International Journal of Scientific Research and Management (IJSRM)
||Volume||5||Issue||07||Pages||6257-6264||2017||
Website: www.ijsrm.in ISSN (e): 2321-3418
Index Copernicus value (2015): 57.47 DOI: 10.18535/ijsrm/v5i7.58

An Efficient Block Matching Algorithm for Fast Motion Estimation Using New Three Step Search and Tabu Search Algorithm

Savita Malik* Vijay Nehra**
*M.Tech Scholar, ECE Department, BPS Khanpur, Sonipat
**Head of Department, ECE Department, BPS Khanpur, Sonipat

Abstract

Over the last couple of decades, video processing and coding has grown exponentially. The processing power of the computers available has grown in almost equal proportions. However, with the introduction of newer video standards, which are further more complex, it has become imperative to work on more optimized algorithms and implement them efficiently and judiciously. In this paper, we compare the two most commonly used search algorithms, New Three step and Tabu Search for motion estimation and decide which one is better for a given type of video sequence. This information can help in better decision making regarding the choice of the algorithm for a certain video sequence and PSNR improved up to 40.0742.

Keywords:

New Three Step, motion Estimation, Tabu Search, block matching, micro block , current block.

1 Introduction

With the development of multimedia era and broadly use of internet, video storage on CD or DVD and streaming video has become very popular. The demand of moving image (video) is increasing day by day. It is essential in many areas such as online monitoring of assembly processes, multimedia broadcasting, robot navigation and inspection, military, remote sensing, medical and real time application [1]. In future cellular phone will send and receive real time video. Video is the sequence of moving images. Video is electronics medium for the recording, playing, broadcasting and display of moving things, in other words video is defined as it is the visual multimedia source that combines a sequence of images to form a moving image. Video coding is the process of dense or condensing a digital video sequence into a smaller number of bits.

Digital video is quickly increasing since 1990 when video standard MPEG-1first developed [2]. Digital videos have some advantages over the analog videos. Digital videos are easy to transmit, reducing noise and able to afford an interactive interface between the users. But due to digital video inbuilt data intensity of video sequence it is complex to store and transmit the video data.

The idea behind video compression based on motion estimation which is used to save number of bits required for encoding the video. The purpose for doing motion estimation is to minimize the energy and bandwidth requirement for transmission of videos over wireless medium.

Motion estimation is the key element in video compression. Motion estimation is used to remove the temporal redundancy between consecutive frames in time domain. But the main purpose of the motion estimation is to maximize the compression efficiency rather than to find the true motion[3]. Motion compensation blocks work, only when there is a past frame is stored. It is used to calculate the displacement vector between the current frame and references frame. There is some correation between the current frame and reference frame that is used to find the best matching position of pixels intensity value of current frame in reference frame[4]. The location where best match is found difference in position of current frame and reference frame is obtained and this is called the motion vector. It only works on the luminance block.. The rest of paper is design as follows. The overall past work is describe in Section II. Section III describes the block matching algorithm new three step search. Section IV describe framework of the implementation used for proposed work. Result discussion describe in section V. Finally, Section VI describes the conclusion of paper.

II. Literature Review

Deepa Mary Thomas et. al, 2012 presented the two classifications of motion estimation which are more popular and used in the process of video compression. After implementation it shows that the PSNR of new proposed algorithm is almost close to the full search but there is a reduction in the computation time.

Chandana Pandey et. al, 2014 focused on the parametric analysis of diamond search algorithm which is the fast block based motion estimation technique. Result shows that number of computation and the PSNR are decreased by increasing the block size. In this paper the speed improvement of DS over FS is obtained in range 91% to 92%.

Ruchi Jain et al, 2014 presented the comparative performance of 5 different block matching algorithms of motion estimation and compared based on the parameters of PSNR and (NC). It is conclude that among all the methods of video compression, block matching algorithm for motion estimation is more accepted.

Akhil mahajan et. al, 2014 discussed the comparison of block based motion estimation and pixel based motion estimation. Pixel based motion estimation algorithms provides the best PSNR as compared to the block based motion estimation. It also can reduce the computational time as compare to block based motion estimation.

M. S. A. P. Chauhan et. al, 2013 presented the comparatively study of the four block matching algorithms named as exhaustive search, new three step search, four step search and diamond search algorithms. It is conclude that DS is best in all the three algorithms because its PSNR value is almost close to full search and it reduces the no. of computations. So DS is preferred to save time and better PSNR value.

