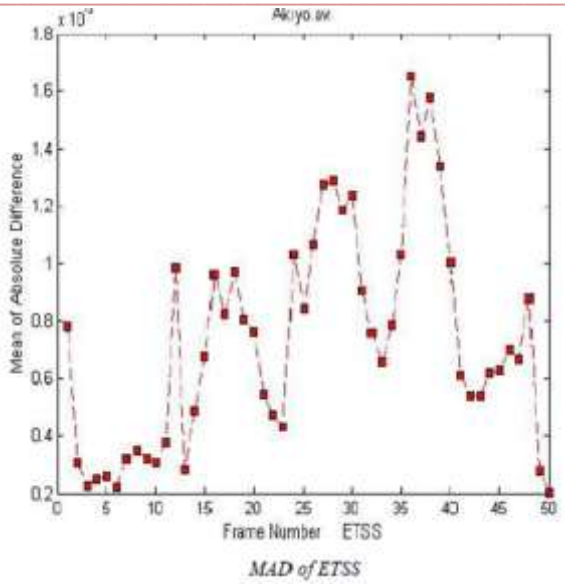


qtdecom1 qtdecom2 qtdecom3 qtdecom4

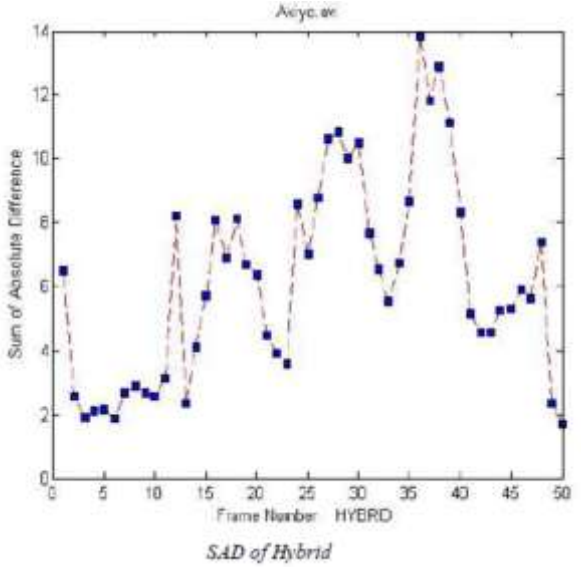
E. Comparison of ETSS with Hybrid graphically between SAD and MAD



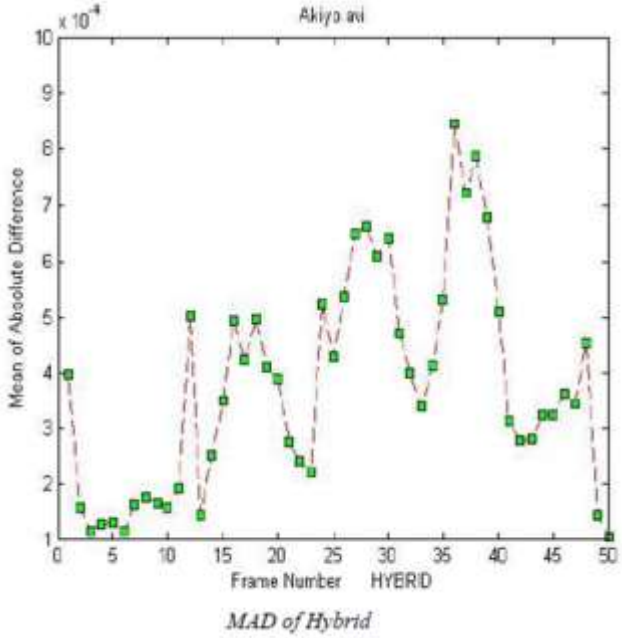
D of ETSS



MAD of ETSS



SAD of Hybrid



MAD of Hybrid

TABLE I

MAD OF FIRST 15 FOR ETSS AND HYBRID Frame No.	MAD of ETSS	MAD of Hybrid
1	0.79×10-3	4
2	0.3×10-3	1.6
3	0.23×10-3	1.2
4	0.25×10-3	1.3
5	0.21×10-3	1.4
6	0.33×10-3	1.2
7	0.35×10-3	1.7
8	0.33×10-3	1.85
9	0.32×10-3	1.75
10	0.3×10-3	1.65
11	0.38×10-3	2
12	1×10-3	5.1
13	0.28×10-3	1.5
14	0.48×10-3	2.5
15	0.68×10-3	3.5

TABLE II

SAD OF FIRST 15 FOR ETSS AND HYBRID Frame No.	SAD of ETSS	SAD of Hybrid
1	13	6.5
2	5	2.5
3	4	2
4	4.2	2.1
5	4.5	2.15
6	3.9	1.96
7	5.1	2.6
8	5.5	2.8
9	5.1	2.6
10	5	2.5
11	6	3
12	16.3	8.2
13	4.85	2.3
14	8	4
15	11	5.5