Darshna D.Jagiwala et. al, 2012 discussed the analysis of the block matching algorithms which are used for the motion estimation in video standard H.264. Generally motion estimation is

quite computationally intensive and can save up to 80% of computation power.

M.R.Khammar, 2012 presented the review of the block matching algorithms which are used for the motion estimation. In this paper four algorithms are discussed named full search, four step search, diamond search and ARPS and compared in the value of PSNR and search points per macro block for the different block size and area

Chandana Pandey, et. al, 2015discusses the literature survey of motion estimation for block matching algorithm which have been proposed. The comparison is between three step search, new three step search, four step search, diamond search, hexagonal diamond search, modified diamond search, fast diamond search and orthogonal diamond search. Different variants of DS are also providing the good result without degradation in the quality of video. By reducing the no. of search points, speed of all the algorithms can be improved.

Ionuţ Pirnog et. al, 2011 presented about the importance of the search window dimensions for fast block matching algorithms for motion estimation. The results showed that for increased search windows some of the algorithms in the second category show an increase of the PSNR between the current frame.

Ram Srinivasanand et. al, 1985 proposed computationally simpler and effective method for estimating motion in a video sequence. A simpler coder based on this is being investigated for video conferencing purposes with various video sequences.

Vivek Sinha et. al, 2015 presented the improved performance of the H.264 codec for various motion estimation algorithms under different motion video conditions. The results make easy choice of a particular combination of parameters for a given application under a set of constraints.

III- Block Matching Algorithms

In recent years, there are many fast block motion estimation algorithms have been proposed to reduce the computation complexity in video encoder. There are many fast algorithms but block matching motion estimation is mostly used because it is highly dependent and no other technique is like this, which can generate good visual quality for all videos. It is the best method of motion estimation. It is used to reduce the temporal redundancy.[2]. In BMA the motion vector is calculated for entire block of pixels instead of individual pixel. This calculated motion is applied on all the pixels in blocks. A more accurate motion vector is estimated by applying BMA which reduce the computational requirements. In BMA the video is converted into the frames. BMA is applicable when there are two frames one is current frame and other is reference frame. The reference frame may be past frame or future frame.

There are 4 parameters are involved in the block based motion estimation.

1. Cost function
2. Search parameters
3. Block size
4. Performance measure parameter

New three step search algorithm: The new three step search algorithm is different from the three step search algorithm because it is centered

biased checking point scheme. and it is a halfway stop technique for stationary or quasi stationary blocks. It reduce the computational complexity. The checking point in NTSS are 17 and 33 for the best case and worst case respectively [5]. The steps of NTSS are:

STEP 1:There are 8 checking points including the center point. In this the minimum cost function is calculated in two ways. Firsty take the step size=4 and then step size=1 away from search origin.

STEP 2: In the second step, halfway stop technique for stationary or quasi stationary block is employed. There are three cases:

a). Calculate minimum cost function, if the cost function is found at the centered position then search is stopped.

b). When S=1. The minimum cost function is not at the centered positioned then change the origin of search to that point and find the minimum cost function point adjacent to it. That point which represent the minimum cost function is the closest match and motion vector is set at that point.

c). If minimum cost function is not found in(a) and (b) then TSS procedure is applied taken the step size=4 [5].

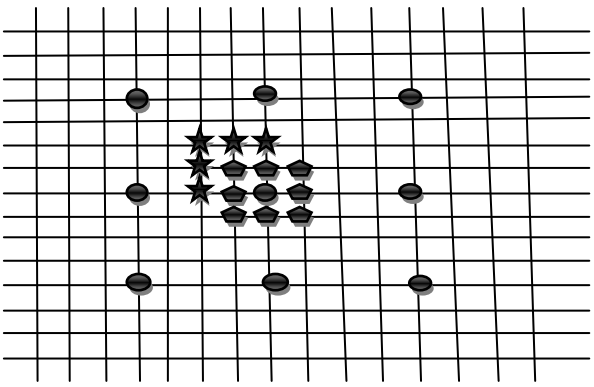

Fig 1 NTSS search process [5]

Outer step **inner step** **2nd step**

IV Framework of the Implementation

In this investigation, there is PCA technique is applied followed by LBP.

From the new three step search algorithm a new algorithm is proposed tabu search. The steps of tabu search are as follows:

Step 1 Consider an initial tabusize. Take block at the Center of the search area and assume eight blocks around the center point and add it to tabu list.

Step 2 Search Using Tabu Search for next block If the best match obtained is at the center, then reduce the tabusize in the tabu search. If more than one of the other points is the best match using fitness function, then it becomes the center and again step 1 is repeated.

Step 3 When the step tabusize becomes unity, all the eight blocks around the center are selected for the search and the best among them is picked as the required block.

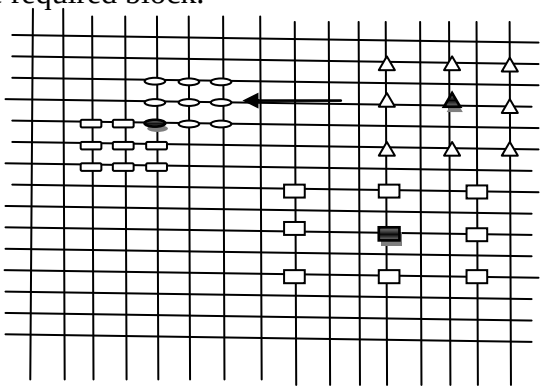

Fig 2. Tabu search [self elobareted]

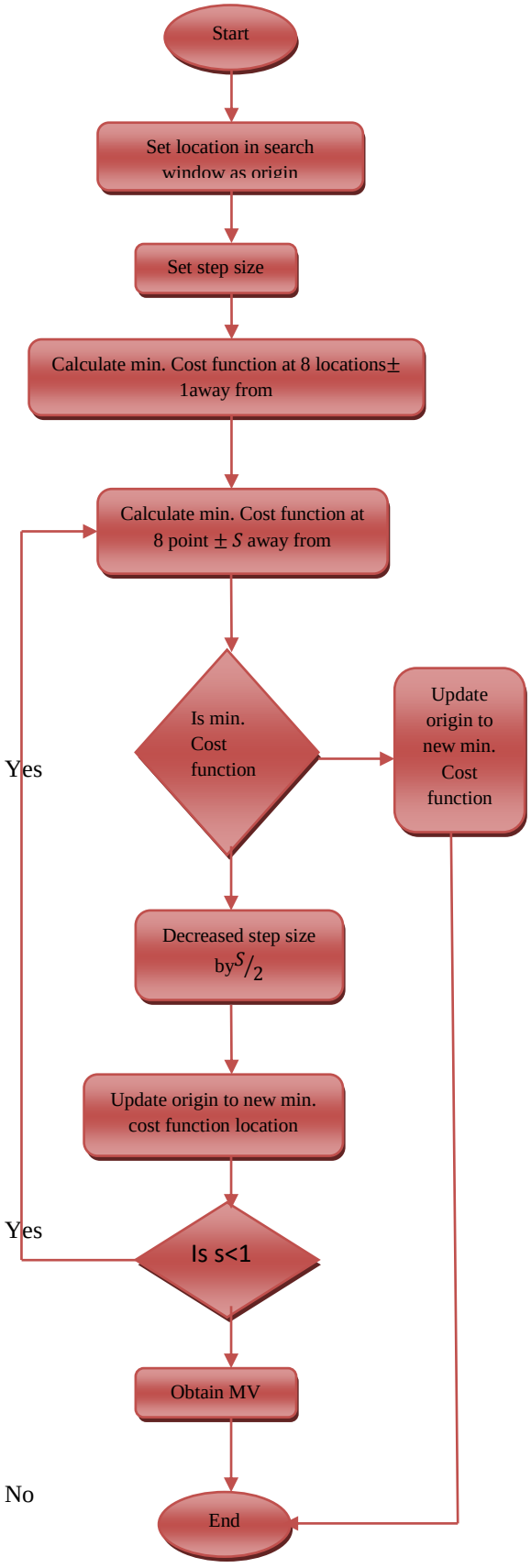

Fig 3 Proposed Methodologies

V Result & discussion

New three steps and Tabu search are analyzed in the research work. Tabu search gives modified result as compare to new three step search.

A comparison between two techniques is given by table 1. It shows that peak signal to noise ratio is improved up to 39.9840 for 16 step size.

Table 1 Comparative Analysis of N3SS & Tabu Search (Step Size = 16)

Performance	N3SS	Tabu Search
PSNR	39.9280	39.9840
MSE	9.7564	7.3824
SSIM	0.9758	0.9788

Fig 4 shows the graphical representation of different algorithm performance for 16 step size . Mean square error is decrease up to 7.3824 and SSIM improved up to 0.9788.