V. CONCLUSION

A Hybrid block matching motion estimation technique which is a combination of Efficient Three step search (ETSS) and Hexagonal search (HS) and compared with ETSS using matching criteria Sum of absolute difference (SAD) and Mean of absolute difference (MAD). This hybrid algorithm gives better result and requires fewer search points than the TSS, FS, NTSS & 4SS. Hexagonal search gives better result than Diamond search (DS) and Cross Diamond Search (CDS).All the experimentation is carried out on Standard database Akiyo.avi. And it is seen that this Hybrid motion compensation technique gives better result than renowned ETSS technique in terms of computational complexity. In future still there is a scope of improvement in developing a new block matching motion estimation approach by combining the various existing block matching motion estimation algorithms for the color video compression for achieving good compression ratio with reduced encoding and decoding time. Further this new block matching motion estimation approach can be encoded and decoded by using various coding technique

FUTURE SCOPE

In future still scope of improvement in developing new block matching motion estimation approach by combining the various existing block matching motion estimation algorithms for the color video compression for achieving good compression ratio with reduced encoding and decoding time. Further this new block matching motion estimation approach can be encoded and decoded by using various coding technique.

REFERENCES

[1] Faizul Haldi Jamil, Ali Chekima, Rosalyn R, Porle, Othman Ahmad "BMA Performance of video coding for motion estimation" IEEE transaction international conference on intelligent system modelling and simulation-2012.
[2] T. Koga, K. Iinuma, A. Hirano, Y. Iijima, and T. Ishiguro, "Motion compensated intertrame coding tor videoconferencing," in Proc. National Telecommunications Conf., New Orleans, LA, pp. GS. 3. 1 - GS. 3. 5, 1981.
[3] R. Li, B. Zeng, and M. L. Liou, "A new three-step search algorithm for block motion estimation," IEEE Trans. Circuits Syst. VideoTechnology vol. 4, pp. 438-442, 1994.
[4] L. M. Po and W. C. Ma, "A novel four-step search algorithm for fast block motion estimation," IEEE Trans. Circuits Syst. Video Technology vol. 6, pp. 313-317, 1996.
[5] Jo Yew Tham, Surendra Ranganath, Maitreya Ranganath, and Ashraf Ali Kassim "A Novel Unrestricted Center-Biased Diamond Search Algorithm for Block motion estimation" IEEE transactions on circuits and systems for video technology, vo!. 8, no. 4, august 1998.
[6] Shan Zha Kai-Kuang Ma, "A new diamond search algorithm for fast block-matching motion estimation" Image Processing, IEEE Transactions Feb 2000.
[7] R. A. Manap, S. S. S. Ranjit, A. A. Basari, B. H. Amad "performance analysis of Hexagon -Diamond Search Algorithm for motion estimation" IEEE Transaction volume3. 2010.
[8] C. H. Cheung and L. M. Po, "A novel cross-diamond search algorithm for fast block motion estimation," IEEE Trans. Circuits Syst. Video Techno!. , vol. 12, no. 12, pp. 1168-1177, 2002
[9] Ce Zhu Xiao Lin , Lap-Pui Chau ,Keng-Pang Lim , Hock-Ann Ang Choo-Yin Ong , "A novel hexagon-based search algorithm for fast block motion estimation" Acoustics, Speech, and Signal Processing Proceedings (ICASSP '01). 2001 IEEE International Conference.
[10] Xuan Jing and Chau Lap-Pui, "An efficient three-step search algorithm for block motion estimation," IEEE transactions on multimedia, Vo!. 6, No.3, pp. 435-438, 2004.
[11] Ce Zhu Xiao Lin , Lap-Pui Chau ,Keng-Pang Lim , Hock-Ann Ang Choo-Yin Ong , "A novel hexagon-based search algorithm tor fast block motion estimation" Acoustics, Speech, and Signal Processing Proceedings. (ICASSP '01). 2001 IEEE International Conference.
[12] Li Hong-ye Liu Ming-jun "Cross-Hexagon-based motion estimation algorithm using motion vector adaptive search technique" International Conference on Wireless Communications & Signal Processing, 2009.
[13] David J. Jackson, Wagdy Mahmoud ,William AStapIeton Patrick T. Gaughum "Faster fracta! image compression using quadtree recomposition". Reprint submitted to Elsevier 27 Oct 1995.
[14] SUN Ning-ning, FAN Chao, XIA Xu "An Effective Three-step Search Algorithm for Motion Estimation" IT in Medicine & Education, ITIME '09. IEEE International Symposium -2009.