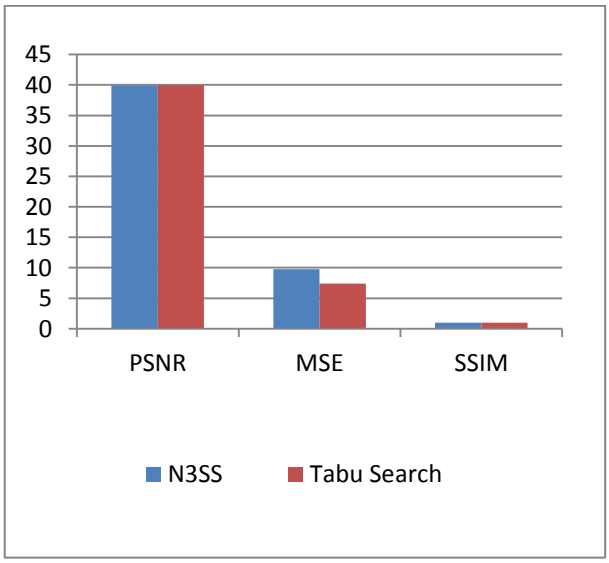

Fig 4 Performance analysis of different algorithm with step Size =16

A comparison between two techniques is given by table 2. It shows that peak signal to noise ratio is improved up to 40.1292for 8 step size.

Table 2 Comparative Analysis of N3SS & Tabu Search (Step Size = 8)

Performance	N3SS	Tabu Search
PSNR	40.0742	40.1292
MSE	9.1207	6.9127
SSIM	0.9796	0.9824

Fig 5 shows the graphical representation of different algorithm performance for 8 step size . Mean square error is decrease up to 6.9127and SSIM improved up to 0.9824.

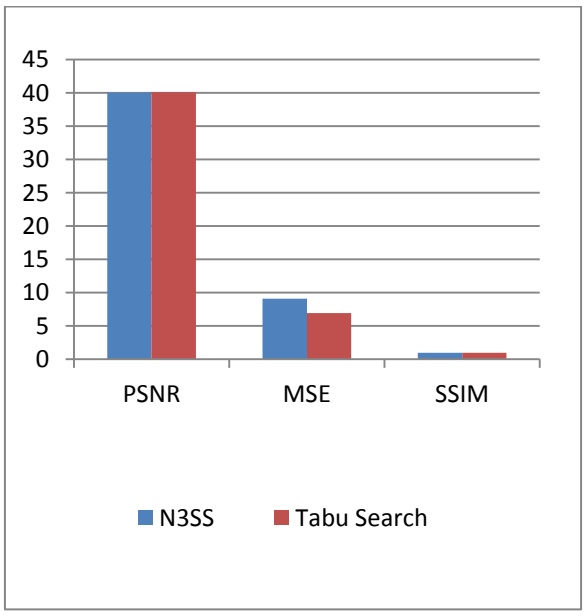

Fig 5 Performance analysis of different algorithm with step Size =8

Table 3 Comparative Analysis of N3SS & Tabu Search (Step Size = 4)

Performance	N3SS	Tabu Search
PSNR	41.690	42.415
MSE	8.30227	6.3876
SSIM	0.9816	0.9887

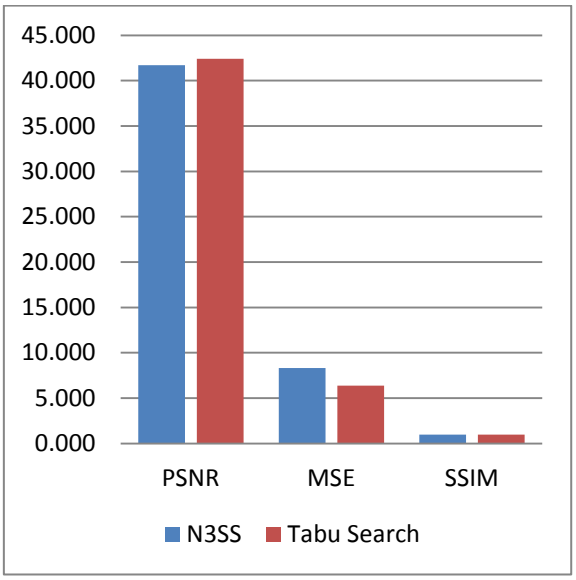

Fig 6 Performance analysis of different algorithm with step Size =4

Fig 6 shows the graphical representation of different algorithm performance for 4 step size . Mean square error is decrease up to 6.3876 and SSIM improved up to 0.9887.

VI Conclusion

The methodology has been developed in this paper, is based on new three step search and Tabu search. The proposed techniques have high peak signal to noise ratio, high structure similarity index Measure & least mean square error. Peak signal to noise ratio is 40.1292 with the Tabu. Future scope of research work is to block matching with very high PSNR.

References

[1].DarshnaD.Jagiwala, Prof. Mrs. S. N. Shah,"Analysis of block matching algorithms for motion estimation in H.264 Video Codec", International Journal of engineering research and applications (IJERA), Vol. 2, pp.1396-1401 , November- December 2012.

[2]. Deepa Mary Thomas, "A novel based approach for finding motion estimation in video compression", International journal of advanced research in computer and communication engineering, Vol. 1, pp 514-521, , October 2012.

[3] Sriram B, Eswar Reddy M, and SubhaVarier G, "Study of various motion estimation algorithms for video compression/coding standards & implementation of an optimal algorithm in LabVIEW", International Journal of Emerging Technology and Advanced Engineering, Vol. 3, April 2013

[4]. S.R. SubramanyaHiral Patel IlkerErsoy, "Performance evaluation of block-based motion estimation algorithms and distortion measures", Proceedings of the international conference on information technology: coding and computing, 2004

[5].M. S. A. P. Chauhan, Prof. R.R.Parmar,Prof. S.K.Parmar, and Prof. S.G.Chauhan, "Comparative analysis on the performance of block matching motion estimation algorithm, journal of information, knowledge and research in comp. engineering, Vol.-02, pp 366-370, Nov 12 to Oct 13.

[6].Chandana Pandey and DeependraPandey," Parametric analysis of diamond search algorithm for fast motion estimation", International journal of advanced research in computer science and software engineering, Vol. 5, pp 47-50, 2015.

[7]. Ruchi Jain and TruptiBaraskar , "The comparative analysis of various approaches used in motion estimation.", International journal of advance foundation and research in computer (IJAFRC),Vol. 1, December 2014.

[8]. Akhilmahajan, Dr. Kamal and Deepak kumar, "Comparative analysis of pixel based motion estimation with block based motion estimation", International journal of recent research aspects, Vol.1, pp. 78-83, Sept. 2014.

[9]. M.R.Khammar, "Evalution of different block matching algorithms to motion estimation", International journal of VLSI and embedded system, Vol. 03, pp 148-153, July Aug. 2012

[10]. ChandanaPandey, DeependraPandey, "Literature review on block matching motion estimation algorithms for video compression", International journal of advanced research in computer engineering & technology (IJARCET) , Vol. 4, pp 1843-1847, May 2015

[11]. Ionuț Pirnog and Claudia Cristina Oprea, "Block matching motion estimation with variable search window size'', International journal on advances in software, , Vol. 4 , pp 521-531, 2011

[12]. Ram Srinivasanand K. R. Rao, "Predictive coding based on efficient motion estimation", IEEE transactions on communications, Vol. -33, pp 888-896, August 1985

[13]. Vivek Sinha and Dr. K. S. Geetha, "Implementation of H.264 video codec for block matching algorithms", International journal of science and research (IJSR), Vol. 4, pp 1765-1769, September 2015

[14]. Tina yutian and Mubarak shah," Motion estimation and segmentation", Machine vision 1996

[15]. Nicole S. Love and ChandrikaKamath, "An empirical study of block matching techniques for the detection of moving objects".

[16]. Ankita P. Chauhan, Rohit R. Parmar, and Shahida G. Chauhan, "Comparative study on diamond search algorithm for motion estimation", International journal of engineering research & technology (IJERT), Vol. 1 ,pp 1-6, December-2012

[17]. Muhammad aakif sheikh and sagar s. badnerkar, "Video Compression Algorithm Using Motion Compensation Technique: A Survey",International Journal of Advance Research in Computer Science and Management Studies, Vol. 2, pp 357-363, March 2014

[18]. Hussain Abo Surrah,andMohd. JunedulHaque, " A Comparative Approach for Block Matching Algorithms used for Motion Estimation",IJCSI International Journal of Computer Science Issues, Vol. 11, pp 134-138, , May 2014

[19]. Ms. Maya Gaikwad, "Implementation of four step search algorithm of motion estimation using FPGA",International Journal of Advanced Research in Computer Science and Electronics Engineering , Vol. 1 pp 68-72, , May 2012

[20]. Ms. S. G. Farkade and Prof. S.D.Kamble, "A Review on Different Block Matching Motion Estimation Techniques for Fractal Video Compression" pp 429-433.

[21]. Tejas B.N. Bharathi S H VidyaSagar K.N., "Block Based Algorithms for Estimating Motion"International Research Journal of Computer Science (IRJCS), Vol. 3, May 2016.